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MECHANICAL CONTRACTING

Incoming & outgoing
MCAA presidents

p 22

PLUMBING

Lead the way on
No-lead legislation

p 42

HYDRONICS

Service supprises

p 46

phc

plumbing + hydronic contractor

news

History & Innovation

p 26

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March 2013 Vol 13 | No 3

MCAA 2013
Convention
Preview p 20

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HYDRONICS

| FIELD REPORT |

Texas school district embraces multi-unit, tankless water heating

BY SCOTT ISAKSEN

A series of successful installations made Cliff Holden, construction manager for the Burleson Texas Independent School District (BISD), a big believer in tankless water heating systems for the school-building projects he oversees. Since 2007, the 15-unit BISD has erected six new educational facilities under Holden's direction, and the latest three have all featured multiple-unit, tankless solutions — in no small part because he wholeheartedly championed the idea.

The newest of these projects is also the largest and most complex: the 550,000-square-foot Centennial High School in Burleson, about 12 miles south of Fort Worth. Centennial's hot-water delivery strategy features three multi-unit systems, encompassing a total of 25 tankless water heaters from Noritz America. These units feed food-service and culinary kitchens as well as locker-room sinks and showers in the main building; plus locker room facilities in the adjacent, standalone, indoor-practice field house.

A commitment to maximizing energy efficiency helped spur BISD's move to tankless in 2009 with the construction of Clinkscale, one of 10 elementary schools in the district.

"At 97,000 square feet, Clinkscale is identical in size and layout to our Frazier school," said Holden, explaining the district's economic rationale for sustainability. "But its annual operating costs are nearly \$16,000 less because of its use of tankless water heaters and geothermal HVAC, rather than gas-fired boilers and rooftop air conditioners."

Friday night lights

Energy efficiency was not the primary driver behind Holden's first move to tankless in 2007 at the school district's football stadium. At that juncture, the facility had been using a pair of 400,000 Btu per hour (Btu/h) gas-fired boilers, installed earlier in the decade, to provide hot water to the locker rooms. The big negative with these units involved irritatingly high maintenance costs. "Half the time, one of the boilers wasn't working. The annual repair costs were tremendous and ongoing," Holden said.

As a result, BISD began looking for less costly alternatives, ultimately opting to go tankless. Holden replaced both stadium boilers with 10 Noritz 199,000 Btu/h tankless water heaters, installed in parallel for the sake of system redundancy. The switch was definitely an educational experience.

"We really didn't require 10 units to serve peak demand at the stadium; it turned out half that number was enough," Holden explained. But the conversion convinced BISD management that they had made the right choice, in terms of performance and energy savings, by switching to a multi-unit tankless solution.

After a second successful install at Clinkscale and with a third project underway at Nola Dunn, the BISD was ready for the challenge of the \$117.5 million Centennial project. Construction began in June 2008 and finished in the fall of 2010, just in time for the new school year.

Fort Worth-based Century Mechanical Contractors, Inc. (CMC) handled the plumbing and HVAC work at Centennial as well as at Clinkscale and the Academy. BISD and general contractor Charter Builders of Dallas chose CMC because of the latter's expertise in geothermal systems. Project Manager Chad Kroeker, P.E., explained that a geothermal solution was especially critical at Centennial because it was a two story structure. "A typical DX rooftop system would have involved running duct chases through the building to get air to the first floor. The school district did not want to utilize floor space for this ductwork in its new building," Kroeker stated.

CMC subsequently was also given the nod to handle the three, 25-unit tankless installations, although the company was not nearly as familiar with this technology as it was with geothermal. Still, Kroeker wasn't worried. "Not only do I have a Noritz residential unit in my house, but so does my father-in-law. Both installations were retrofits, and we



Six Noritz gas-fired condensing tankless water heaters provide hot water to the kitchens at Centennial High School's main building. Photo: Randy Crow

enjoy the energy-saving way these systems work, providing hot water strictly on demand," Kroeker said. "The multi-unit installations at Centennial and the other two schools were definitely something new to us at CMC, "but because of my previous exposure to the technology, I was totally confident it would work."

One building, 3 hot-water systems

The size and floor plan of the main structure at Centennial are complex enough to warrant three separate hot-water zones, according to Kroeker.

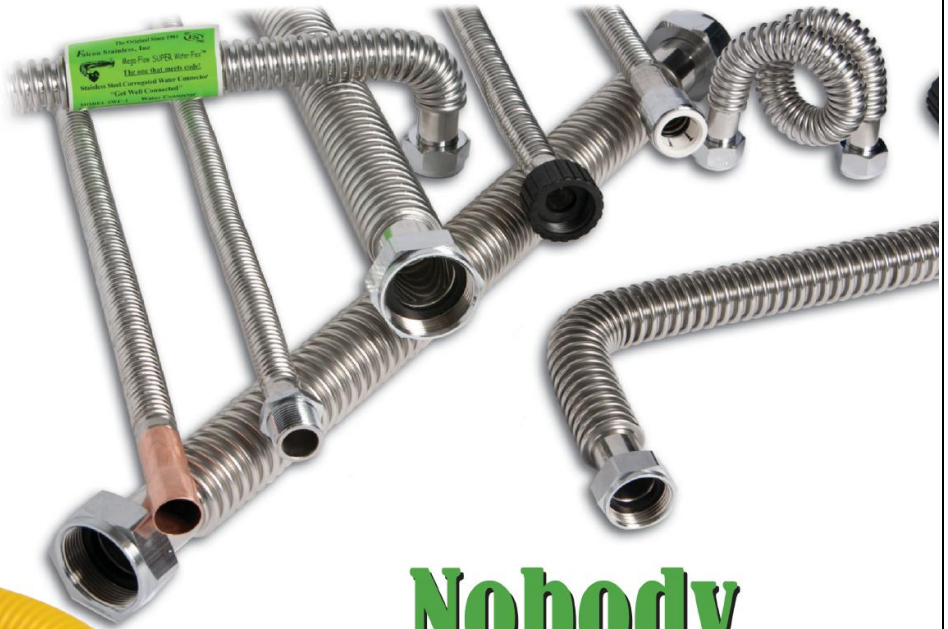
1. Kitchen facilities: Extending from the building's circular hub are four different wings. Three house classrooms, and in one of these is the culinary arts kitchen for teaching. Contained within the hub is the cafeteria and food-service kitchen for preparing student meals. Close by, so the hot water need not travel far, are six gas-fired, high-efficiency condensing tankless water heaters with an efficiency rating of 93 percent and gas inputs of 199,000 Btu/h. A dedicated system controller in the same space maintains a constant output temperature, independent of usage. Venting was done with flexible, easy-to-install 4-inch PVC pipe.

2. Gym wing locker rooms: The fourth wing of the main building contains the school gymnasiums and their adjoining locker rooms. These receive hot water from a mechanical room on the mezzanine level of this wing where nine, gas-fired tankless units with inputs up to 380,000 Btu/h

➔ Continued on p 60

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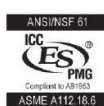
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HYDRONICS • Continued from p 58

are linked together and operated by a single controller. Because the nine tankless heaters are conventional atmospheric units, venting consists of five-inch, Category III Stainless Steel.

The school district wanted to minimize the wait at the tap and shower head by bringing the hot-water lines as close as possible to the outlet. A 600-foot loop of three-inch, copper pipe was built to connect the plumbing fixtures to the nine-unit tankless system. The system sits idle

until the temperature of the water in the loop drops below a preset level, at which point the controller activates a circulator to begin pumping hot water from the tankless system. The number of units firing depends on the number of showers and faucets in operation.

Kroeker acknowledges that the system startup involved a learning curve because of the piping circuit's length and the volume of water it holds: 420 gallons. The system uses a mixing valve to regulate the

temperature in the loop. But because of the additional pressure drop through the tankless units, maintaining the preset temperature proved elusive at first.

"When there was little or no demand, the water returning from the locker rooms wanted to stay in the loop rather than returning to the tankless system, so the loop would cool down too far," Kroeker explained. The adjustment of a balancing valve and a few other system tweaks ultimately solved the problem.

"I do not regard our struggles with the locker rooms at Centennial as an argument against this type of multiple-tankless system. It just took us a little time to diagnose and solve the problem correctly. Once we did, the system operated fine."

3. Restrooms: Seventy-five, electric point-of-use instantaneous water heaters, made by Stiebel Eltron, serve the restroom facilities in the other three wings of the school. For the most part, each POU unit is connected to a single sink; however, wherever sinks are positioned back-to-back with a contiguous wall in between, a double-sized unit will be used to generate hot water for both.

Holden decided to use POU technology because hot-water demand, which is confined to hand washing at the restroom sinks, would be very light and intermittent. This factor, combined with the fact that the restrooms are dispersed over three separate wings, spurred Holden to find a way to eliminate the hot-water circulating

• Continued on p 62

60



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HYDRONICS • Continued from p 60

system he had relied upon to deliver hot water quickly.

"With POU, we still get warm water to the sinks quickly, but without using a lot of energy and copper tubing to circulate it around the building 24/7," Holden explained. "The tankless and the point-of-use systems are a major improvement over the old ways of bringing hot water to wherever it is needed. They don't take up nearly as much space and they don't waste energy creating hot water when there is no demand for it."

Installation — involved, but not difficult

The nearby indoor practice facility is equipped with virtually the same system as was installed in the gym wing of the main building, except that 10, rather than nine, Noritz, 380,000 Btuh tankless units were used. Once again, 5 inch stainless steel was used to build the vent runs.

"Below each tankless unit are two tees, one for incoming cold water and the second for outgoing hot water. All those pieces and connections weren't

all that difficult for our plumbers to make, but assembling them did take time," Kroeker said.

"Fortunately, our service technician, who wired the controllers and programmed the three tankless systems, is a fast study," Kroeker continued. "You need someone patient enough to read the literature or to take the relevant training course offered by Noritz to get the job done right the first time."

Kroeker anticipates specification of tankless water heaters on commercial projects will grow for the same reasons the technology has been a good fit in residential applications. On-demand operation saves energy, while the elimination of hot-water storage saves space.

"The footprint advantage is a big deal in commercial applications," Kroeker noted. "At Clinkscale, the water heaters had to fit inside the janitor's closet: A tank-type water heater would not have fit into this space."

Kroeker also regards the multiple-unit strategy as a huge advantage for

any application that simply cannot do without hot water for any duration.

"You see a lot of commercial applications, especially restaurants and schools, with two tank heaters whose total storage capacity roughly matches the peak demand of the project. As a result, if one goes down, the operation doesn't have enough hot water," Kroeker said.

He added, "A multi-unit tankless job frequently involves more than two or three units, so each water heater contributes a smaller share of the overall demand. If one or even two must be valved off for maintenance, the system output is much closer to maximum building demand."

Meanwhile, the system sits idle at night, over weekends and holidays — as it should — saving energy by not generating hot water when none is needed.

"You can turn a boiler down during the off hours," Kroeker said. "But when you need it back online, the system will take more time and more fuel to reheat all the water it has stored."

Kroeker has a rooting interest in BISD's sticking with tankless, and not just because of the work it brings to CMC. He's also a resident of Burleson.

"As a taxpayer, I like to see lower operating costs, so I definitely like the decision to go tankless," Kroeker said.

Holden does not yet have comparative figures to determine precisely how cost-effectively the various hot-water systems at Centennial performed during their first school year in 2010-2011. But based on what he can see, the maiden voyage was an unqualified success without problems with any of the systems, tankless or point-of-use.

"Everyone — our maintenance director, the administration and the school board — is pleased," Holden stated. "We learn a bit more about tankless system sizing and design with each project. But I fully expect the school district will remain supportive of our use of tankless water heating on future projects." ●

Scott Isaksen is an Applications Engineering Manager for Noritz.

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