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**PRODUCTS
OF THE YEAR**
2017

Boiler System Puts Efficiency In Historical Venue

Antique boilers are replaced at the Castle in the Clouds facility, cutting energy costs and carbon footprint.



The Castle in the Clouds estate, completed in 1914, is a museum, exhibit gallery, restaurant, and wedding venue, made more comfortable with a boiler-system upgrade.

New Hampshire's White Mountains are known as one of the most significant ranges east of the Rockies, and rightly so, considering they're home to Mt. Washington, the highest point in the Northern Appalachian Range at 6,288 ft. above sea level.

Lesser known but just as stunning, the Ossipee Mountains form a peculiar, almost perfect circle of rolling peaks just south of the White Mountains. It's here that successful shoe manufacturer Thomas Plant built a hilltop estate on 6,300 acres between 1913 and 1914. Perched on an outcrop overlooking Lake Winnepesaukee, the 12,000-sq.-ft. home resembles a castle.

Its accompanying carriage house is several thousand feet smaller and of similar stone and oak architecture. Today the property is called Castle in the Clouds and is owned and operated by the non-profit Castle Preservation Society. It includes the historic house museum, an exhibit gallery, horseback riding, and offers an acclaimed restaurant and one of New England's most stunning wedding venues.

Since acquiring the historic core of the property in 2006, the society has invested about \$3 million in building renovations, addressing everything from roof repair to masonry repointing. "Over the past 11 years, we've been busy seeing to what I'd call 'urgent repairs,'" said Charles Clark, executive director of the Castle Preservation Society. "At the same time, we've been painfully aware that the two primary buildings use about 400 gallons of oil per week during the winter."

The mechanical systems in both buildings were more than 20 years old, but the fact that they still made heat meant they weren't a high priority until recently.

A nine-section, 1.7 MBtu boiler in the Castle served a cast-iron radiation system, while an 800,000 Btu cast-iron boiler in the Carriage House provided hot water to a mix of fan coils and fin-tube baseboard. Both were oversized by roughly 300%.

RIGHT SET OF EARS

Replacing the boilers didn't become a real possibility until word made it to the right set of ears. Those ears belong to the owner of Eastern Propane & Oil, Rochester, NH. "Chuck Clement, who owns Eastern, learned about the need from someone who sits on the board of directors at Castle in the Clouds," said Terry Rickards, tech support and training specialist at Eastern. "After learning a lot more about the property, the organization and the heating systems, Chuck Clement decided to make an in-kind do-

nation to retrofit the systems at both the Castle and the Carriage House.”

He toured the facilities and drew up a plan for both retrofits and submitted a proposal. The Castle Preservation Society eagerly accepted.

CASTLE GETS ITS DUE

Prior to the retrofit, Eastern Propane & Oil installed two, 1,000-gal. underground propane tanks on the property. Nearby Ambrose Bros. Inc. donated the time and manpower to dig the holes for the two new tanks. Ed Ambrose, owner of the excavating company, is a member of the board of directors at Castle in the Clouds. When it came time to retrofit the Castle’s mechanical room, all of the components were in place.

“It was still early spring when we started on the main building, so we needed to leave the giant existing boiler in operation until the new units were up and running,” stated Rickards. “All of the new boiler piping was replaced, including pumps, system feeders, valves, and air separation.”

Instead of one larger unit, Eastern chose two, 285 MBH NeoTherm condensing boilers from Laars Heating Systems Co., Rochester, NH. This provided some redundancy and doubled the turn-down ratio.

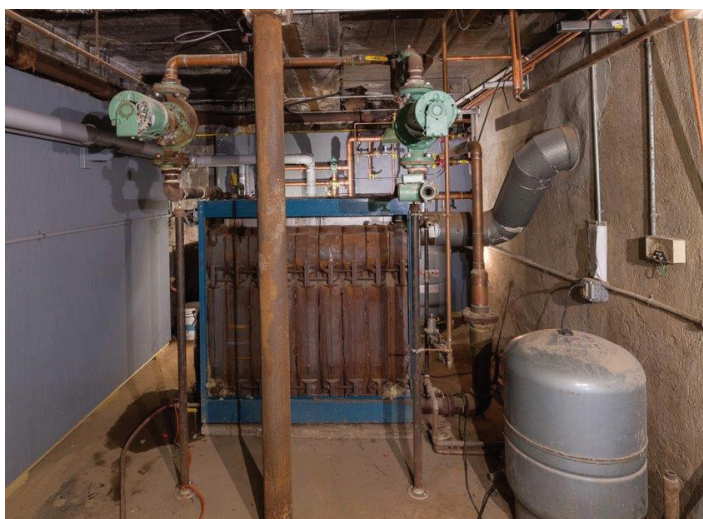
“We’ve used the NeoTherms before on residential and commercial jobs without any trouble,” said Rickards. “Aside from that, one of the main reasons we selected them for this job is that I don’t need a third party control to stage the two units. The onboard Laars control allows me to put them in a lead-lag configuration very easily.”

The 95% AFUE boilers are ground-mounted and piped primary/secondary. A Neptune system feeder was added for easy application of glycol and corrosion-inhibiting chemicals.

The size of old boiler made working in the room very difficult, but since uninterrupted heat was a requirement of the job, it had to stay in place. When switchover day came, the 2.5-in. copper main was cut and drained. A large Taco (Taco Comfort Solutions, Cranston, RI) air separator and four Watts (North Andover, MA) isolation valves were installed, and the system was tied into the 2-in. copper coming from the Laars boilers. “The boiler room and wiring is simpler that you’d think because the entire building is heated by one giant zone of cast-iron radiators,” said Rickards. “Just as soon as the system was purged and the new units were fired, we started tearing apart the existing boiler. The building went without heat for only half a day.”

CARRIAGE HOUSE LESS OF A TWISTER

While one crew was working on the Castle, another was installing two, 210,000 Btu NeoTherm boilers in the Car-



Above. The old boiler had to remain operational during installation, making the boiler room a tight fit for Eastern Propane & Oil workers as they installed the new boilers donated by the company.

Below. Redundancy, efficiency, and much-improved indoor air quality resulted from installation of the two NeoTherm condensing boilers.



riage House. In much the same way that Eastern technicians allowed the big boiler in the Castle to remain online, the oil boiler in the smaller building would too. But this time, the existing unit would run for more than a few days.

“The building has two, 330-gallon oil tanks that were nearly full when we started the project,” said Rickards. “So we installed the new system and left the tie-in and fire-up for next fall. Luckily the Carriage House mechanical room is bigger and the oil boiler is smaller, so it wasn’t a continuous game of Twister like it was in the Castle.”

While the system in the Carriage House is smaller, it was definitely more complex. The basement area is unconditioned, with half of it used for storage and half a crawl space for mechanicals.

Above, the conditioned space is a mix of offices, restaurant seating in the former horse stalls, the exhibit gallery, and a large reception and meeting area.

There are two main zones coming off the boiler system. One goes directly to two air handlers, each with a zone valve. The other zone passes through an insulated chase, across the basement, and up to the office areas.

Here, the existing piping gets messy, with a number of zone valves scattered around, feeding tiny fin-tube baseboard zones.

Because the zones are very different, and with the challenge of pipe running through unconditioned space, Rickards wanted a flexible pumping solution. “At some point, I hope to get rid of all the baseboard and straighten out the office piping, but for right now, it’s what we had to work with,” he explained. “I put in two Taco VR3452 light-commercial pumps because I can use the same circulator, in different settings, on both zones.”

To reduce the risk of freezing in the zone that runs below the old horse stalls, Rickards set the circulator in constant-circulation mode. It’s turned off during warm-weather shutdown. On the loop that supplies water for two air handlers, he set the circulator in proportionate-pressure mode to ensure the right amount of supply water to both fan coils, regardless of whether one or both are calling for heat.

The Taco VR3452 has four modes of operation, allowing it to fit nearly any application in its performance range. An optional communication module provides Ethernet communication, Modbus RTU communication, and allows for simple twin-pump installation if redundancy is needed.


FINISHING TOUCHES


Future plans include installing a fan-coil system in place of the messy baseboard installation in the office areas. Also in the Castle, a few cast-iron radiators should be replaced and a few others, sandblasted at Eastern’s shop, repainted, and put back into use. In the meanwhile, management at the estate can look forward to lower energy bills and a more sustainable future.

“These new systems are a capstone to the list of urgent projects we’ve been juggling over the past decade,” said Clark. “It brings us into a new phase of renovation work where we’ll be looking to minimize our carbon footprint and become the best stewards of this special place for generations to come. **CA**”

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 Specifics on the Laars NeoTherm condensing boiler.

 Information on Taco in-line air separators.