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Radiant makeover

CENTURIES-OLD LANCASTER COUNTY LOG HOME
BENEFITS FROM MECHANICAL SYSTEM UPGRADE



Wrenches in the works? Sure, there were a few at this little job in rural Mount Joy, Pa. But this mechanical contractor is drawn to a challenge. What he found when he got there - with tasks that would be tied to an extensive remodeling project - was an ancient, fuel-oil-guzzling cast-iron boiler, uninsulated walls and plans for a new kitchen to be perched above a “rock quarry.”

“The challenges certainly gave the job some personality,” said Dave Yates, president of F. W. Behler, Inc., York, Pa., who was chosen by the homeowners to do the mechanical system upgrades.

The Martins, a family of four, live in a 2,400-square-foot log home that dates back to the time of the Revolutionary War. It’s been in the Martin family for six generations and they were planning the first-ever major renovation.

Interesting details also included stone foundation walls and massive, hand-hewn logs that defied pipe and tubing runs. Yates affirmed that the old, cold hydronic system needed “some serious therapy.”

Yates was impressed that the homeowners, Bruce and Heike Martin, hired a remodeling contractor, Duane Niesley, who wasn’t an obstacle to radiant heat. In fact, he helped to champion the cause for a mechanical system overhaul that, ultimately, would entail extensive use of radiant. Though, clearly - with strong German heritage on both sides and an appreciation for finely-tuned European hydronics - the homeowners were predisposed to radiant heat.

Bruce Martin met fraulein Heike Quiring, a German native, when she came to the states in 1986 and ‘87 during a Mennonite international visitor exchange program. Before

she left Pennsylvania, they were engaged and, within a few months, Bruce moved to Germany where they were married. Five years later, the family of four moved to Pennsylvania and quickly established residence at the Martin family homestead.

DOING THEIR HOMEWORK

Though they wanted radiant heat, the Martins also looked into other, less-familiar facets of the project. After lengthy research, they specified a com-

In another area that serves as a cool spot to place the family's potato, onion and apple harvest, Yates would locate one of the radiant manifolds and have access for a small staple-up zone underneath the downstairs bathroom.

The home's centrally located, first-floor kitchen would be the focal point of the renovation.

"We all enjoy cooking and food preparation," said Heike Martin. "So we added some cabinets and counter space and found a better spot for the refrigerator.

square-foot laundry room. Its floor would also be heated. Next to it was the downstairs bathroom, soon to be radiantly heated by staple-up from below.

"They wanted to pull out a large standing radiator in the bathroom," explained Yates. "The challenge would be to get enough BTUs into the tile floor through a heavy pine subfloor."

Yates used Watts Radiant's RadiantWorks program to determine each room's need for tubing and water temperature based on the design-day temperature of zero degrees while plugging-in building specs and construction materials information.

"The supplier's heat loss and radiant panel program made the job effortless. I find it difficult to understand why any contractor would allow someone else to do this aspect of the job, one of the most critical steps in the process. After all, if the system fails to perform, I'm the guy hanging out to dry," he said.

For Yates, this pointed to the importance of directly interviewing the homeowners to avoid confusion and wrong assumptions. That's not always easy when a GC's involved, but Niesley encouraged it. According to Yates, they decided to salvage as much of the existing mechanical system as possible. That meant marrying-up the new radiant system with the tangle of iron piping that joined other hydronic lines within the home. A snip here and a tuck there eliminated many of the old lines, soon streamlined into a neat and orderly secondary loop.

This also presented a slight design challenge because of the heating curve for the several remaining radiators and the typical need to reset system temps based on outdoor ambient temperatures. Yates planned to run these as one high-temp zone.

MOUSE CONDO

While making the heat load calculations, the kitchen became an interesting challenge for Yates and Bob Seiger, one of his chief installers. The room was a bit troublesome because of its location above the "rock quarry," Bruce Martin's favorite description of the centuries-old pit, filled with rocks, rubble, old timbers, glass and pottery shards, a thoroughly worked-over cache of walnuts



pact, high-efficiency boiler to replace the old monster downstairs, favored replacement of a crusty old fuel oil tank and had a pretty good feel for other mechanical system upgrades.

"Hydronics is a passion for us," said Yates. "These folks were talking my language. They even referred to 'remodeling the house around the mechanical system.'"

Roughly half of the home would be involved in the renovation. Fortunately, the basement had a large room for the mechanicals, once necessary for the old boiler down there; without it, they'd have plenty of room for the new mechanicals and a work area for Bruce.

We'd endured the cold floors long enough."

In fact, the kitchen floor was ice cold during the winter months. The foundation below it "breathed" because of the generously ventilated rock foundation.

"This was not by intent," said Bruce Martin. "The old foundation moved here and there over the years and so the winter winds had relatively free access to the space below, something we'd definitely do something about during the renovation."

The only source of heat in the kitchen was a standing radiator; they evicted it in favor of a dishwasher, an appliance Heike had waited 16 years for.

Connected to kitchen is the 100-

and corn cobs, and, Heike was certain, one of the oldest, continuously inhabited “mouse condos” in all of Lancaster County.

The floor of the kitchen would be suspended above the pit. Its underfloor was inaccessible.

“Even if we did have access to it, it was too rough for crawl space work,” said Yates. So he immediately set his sights on SubRay, a product made by Watts Radiant.

“SubRay delivers a lot of heat at very low operating temperatures,” continued Yates. “Connecting panels are simply screwed to the top of the subfloor and the tubing weaves between them; it delivers up to 40 BTUs per square foot. We’ve used SubRay for many different jobs, even a multi-tiered, octagonal timber-framed home, so we’re familiar with its versatility and performance.”

The remodeling contractor sealed the stone foundation and cleverly devised a way to heavily insulate the underfloor of the kitchen; cold toes would be a thing of the past. Since the laundry room needed heat, too, and would become an extension of the diagonally laid ceramic tile surface that the Martins had chosen for the kitchen, Yates chose to extend the SubRay into that area as well, all on the same thermostatic zone.

The bathroom staple-up offered a new challenge. Unevenly spaced joists were running in one direction above a very narrow access area, and the drain and water lines were going in another. Yates found the Watts Radiant’s EPDM radiant tubing, Onix, to be the solution.

“In a space where PEX would have been virtually impossible to install, the Onix tubing was easily woven around all the obstacles, including a number of protruding nails that had been used to hold down the concrete board under the finished ceramic tile floor above,” said Yates.

THE RIGHT EQUIPMENT

The homeowners had selected an oil-fired Laars “Max” boiler and its partner, a 40-gallon DuraFlow indirect-fired hot water heater, chosen to easily meet the family’s domestic water needs. The boiler is a low-mass, direct-vent unit with a two-pass cylindrical heat exchanger that delivers about 87 percent efficiency.

According to Yates, the new boiler would use up to 60 percent less fuel than the old one while retaining 40 percent of the heat previously lost to the chimney and would occupy only one-quarter of the space needed for the old one.

“‘Balanced flue’ for the sidewall venting is Laars’ term for direct venting of the Max boiler,” explained Yates. “It’s a quick and easy connection with stainless steel lines between the boiler’s exhaust and outdoor air and the termination box where the incoming air passes over the outgoing, inner stainless steel piping. This pre-warms the incom-

was not factored into the total load for sizing the boiler. Setting up an indirect on a priority zone in a radiantly heated home works well because of the minimal loss of heat to comfort zones while the system idles and allows the full power of the boiler to quickly regenerate the domestic tank.”

The control panel itself was another task. “Rather than building one, we chose to provide the design specs to Watts Radiant,” explained Yates. “This job was ideally suited to fabrication of a small, simple HydroControl panel, made by their experts and shipped to



ing air. No flue draft regulator is needed when using this kit.”

The Laars DuraFlow indirect-fired water heater would replace a free-standing electric unit that began duty 15 years ago.

“With exposed element wiring and clumped-up insulation, it was ready for the plumber’s morgue,” said Yates. “With multiple zones, the indirect’s load

the job site with the SubRay, tubing, manifolds and other materials.

“The panel is the heart of any radiant system, and it sets the tone for how all of its parts will operate. We needed to provide a multiple-temperature system from a single temperature source. We had two high temperature zones: the indirect hot water tank and the remaining cast-iron radiators; and two lower-

temperature zones for the staple-up lower bath and kitchen, both with SubRay. We also needed to ensure that this system would be as quiet as a church mouse."

BUDGET REALITIES

"We sure had some fun playing with the panel's design," said Yates. "Budget was a real concern, so simple mixing strategies were needed. We reduced pumps and mixing valves by running higher-temperature water through the staple-up floors first and using that two-loop manifold's return flow to feed the lower temps required by the SubRay in the kitchen and laundry room. It returned to the boiler from there, essentially as an extended, single loop. The flow rates were low enough to support the strategy. Hey, eliminating one pump and a mixing valve, that's money saved."

"As with any system we install, we try to keep it simple and cost-effective. The fewer bells and whistles, the fewer long-term maintenance issues. I like my sleep to be uninterrupted, so designing things right at this stage is a critical issue. To save some bucks, the owner chipped in, too. After we cut off the boiler piping, Bruce went to town breaking down that old cast-iron beastie into its smallest pieces. By noon, he'd completely dismantled it and removed every trace of it. I think I'll hire him. On second thought, he's a workman's comp liability risk."

As the job neared completion, two new 275-gallon oil tanks were delivered by Highland Tank from the manufacturing plant just 10 miles away. The new 12 gauge "ToughTanks" by Highland, the only remaining United States supplier of steel fuel oil tanks, are available in 137-, 275- and 330-gallon capacities and are UL-80 labeled for oil use (a UL-142 label is available) and are available with double-wall construction.

The twinned oil tanks, with fuel lines joined at their bottom outlet, were piped to the exterior with full-sized fill and vent lines.

"There's a fair amount of concern lately about high-pressure pumping (permitting faster delivery of fuel) and tanks having crossover lines becoming over-pressurized," said Yates. "Considering this, I felt the extra time and materials



were warranted. With each tank having its own vent alarm to signal when to stop pumping oil, there's now minimal chance of a spill or rupture."

Flipping through a tablet with notes about the job, Yates rattled-off a few remaining notes about the mechanical system:

- The indirect hot-water storage tank is first with an aquastat governing the relay that energizes the boiler.
- A separate manifold served the SubRay. This zone's operating temperature was set for a range of 137F to 85F, with a 20-degree drop during the initial run through the staple-up zone. The 20-degree drop in temperature provides the proper reset temperature ratio for the SubRay zones, which follow in series.
- All components received isolation valves. A bit more costly up-front, but greatly valuable in years to come if the mechanical components require service.
- Working much like outdoor reset controls, though with much less cost, Yates chose to install a Watts "BES" (Boiler Energy Saver) to lower boiler water temperatures during periods of warmer weather to reduce stand-by heat

loss. The unit's microprocessor continuously monitors and accumulates boiler cycling data to increase or decrease water temperature.

"We made it through our first winter in the newly remodeled house," said Bruce Martin. "There's really no way to describe the feeling of comfort when it's so raw outside, the snow's piled up and we wake up to warm home with warm floors. It's pretty remarkable."

Add to that the satisfaction they had when the two fuel oil tanks were topped-off after four months.

"The tanks were filled with less than 250 gallons," they said. "It provided super-efficient heat for the entire house during a severe winter, all of our hot water for showers, baths and laundry, and with way less oil than we've consumed before." | FON