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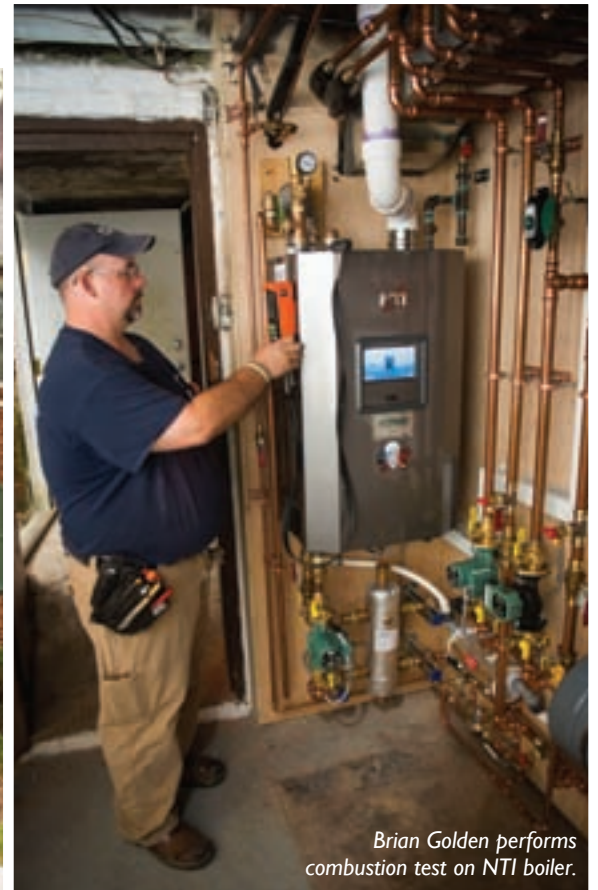
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Hydronic retrofit

BY DAN FOLEY



Homeowner, Erin Holohan, with lead technician, Brian Golden.



Brian Golden performs combustion test on NTI boiler.

Several years ago, I received a phone call from my friend and mentor, Dan Holohan. His daughter Erin, and her husband Drew, had purchased a home in Silver Spring, Md. He asked me if I could stop by and take a look at the mechanical system. The 1940s era brick colonial had been a foreclosure sale and was in rough shape. He wanted to make sure it was safe to operate and what improvements we could make to the system.

The mechanical system left a lot to be desired. The gas-fired forced air furnace was fairly new but the AC unit was 15 years old and the water heater was leaking. By far, the biggest issue was the duct system.

The duct layout was marginal, at best. It was undersized, with a lack of return air, and it was designed for heating only. There was insufficient airflow in cooling mode. In addition, the ductwork did not extend up to a third floor guest suite. A window unit was used to cool this level. A deck was built within 6 inches of the top of the AC unit, causing the condenser air to re-circulate over the coil. It would trip out on overload after about 10 minutes of run time.

I gave Erin and Drew a proposal to fix the acute problems understanding that their repair budget had already been stretched to the limit. We did the bare minimum to get the system

operating safely. This may have not been ideal, but was the best we could do at the time.

We replaced the leaking water heater with a new 52 gallon electric model. We then relocated the AC condenser to the side yard where condenser air could flow freely. The furnace was cleaned and serviced. A combustion and draft test was performed to make sure the furnace was burning cleanly and drafting properly.

The duct system was patched back together but a complete duct renovation was not in the budget. We did run a supply duct to a first floor bath that was an addition. This room was on an un-insulated concrete slab. It had three cold walls and a ceiling with minimal insulation. Needless to say, this bath was very cold in the winter (more on this later). The additional duct was intended to deliver more air into this space.

The goal was to make the system safe and serviceable but it certainly was not a premier mechanical

'Foley Onsite' video series

Want to see this hydronic retrofit for yourself? Take a look at the most recent episode of "Foley Onsite!"

PHC News Editorial Director Ashlei Cooper, Homeowner Erin Holohan, Dan Foley, and the Foley Mechanical team walk through the house and the elements that were upgraded.

Watch at: www.youtube.com/tmbpublishing





Renovated mechanical room.

system. The third floor guest suite was still cold in the winter and required a window shaker for cooling. The first floor bath was uncomfortable year round, even with the added ductwork. The problem was the thermostat, located in the living room, satisfied long before the bath received enough supply air to be comfortable. The mechanical system was safe and reliable, but comfort issues abounded.

We serviced the system twice a year for the next couple of years but no changes or upgrades were made to the system. Then I read a column by Dan Holohan discussing the system. Dan mentioned the cold bathroom, the poor duct system, and the uncomfortable forced air heating system. He also mentioned his contractor friend (me) who was not able to fix the system. I have to admit it staggered me like a left hook to the jaw. This got my Irish up, and I took it as a challenge. I knew

how to fix this system. and that was exactly what I was going to do.

I met with Erin and devised a plan. We walked through the house and made notes. I asked which rooms were hot? Which ones were cold? We talked about control and zoning.

We discussed options for the cold first floor bath and the third floor guest suite. We discussed system types, radiator styles, AC systems and controls. After the survey of the home, we went over multiple options and decided on a hydronics-based heating system along with an upgraded AC system.

We agreed that a hydronic system powered by a modulating, condensing gas boiler would be the heart of the system. It would supply a combination of European panel radiators, a towel warmer radiator and cast iron Baseray.

The first step was to do a heat loss/heat gain calculation using Right-Suite software. Then, I could size the radiators for each room and determine the cooling airflow cfm. Then a piping flow diagram was created to show pipe sizes, flow rates and connections. Brian created a boiler room piping diagram and equipment, piping, valves and accessories were ordered.

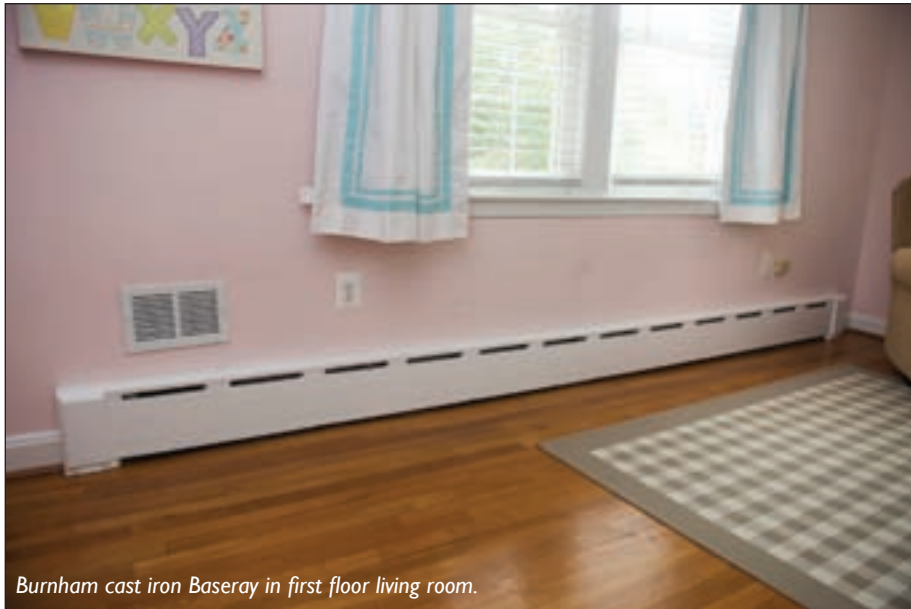
We started the job in June. The first thing we did was to demo and remove the old system. We renovated the entire mechanical system in stages starting with the cooling system.

Cooling system

The existing duct system was designed to handle only heating airflow, most likely with a belt drive motor. It was undersized and short on return air. We modified the ductwork where it was accessible. We enlarged the return and added a return riser in the corner of the first floor living room. I had the duct boxed in and trimmed and added a large return grille to improve airflow. We also modified and enlarged the supply trunkline. Accessible duct joints were sealed with mastic to minimize duct leakage. All registers and grilles were replaced.



Third floor guest suite featuring LG Art Cool and Radson panel radiator.



Burnham cast iron Baseray in first floor living room.

We then replaced the existing cooling equipment with a new Carrier 16 SEER AC unit, new lineset and a new Carrier variable speed air handler. A media cartridge air cleaner filters the air. We set the outdoor unit on a poured concrete base pad as I have never been a big fan of plastic pads.

It was not possible to get sufficiently sized ductwork from the basement mechanical system to the third floor guest suite. This was the hottest room in the house in the summer. I did not consider the window unit a viable solution. We had to come up with a better idea.

After discussing various solutions with Erin, we decided on a ductless split system for this area. An LG Art Cool unit with a wall mounted cassette was selected to cool this space. Since it is a heat pump, it can provide heat during shoulder seasons. It also operates as an independent zone allowing the occupants to control the temperature

in this zone.

The LG outdoor unit was also set on a concrete pad, hidden behind some shrubs on the front corner of the house. The lineset was hidden in Slim Duct trim up to the third floor to give it a nice finished look.

Heating/DHW system

My lead tech, Brian Golden, helped immensely with the mechanical design. We decided on an NTI Trinity modulating, condensing gas boiler. Venting through the side wall was an issue due to window locations. We used a Centrotherm PPS flexible chimney liner kit to vent through the chimney chase. Combustion air is ducted to the boiler from the outside through 3-inch PVC pipe.

We controlled the hydronic system with a Honeywell AQ series boiler and zone control. This control has integral reset capability and controls the boiler supply water temperature based on outdoor temperature. It also controls the boiler modulation and firing rate through a 0 - 10vdc

output minimizing short cycling. Add on relay modules control the circulator pumps and zone valves.

Brian commented on the controls, "I really liked the flexibility of the AQ controls and the ease of wiring and installation. Programming the control was a snap."

A Legend hydro-separator isolates the boiler flow from the system flow. Taco 007 and Viridian circulator pumps provide flow through the system, which is zoned with Taco Sentry zone valves. Webstone flanges and valves allow for easy purging, service and component isolation.

The electric water heater was removed and replaced with a 50 gallon NTI stainless steel indirect DHW tank connected to the boiler. This setup will supply more hot water, reliably and efficiently. A DHW re-circ pump was added to minimize the wait time for domestic hot water at the fixtures.

A combination of radiators was used to heat the basement and three upper floors. We used Radson European radiators in the basement rec room, laundry room and half baths. The basement was set up as a separate zone. TRV's were installed on each radiator to allow for fine tuning the temperature. As the basement was only partially finished, it was fairly easy to pull the Uponor MLC piping to each radiator location.

We decided on Burnham Baseray for the first floor because of its low profile. I also like the thermal mass of the cast iron baseboard. We used the Radson panel radiators in the kitchen and mudroom because of minimal wall space available.

Two areas presented a unique challenge. The first is a porch that

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Runtal towel warmer radiator in master bath.



Honeywell programmable TRV on panel radiator.

was enclosed to create a sunroom. It was surrounded by glass and built over an unheated storage space. My calculations called for 18 feet of Baseray so we installed 14 feet along the long wall and 4 feet on the short wall. The key was making this an independently controlled zone. We added 2-inch extruded foam insulation to the concrete storage room below the sunroom. We do not typically install insulation, but I made an exception here. I was told that Dan enjoys sitting in a recliner in this room with his favorite beverage. This winter, he will be able to enjoy it surrounded by warmth and comfort.

The second challenge was the first floor bath that sits as an appendage on the left side of the house. The first thing we did was to add insulation. We could not change the slab on grade or open up the walls. But, we did add a layer of R-30 insulation above the ceiling to help hold in the heat. We then added a Radson vertical wall panel radiator that was selected to maximize heat

output in limited wall space. You won't be hanging a side of beef in here this winter.

The second floor was heated with Burnham Baseray, which is controlled as a separate heating zone. We installed a Runtal towel warmer radiator in the second floor bath. This floor was difficult to pipe but Brian Golden and Lamin Jah figured out a nice solution. We pulled the flexible MLC pipe through joist and wall cavities the way an electrician would pull cable. Access holes were cut in the plaster walls and ceilings to allow access for the piping, and patched and repaired when the work was done. All heat mains and lines were insulated within the walls.

The third floor guest suite was heated with three Radson panel radiators, again on a separately controlled zone. This allows the zone to be set lower when not in use without affecting the comfort in the rest of the house. We tried something a little different on this zone. We installed Honeywell programmable TRVs. They are

battery operated and allow for programmable setback on each individual radiator without any complex wiring. This is a new product for us and the first time we have used them. They were simple to install and easy to program. I envision using these TRVs on future projects.

The system was started and commissioned in July. The AC system passed the test and performed flawlessly. I visited on a hot August afternoon and the house was nice and cool. Erin was particularly impressed with the third floor LG system which replaced the window unit. The third floor was a comfortable 74°F with low humidity. It was also whisper quiet compared to the old unit.

The new indirect DHW tank supplies all the hot water they need and never runs out. The heating system has operated over a few cool nights this fall when the temperature dipped below 30°F. While this has hardly been a test of the system, Erin has reported back that the home

is comfortable and quiet. Gone is the noise of the blower kicking on forcing air through an undersized duct system. It has been replaced by a gentle warmth that envelopes the space. In addition to the comfort provided the new mechanical system, I predict utility savings as well due to the higher efficiency equipment and zoning.

Erin added, "Brian, Lamin, and your entire crew were a pleasure to deal with. They were professional, cleaned up after themselves, and a joy to have in our home. I know this was a difficult job for them but they stuck with it and got it done. We can't wait for cold weather to try it out."

The true test will be when Dan visits this winter and sits in his favorite recliner. ●

Dan Foley is president and owner of Foley Mechanical, Inc. based in Lorton, Va. FMI specializes in radiant, hydronic and steam systems as well as mechanical systems for large custom homes. He can be reached at 703-339-8030, www.foleymechnical.com, or dfoley50@verizon.net.

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