BOILER FACTS

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TOOLS AND TECHNIQUES FOR TECHNICIANS

Heating system 'Beat Downs'

(Or how a lack of understanding can really mess up a good system)

After all these years of bouncing around the basements of homes around New England, I am never surprised by the ingenuity some heating contractors employ to solve a problem. Recently, I had the opportunity to be told by a general contractor that I was full of it! He said that I obviously didn't understand the workings of a steam heating system and the information I was telling him was incorrect! He and his "plumbing buddy" had just finished "beating down" an old one-pipe steam system during the renovation of an old home and now parts of the house were not heating and the pipes were banging every time the boiler fired up! Through a wholesale friend, I was asked to come out and take a look!

During the past few months, we have been presenting a few seminars on various subjects. One of them is on Steam Heating Systems, which concentrates on understanding and troubleshooting all types of low pressure steam systems. Of all the systems we discuss, one-pipe systems are perceived as being the easiest to understand. The reasoning is very logical: there is only one pipe feeding each radiator, so what's so difficult to understand? But as we got into the "hidden" aspects of one-pipe systems, people started realizing these systems have certain rules that need to be followed if the system is going to be successful.

A typical one-pipe steam system chugs along for years unnoticed, until finally the boiler needs to be replaced or the new homeowner decides to remodel a kitchen or bedroom and needs to move or relocate some radiation. If it is done correctly, the system will continue to provide comfort and warmth to the house, but as soon as one of the "rules" is ignored or broken, anything can happen and "all bets are off!"

And this is what was happening with that newly renovated house with the old steam system. One of the first things to check when troubleshooting a steam system that has a brand new boiler on the job is to make sure the boiler was sized for the connected load. This means counting the square foot rating of all the radiators in the house and see if it matches the boiler's rating plate. This is important for two reasons:

1. If the boiler rating is less than the connected load, it won't be able to heat all of the radiators in the house, because it is undersized.
2. If the boiler rating is greater than the connected load, the system will experience velocity and counter-flow problems. This can lead to spitting radiator vents, sloshing, gurgling and banging pipes and radiators, boiler short-cycling and uneven heating.

It turns out the boiler was considerably oversized, which created a lot of their problems. And to make matters worse, when they remodeled the kitchen, they moved a couple of radiators to the other side of the room. This seemed innocent enough. Unfortunately, there exists another rule governing the size, the pitch and the length of pipe run used to feed each radiator. This is critical, especially in one-pipe systems and the reason is basic. The pipe that is used to deliver steam out to the radiator is also asked to bring the condensate formed in the radiator back to the main. This occurs simultaneously, so it is important the velocity of the steam (how fast it is traveling towards the radiator) doesn't exceed a maximum. If it does, the condensate won't drain back, and in fact, will be driven towards the radiator, causing banging and sloshing noises. Think of it this way… steam traveling in a pipe is like wind heading in one direction, while the condensate is trying to gravity drain back underneath this wind in the opposite direction. As long as the tunnel is big enough and there is sufficient pitch, things will work as they should.

When our contractor friends remodeled the kitchen, they were not aware of these piping concerns; they just used the same sized pipe that had worked for the last 60 years. But with the oversized boiler and the additional length of horizontal run from the main to the radiators, they had nothing but cold, noisy cast iron decorations.

I received a call from a local heating contractor who did work for a big management company that owned a lot of property. It seems that one of their buildings was giving them a lot of headaches with nuisance service calls, so the contractor asked me

to meet him at the job.

What we saw when we walked into the boiler room was quite remarkable. The first thing that got my attention was the five or six year old pressure reducing valves sitting on top of the boiler. The next item of interest was the expansion tank--or lack thereof. There was a ¾" copper line piped off the top of the boiler which went straight up into the sheet rocked ceiling. But we couldn't see any expansion tank, only a piece of pipe!

The final piece to this "Rembrandt" was the piping of the relief valve. Connected to the bottom of the discharge line from the valve was a piece of 6" flue pipe. And this flue pipe was positioned by a milk crate that was carefully wedged against the boiler. From there, more flue pipe was attached--in fact, 40 feet of flue pipe! The janitor had built a drainage system using the flue pipe that ran from the bottom of the relief valve piping in the boiler room to a back room where a floor drain was located.

The relief valve would constantly dump water onto the floor every time the boiler fired. And since he was TIRED of mopping up the water, he built the "drainage system" that emptied into a floor drain. But when the boiler turned off, the pressure in the system would drop. This caused the PRV to feed gallons of make-up water back into the system. Unfortunately after a few of these cycles, the minerals from the raw make-up water came out of solution and gathered on the PRV's seat, causing it to fail plugged.

Next came numerous phone calls to the Management Company from the upper floor tenants complaining of being too cold. Of course, where there is no water, there is NO HEAT! To solve this problem, the janitor would then replace the "old" pressure-reducing valve with a brand new one. This would continue throughout the entire heating season.

The cause of this whole miserable story was the hidden, waterlogged steel expansion tank that was hiding above the sheet rock. It appears the tank had been installed incorrectly ever since the boiler was replaced. But the janitor had access to the tank and he would just drain it down every time it became waterlogged. Once the new ceiling went up and covered the tank, the problems multiplied. But instead of solving the real issue of why was the tank waterlogging in the first place, the janitor just did what he could, which was to build a "drainage system."

Both of these problems shouldn't have happened. The information is readily available; just take the time to ask! If you come across problems out in the field and you want to discuss it, e-mail me at gcarey@fiainc.com.