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Heating System Problems

Lack of knowledge can be the cause

A contractor asked me to visit an apartment building that was giving the property management company a lot of headaches with nuisance service calls, so I met him on the job.

What we saw when we walked into the boiler room was quite remarkable. The first thing that got my attention was the six, old pressure-reducing valves (PRVs) sitting on top of the boiler. The next item of interest was the expansion tank or lack thereof...there was a 3/4" copper line piped off the top of the boiler and it went straight up into the sheet-rocked ceiling. However, we couldn't see any expansion tank, only a piece of pipe!



A drainage system that led to a floor drain in another room, built by a janitor to deal with a leaky boiler, was only a temporary fix. A much bigger problem loomed.

The final piece 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, which was positioned using a milk crate that was carefully wedged against the boiler. From there, more flue pipe was attached. The building's 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, the janitor built the "drainage system" that emptied into a floor drain. However, 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 plug up. Next came numerous phone calls to the management company from the upper floor tenants who complained 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" PRV 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 sheetrock. The tank had been installed incorrectly when the boiler was replaced. Initially, the janitor had access to the tank and he would just drain it down every time it became waterlogged. However, once the new ceiling went up, it covered the tank and the problems multiplied. Instead of solving the real issue of why the tank was waterlogging in the first place, the janitor just did what he could, which was build a "drainage system."

One-pipe steam systems

During the past few months we have presented quite a few Zoom seminars on various heating subjects. One of the most popular subjects was "Troubleshooting Steam Systems," which concentrated on understanding and troubleshooting the different types of steam heating systems. Of all the systems discussed, one-pipe systems were perceived as being the easiest to understand.

The reasoning was very logical; there is only one pipe feeding each radiator, what's so difficult to understand? However, as we got into the "hidden" aspects of one-pipe systems, contractors began to realize 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 warmth to the house, but as soon as a "rule" is ignored, anything can happen.

This was what was happening in a newly renovated house with an old steam system. The homeowners were experiencing cold radiators and spitting vents. A friend of mine asked me to come and take a look. One of the first things to check for when troubleshooting a steam system with a brand new boiler is if the boiler was sized for the connected load. This means counting the square foot equivalent direct radiation (EDR) rating of each the radiator in the house to 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 problems. 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 a one-pipe system, 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 that the velocity of the steam (how fast it is traveling towards the radiator) doesn't exceed a maximum. If it



Like a one-man band, the connections of a one-pipe steam heating system need to be positioned correctly for everything to work harmoniously.

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 using gravity to drain back underneath this wind in the opposite direction. So long as the tunnel is big enough, and there is sufficient pitch, things will work as they should.

When the kitchen was remodeled, members of the contracting team were not aware of these piping concerns; they just used the same size pipe that had worked for the last 60 years. However, 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.

Both of these problems shouldn't have happened. The information is readily available; just take the time to ask!

If you have any questions or comments, e-mail me at gcarey@fiainc.com, call me at (800) 423-7187 or follow me on Twitter at [@Ask_Gcarey](https://twitter.com/Ask_Gcarey). **ICM**