HEATING SYSTEM oddities

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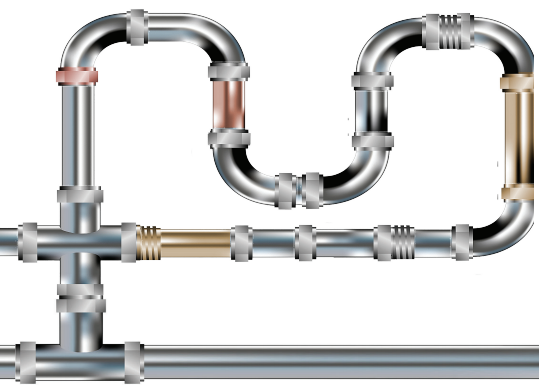
Following is a sampling of jobsites that I have seen over the past heating season. Each one was exhibiting some type of problem due to someone either ignoring the standard installation practices or thinking the job was located in an area where the "laws of physics" did not apply.

A large apartment complex in the downtown Boston area was experiencing some very severe overheating with their steam system. The Management Company had recently purchased a weather-responsive control from our company. This control was suppose to measure the indoor temperature, the outdoor temperature and then make a decision on how long the burner/boiler should run to satisfy the building's heating needs.

I met with the service technicians who were trying to figure out the problem. We started by going through the operation of the control. Within a few minutes, we found one of the problems. One of the components of these weather-responsive controls is a sensor that is located near the end of a steam supply main. It is wired back to the control and its purpose is to sense when there is temperature in the system. This tells the control that steam has been distributed throughout the building. The control will let the boiler run for so many minutes, then keep it off for so many minutes, based upon the heating cycle. However, none of this can happen until the "steam-established" sensor measures temperature in the system.

In this system, someone installed the sensor on a return line *that had long been disconnected* from the system. That's why the building was overheating. The sensor never "sensed" any temperature, so the control kept telling the boiler to run and run! The boiler was cycling off its pressure control. The solution was to relocate the sensor to one of the steam mains.

As we walked through the building, I noticed the basement apartments, which were on the same grade as the boiler room, had two-pipe radiators with steam traps. The steam system had no condensate return pumps, only gravity returns. Logically, these radiators should be filled with water all the time because they are below the water line of the boiler. Nevertheless, I was told they were working fine.



I asked the maintenance man if he knew anything about these radiators and he started to smile, then said, "Follow me." He took us outside to the courtyard and pointed to all the holes in the building where pipes were draining water. Every basement radiator was piped to the outside where its condensate was dumped! No wonder they were "working." Of course, the make-up water was eating the cast-iron sections for lunch and the fuel usage had to be excessive, but at least the basement apartments were warm!

Here's a good one—and it's true! A local service manager contacted me to look at a heating system his installation department had installed two years ago. The system consisted of five zones of baseboard and one indirect water heater. They installed a good air separator with a diaphragm expansion tank and pressure-reducing valve on the supply. They also installed all the circulators on the supply, "pumping away" from the expansion tank. That is why he had me at the job. It turns out the homeowner was threatening to sue the Oil Company because the circulators were on the supply-side of the system. Huh???

Recently, the homeowner had a family party and a relative, who happens to be a plumber, looked at the heating system and proudly exclaimed, "This system will never work! These circulators ***have to be*** installed on the return so they can pull the water back from the system."

He explained that these circulators would never be able to *lift* the water out of the boiler, which is why the system will never heat! Mind you, the system has gone through one heating season and is now entering its second one. Of course, the house has heated wonderfully. Nevertheless, the "plumbing relative" convinced the homeowner that his heating will not work and that is why he is suing the Oil Company. So here is a little warning to all you who believe in locating your circulators on the supply. We all know it is the better way to install circulators. The system operates more quietly, with no gurgling or sloshing noises. But, make sure you tell your customers to keep their relatives away from their new heating systems!

This last job was interesting...the steam system had both its main vents and radiator vents on the first floor spitting water. Naturally, in addition to the spitting, there was a fair amount of water hammer. I met one of the service technicians

at the job and he walked me around the building. The system was a one-pipe steam system with a gravity wet-return. One of the things I noticed was, at the end of each main and at the base of each riser, a float and thermostatic trap was installed. The outlet of each trap then drained into the wet-return that ran on the floor around the basement and into the Hartford Loop. We walked over to the boiler and checked out the settings on the pressuretrol. It was set for five pounds and the differential was set for two pounds. This meant the system's pressure operated between three and five psi. I was starting to see the cause of the problem. We then measured the distance between the outlets of the traps and the water line of the boiler. There was only three feet of vertical distance between them. When you have steam traps in a system, remember that one of the functions of the trap is to prevent the steam from getting past the trap and into the return lines. The traps on this job were working fine. Unfortunately, in this situation, it was the cause of the problem. This was a one-pipe system with gravity returns. There were no condensate or boiler feed pumps, so there was no need for the traps. Why someone bothered to install them is another story.

Without any steam pressure in the return, the only help the returning condensate had to overcome the pressure in the boiler was its static pressure. For every pound of pressure in the boiler, the water would have to stack up 30". In this system, the boiler was running between three and five pounds. Therefore, the water would have to stack up 90" to 150" (7' to 12') to enter the boiler.

This explains why the vents were spitting water. As the boiler was firing and building steam pressure, the condensate returning from the system was "stacking" in the returns, trying to develop enough pressure to overcome the pressure in the boiler. Eventually, the condensate backed up high enough to reach the first floor radiator vents. This situation also explained why the boiler was flooding. Initially, they thought it was a defective water feeder, so they replaced it. However, when the problem persisted, they asked for help. We concluded that while the condensate was backing up in the system, trying to overcome the boiler pressure and was not able to return to the boiler. This obviously affected the water level, causing the automatic feeder to add make-up water into the boiler. Once the system satisfied and shut the boiler off, the leftover steam condensed in the boiler, allowing all the water out in the system to drain back. This raised the water level to the point of flooding the boiler.

The quick solution to this system's problem was to replace the pressuretrol with a vaporstat. The vaporstat allowed us to set the maximum pressure at 14 ounces. By keeping the pressure low in the boiler, the condensate would not have to stack any higher than 28-30", which was still below the F&T traps. We also added extra main vents near the end of each main to improve the venting capacity. This helped prevent the burner from short cycling due to the lower pressure settings. ICM

If you have any questions or comments, e-mail me at gcarey@fiainc.com or call me at FIA. 1-800-423-7187 or follow me on Twitter at @Ask_Gcarey