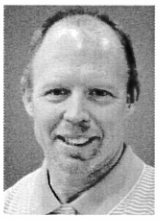
How unwanted flow can create HVOC!



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The following are a couple of jobs that I was called out to look at with some service technicians. Each job had a similar theme—overheating or unwanted heat in a zone that was off, the thermostat was not calling and the respective zone valve was closed.

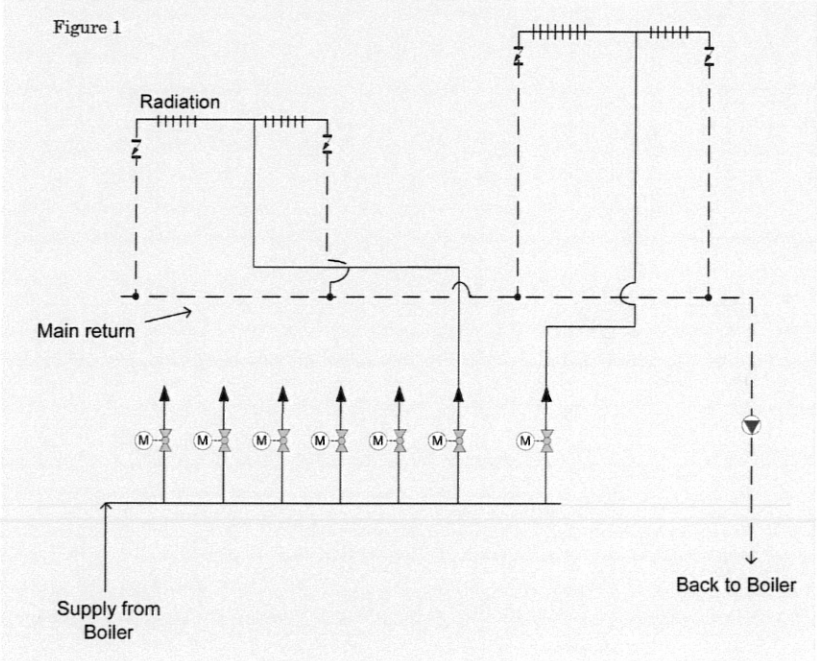
The First Job

The first job looked like the drawing in **Figure 1**. You can see that the system was zoned with zone valves on the supply header down in the boiler room, and the system circulator that served all of the zone valves was on the return line pumping back towards the boiler. The service technician tried to describe over the phone how it was piped and what was happening. A top floor unit was overheating so badly that the tenant had the thermostat turned down as low as it would go, had windows partially opened and it was still 77-78 degrees F in the unit. After a while, we decided to meet at the apartment building to see if we could figure out what was happening.

The boiler room piping was basically as drawn in **Figure 1**. Of course, when we first started, we did not know that the top floor zones were piped with one supply line and two separate returns connected to the main return line in a ceiling somewhere. All of the other units were piped as simple series loops. When we first began looking, the piping in the mechanical room looked like every other multi-zoned hydronic heating system that used zone valves. The circulator was set up to run on constant circulation. When the outdoor temperature dropped below a set temperature, the circulator would turn on. Each individual apartment had a thermostat wired down to its respective zone valve in the basement. Whenever the thermostat called for heat, the zone valve would open, allowing the hot water that was already circulating around the building into the zone of the baseboard.

As we were checking out the boiler room piping, we kept asking ourselves how water could be circulating through a zone with its zone valve closed. The obvious answer is it can't...but at the same time we had a unit upstairs that was severely overheating. Luckily, each zone valve had a service valve that could be used when you had to fix or replace the zone valve. We decided to close that valve to see if the overheating stopped or continued. By closing this valve, we were taking the integrity of the zone valve right out of the equation. We waited a while and then checked the supply piping for the overheating zone and, sure enough, the line was stilled cold (ambient temperature)! There was definitely no flow going past the zone valve and up into the apartment. This made us think there had to be a "cross-connected" pipe somewhere that was feeding the other unit, or somehow the thermostat wiring to its respective zone valve had to be crossed. This would allow one thermostat to call for heat and the wrong zone would open, allowing hot water to flow through the wrong apartment.

Figure 1



As we were discussing these various scenarios, I kept asking, "How long has this problem existed?" The property manager, who was receiving the phone calls, said it had been going on for about three weeks. I asked if in that time frame, had any work been performed on the system, were thermostats replaced or was there piping work? The answer was "No" to all of the above. The service technician and I decided to visit the overheating

apartment to see if there was something there which wasn't visible from the boiler room.

Once inside the apartment, we took the baseboard enclosure off. I wanted to be able to see all of the piping, including the supply and return lines. Once we did, two things "jumped" out at us. First, there were three pipes coming into or leaving the apartment. Second, there were two check valves in the piping at either end of the apartment. If you look at **Figure 1** again, you can see that in fact there is one supply pipe that splits left and right, feeds both sides of the apartment and then returns individually into the main return line. That explains why they had installed check valves to prevent the water that was flowing along the return main from any of the other zones to "move" backwards up one of the "off" return lines, through the baseboard and back down the other return line. We speculated that somehow the integrity of one or more check valves was compromised. Either something became lodged onto the seat or the flapper was deteriorating or somehow leaking. Regardless of the cause, we suggested that both check valves in the overheating apartment be replaced with new ones. Once they were, the overheating complaints stopped.

The Second Job

The second job also resulted from complaints of overheating and it too was zoned with zone valves and one main circulator pumping throughout the building. However, the piping in this system was different from the previous problem job, as seen in **Figure 2**. All of the zone valves were located back in the mechanical room, but this time they were installed on the return manifold because the supply main left the boiler as a single pipe and then split off to the various zones in the ceiling and behind the walls. The only convenient way to zone the system was to locate the zone valves on each return that came back separately to the boiler room.

The complaint from the homeowner was that two zones were overheating, even though the thermostat was satisfied and not calling for heat. They described to the service technician that in each of the too-hot zones, a certain amount of cast-iron baseboard was heating, not all the way across, but enough to throw some heat into the space, making it uncomfortable.

The house had recently gone through a renovation and some changes were made to the heating system that forced the plumbing contractor to relocate and re-pipe some of the cast-iron baseboard. The service technician went to the customer's house the first time and confirmed that the zone valves were definitely closed, the thermostats in the "trouble" zones were not calling and the return piping of the system side of each zone valve was ambient temperature.

The way this system was piped, there were a lot of take-offs from the supply main out to the heating zones (see **Figure 2**). These take-offs were piped with tees, the run portion continuing along the supply main while the branch portion was feeding up to the zone take-off. Now when any of the zones call for heat, hot water is circulated through the main until it reaches the proper take-off for the zone(s) that is calling. In the meantime, hot water is passing by one or more tees that have their branch portion of the tee facing up towards the zone of piping. The water temperature in the riser connected to an off-zone is certainly cooler than the temperature of the water circulating in the supply main. Mother Nature hates an imbalance and will do everything in her powers to re-establish that balance. As the hot water is circulating past these "open" branch runs, heat will go to cold. When the conditions are just right—the temperature difference, the weight difference (the amount of water which varies depending upon pipe size and type of radiation), the location of the first piece of radiation relative to the supply riser take-off—you can have enough heat "go to cold" so that the radiation starts to emit British Thermal Units (BTUs) into the zone. Remember, this isn't water circulating through the zone because the zone valves were working as they should; it was simply heat moving to cold. When a room is already warm enough, any additional BTUs will elevate the space temperature to an uncomfortable level, and that was, unfortunately, happening in this particular home. To solve it, the service technician located (where he could) spring-loaded check valves that prevented the heat from migrating.

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

Figure 2