BOILER FACTS

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TOOLS AND TECHNIQUES FOR TECHNICIANS

Solving a unique air problem...

...with the help of some friends...

A service manager of a local oil dealer called me to look at a hydronic job that was driving them crazy. It seems a customer of theirs had some renovation work done to their house over the summer and ever since the weather got cold and the new heating system turned on, they have been complaining about noise in the system.

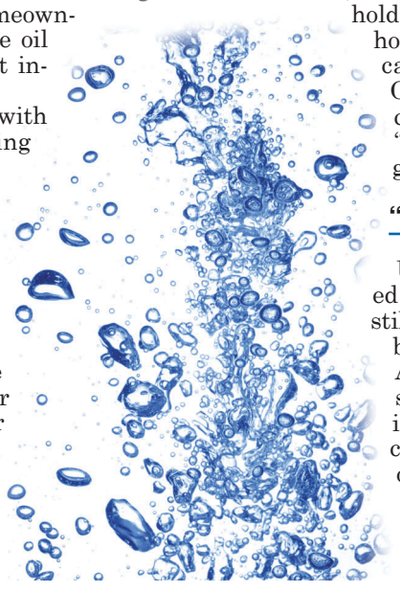
A two-story addition had been added to the customer's house. The heating system had been subcontracted to a plumber who installed a two zone series-loop baseboard system. The first floor zone heated a dining room and sun porch, while the second floor zone heated the new master bedroom. The original part of the house was heated by an oil-fired warm air furnace which had not been changed.

The homeowner complained that every time the heat came on in the master bedroom, he heard gurgling noises in the baseboard, waking him and his wife in the middle of the night.

At first, he tried to get the plumber to come back and fix the problem, but all the plumber did was purge the zone with fresh make-up water. That quieted the system down long enough for the plumber to get out of the driveway, but within hours, the noise would be back. Eventually, the plumber stopped answering the homeowner's phone calls. The homeowner mentioned the problem to one of the oil heat technicians and that's how we got involved.

It was a standard two zone system, with two circulators on the return pumping into the boiler. On the supply was a diaphragm tank hanging off the bottom of a standard air scoop. It was your basic everyday hydronic system, although the "scoop" was installed incorrectly and the pumps were located on the return. I suggested to the oil company they relocate the air scoop correctly and locate the circulators on the supply after the air scoop and expansion tank. The air scoop needs at least 18-24" of straight piping before the air enters the scoop for it to be effective. Of course, by locating the pumps on the supply, they are now "pumping away" from the point of no pressure change. This means every time the pumps turn on, their pressure differential is added to the system's static pressure. This helps prevent air gurgling noises in a system because the added pressure "crushes" any air bubbles and drives them into solution. This allows the water to bring them back to the boiler where they are heated, released and captured by the air separator.

The homeowner called about a week later to let the service manager know that the heating system was noticeably quieter, but there still were some gurgling noises. The noises lasted only 8-10 seconds, but whenever the master bedroom zone called for heat they could hear it.



The Laws of Physics

Hydronic systems all operate under the same laws of physics, and every system should operate quietly. Air in a hydronic system can be the source of many problems, not the least of which is gurgling, "waterfall" noises. When a system is initially filled, cold water is used. Once the boiler starts heating this water, however, air bubbles come flying out of solution. This is because there is a direct relationship between the temperature of the water and the pressure it's under to the amount of air it can hold in solution. In other words, the colder the water, the more air it can hold; the hotter it becomes, the less it can hold. This is why air separators are located on the supply after the boiler. Once the water is heated and the air comes out of solution, the separator "catches" the bubbles before they can get out to the system.

"Tidd-bits"

Unfortunately, even after the suggested changes were implemented, there were still some gurgling noises in the master bedroom, so we went back to the job. All of the components had been installed properly, so we started checking the operation of the system. We cycled the second floor circulator off and on, and sure enough, we could hear the air come "rolling" down the return riser. The vent may have been sticking, since we never heard any air hissing from the air separator.

But as the service technician shut off the circulator, he noticed a gurgling noise that appeared to be rolling up the second floor return riser. He turned the circulator back on and the air came back down the riser. Sure enough, when he turned it off, the air definitely seemed to be floating back up the return riser. This made us take a closer look at the return header. And when I saw it, I thought of an article written by Ed Tidd.

Tidd worked for Bell & Gossett back in the '50s and '60s. He used to go around the country solving air problems in hydronic systems that used B&G products. He saw so many different problems that he decided to write a book called "Tidd-Bits" which was a compilation of all these hydronic problems with their solutions.

One system in particular experienced continual air gurgling and binding problems even though the air separating equipment was installed correctly. It was discovered that the return header was the source of the problem. In our example, the customer had an 11/4" return header, which is quite common; but what was unique was that it had a 12" piece of horizontal pipe after it picked up the second floor ¾" return riser. It then dropped down vertically for two feet before it ran horizontally back to the boiler, picking up the ¾" first floor return riser along the way.

Spending a bit of time calculating zone piping length and fittings compared to the circulator's flow and head capacity, we figured the flow in the master bedroom zone was around 3 gpm. This flow is ideal for the ¾" zone piping, but when it entered the horizontal 11/4" return header, the velocity of this flow rate was so slow—about 6" per second—the return header became an air separator. This allowed any air that was traveling back to the boiler to SEPARATE from the pumped flow.

To make the situation worse, the return header had a two foot vertical drop and because of the insufficient velocity, the air bubbles would NOT flow down the pipe. Instead, they would gather in this horizontal 11/4" header, even though the circulator was running. (Good industry standards suggest a minimum velocity of 2' per second.) The air would then float back up the return riser when the circulator turned off. And this is why the customer could hear the gurgling for 8-10 seconds every time the zone called for heat!

The air separator and vent were working. It was just a unique situation where the air bubbles could not reach the air separator on the outlet side of the boiler because of the improper return header arrangement. Once the service manager had his installation crew re-pipe the header to maintain the proper flow velocity, the problem went away. In fact the homeowner had called him the very next day to say that "last night was the first night in a long time" that he and his wife did not hear ANY gurgling noises when the zone called for heat!

If you have any questions or comments please email me at gcarey@fiainc.com or call me at 1-800-423-7187

I want to wish a Merry Christmas and a Healthy and Happy New Year to all of our ICM subscribers. May the heating season be healthy and prosperous for everyone one of you!

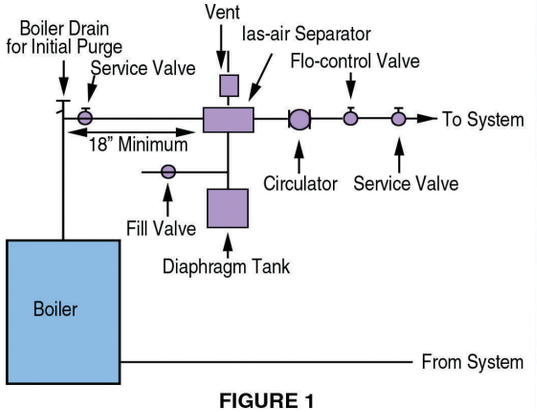


FIGURE 1

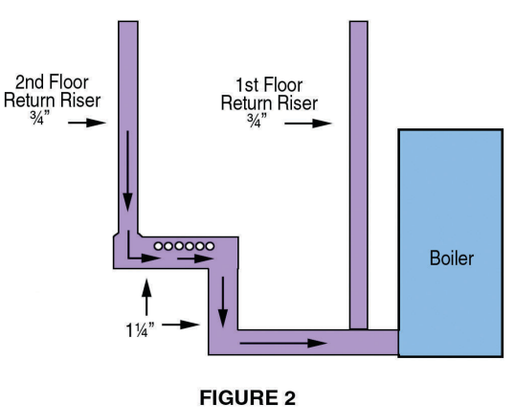


FIGURE 2