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How A Good Troubleshooter Got Results

A true story...

At first, the call sounded like one we hear all the time - not enough heat in a room that had been added onto a house. The service guy told me the radiators were big enough, and that the house had an old gravity hot water system. He asked if I'd stop by to look at it, and I said I would.

When I arrived, the service guy met me in the driveway. He immediately began telling me all about the problem. He explained that someone else had installed a circulator, but that it hadn't helped much with the lack-of-heat problem. I suggested we start in the basement and we headed for the stairs.

The first thing I checked was the piping. I know that pipes have to be large enough to carry the heat from the boiler to the radiators. That's something a lot of guys overlook when they're faced with a problem. Here, however, the piping looked fine. The new fitter had taken great pains to mimic the original fitter's piping techniques. The branch line to the new addition took off from the main at the correct angle. It was the same as the branches that fed the other first-floor radiators. The size was right, and everything else in the basement looked okay.

I talked to the home owner, and she told me most of the house heated well. "It's just the addition," she said. "We've been cold for the past two years. We need some answers, and we need them fast!"

I asked her if the radiators in the addition got warm and she said they did, but the room was still uncomfortably cold. I started to suspect there might not be enough radiation in the new addition.

"What's the heat loss in the addition?" I asked the service guy.

"Seventeen-thousand BTUs," he said.

I checked out the two new radiators.

Together, they put out 90 square feet EDR. I divided the heat loss of the new addition (17,000 BTU/hr) by the square foot EDR. Those radiators would have to have 190 degrees flowing through them before they'd heat that space. And since most hydronic systems work with a 20-degree temperature difference from supply to return, the boiler would have to run up to 200 degrees to satisfy the load.

Radiator Heat Output Varies With Average Water Temperature

Average Temperature	Heat Output per Square Foot EDR
150° F	110 BTU/hr.
155° F	120 BTU/hr.
160° F	130 BTU/hr.
165° F	140 BTU/hr.
170° F	150 BTU/hr.
175° F	160 BTU/hr.
180° F	170 BTU/hr.
185° F	180 BTU/hr.
190° F	190 BTU/hr.
195° F	200 BTU/hr.
200° F	210 BTU/hr.
205° F	220 BTU/hr.
210° F	230 BTU/hr.
215° F	240 BTU/hr

This is a fine point many installers overlook. They think a square foot of radiation puts out 240 BTUs, but that's only true when there's steam in the radiator. The output changes when you circulate hot water. You can see this on the chart.

So how much radiation did we need to add to the addition? Well, a lot depended on the average water temperature flowing through the rest of the house. The home owner told me the rest of the house was comfortable, so we ran a heat loss calculation on the living room and came up with 21,000 BTU/hr. The installed radiation in the living room was 175 square feet EDR. Again, I divided the heat loss by the installed EDR and came up with 120 (21,000 ÷ 175 = 120). That meant the radiators in the living room were providing comfort by putting out 120 BTU/hr. per square foot.

Looking at the chart, I could see this corresponded with an average water temperature of 155 degrees. No wonder they didn't have enough heat in the new addition! The water wasn't hot enough. The original installer had designed this system to run on relatively low-temperature water (165 degrees) because he was using a coal-fired boiler. Low temperature water was the norm in the days of gravity hot water heat.

If we raised the boiler water temperature to satisfy the addition, we would have made the rest of the house uncomfortably warm. We also would have increased the home owner's fuel bills. That's why we decided to add an additional 52 square feet EDR to the addition.

We figured this out by dividing the heat loss of the addition by the heat output we'd expect to get from 155 degree average water temperature (17,000 BTU/hr. heat loss ÷ 120 BTU/hr/square foot = 142 square feet EDR required). We already had 90 square feet installed; the additional 52 would bring us up to 142 square feet EDR, and that's exactly what we needed to bring the addition in line with the rest of the house.

Once we had this figured out, we suggested to the home owner that she put the new addition on its own zone. We explained how this would give control over the system and take her from the 1920s into the 21st century in a hurry. She liked the idea and gave us the go ahead.

I sized a B&G Series 100 for each zone. The 100 provides the large flow/low head characteristic you need for a gravity conversion job. I added two B&G Flo-Control valves, one for each circulator, to prevent gravity circulation to a heat satisfied zone. I also had the installer pipe in a bypass to protect the boiler from thermal shock.

The system works beautifully now!

For answers to your hydronic questions, contact your local Bell & Gossett representative.

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How to Increase Your Profits with LowWater Cutoffs on Hot Water Boilers

Most gravity steam boilers operate at 2 psi or so, and every one comes with a low-water cutoff. You probably can't imagine a steam boiler operating without that essential safety control. What would happen if the boiler ran out of water and the burner continued to fire? If you've ever seen a burned-out steam boiler, you know that the stakes are very high. And that's why every steam boiler comes with a low-water cutoff.

But now consider a hot water boiler. Most operate at six times the pressure of the typical steam boiler, yet many have no protection against a dangerous low-water condition. Some hot-water boilers have that crucial protection, but these are typically larger boilers, 400,000 BTUH and higher. Why boilers of this size? Because it's code. Contractors usually install these boilers in multi-family housing and commercial buildings places where there are lots of people.

But what about smaller hot water boilers? You know, the kind you find in single-family homes. Plenty of people living there, but many don't have low-water cutoffs, do they? Why? Because in some states, there's no law that says you have to install them or you've chosen not to comply with your state's code. Be aware that most states now require low-water cutoffs on all boilers regardless of size or type. At about $100.00, a low-water cutoff is an inexpensive insurance policy protecting you and your customers.

What's causing this shift in policy? We suspect it may have to do with the rapid growth of hydronic heating in certain areas of the United States. Did you know that the radiant-floor-heating market has been growing at a steady rate of about 30% a year for several years now? Many newer hydronic heating systems include at least some radiant floor heating. And when all or most of your system piping winds up below the boiler, the boiler manufacturer requires you to install a low-water cutoff. It's time to start thinking seriously about potential system leaks, and about the people who are going to live in that house.

Even a simple baseboard-loop system can have several feet of piping that dips under a concrete slab to clear a doorway. That piping's out of sight and prone to corrosion and leakage; in most homes, there's nothing to protect the boiler from a low-water condition. Maybe you're thinking the feed valve will protect the boiler if something goes wrong? If you are, consider this situation.


M&M low water cutoffs: RB-122 (120V - left) and RB-24 (24V - right)

Suppose the burner locks into the firing position and doesn't drop out when it should. Anything from a stuck-open gas valve to a faulty control can cause this problem. Once the burner locks in and keeps firing, the temperature and pressure inside that boiler will build until the relief valve opens. In most homes, this happens at 30 psi.

So the relief snaps wide and unloads a furious blast of steam. Once the immediate danger passes, the valve quickly seats itself. In most homes, they seat at about 26 psi. But remember, the burner continues to fire.

And then in a few moments, the relief valve roars open again, dumping even more steam into the boiler room. Unless someone notices, this will continue until there's little or no water in the boiler.

Now consider this. While this is happening, the system pressure never drops below 12 psi. Because it doesn't, the feed valve can never feed. And if the feed valve shot water into the boiler, there's no telling what could happen.

Can you see how low-water cutoffs are in the best interest of your hot-water heat customers? It's to your great advantage to mention them to your customers, especially if you're replacing their boiler. When they realize a low-water cutoff is in their best interest, most homeowners say, "Sure, install it!" This is especially true when you're replacing their boiler, because the cost of the low-water cut off seems modest compared to the cost of the complete job.

Think about it. If you mention it to them as an option, explaining the facts about feeders and boiler protection, they might just say "Yes!" And if they do, you'll make more money on that job while you're protecting that family from potential danger.

And if they say "No," you're still better off. You've raised an issue with a solution that's in their best interest. You've shown you care about their safety.

When you sell with your customers' best interests in mind, you separate yourself from other contractors in a big way. This caring approach and awareness of the workings of hydronic systems make you more professional in the customer's eyes. And the best part: you'll probably increase your profit on every job you do.

For more information on boiler controls or answers to any steam or hot water heating question, contact your local McDonnell & Miller/Hoffman Specialty representative or visit our websites at www.mcdonnellmiller.com or www.hoffmanspecialty.com.

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