

# FROM THE FIELD

## Commercial Steam – Part I

BY DAN FOLEY CONTRIBUTING WRITER

**M**y company has installed and serviced residential steam boilers since it started more than ten years ago. We have also developed a profitable niche of repairing, servicing and installing commercial steam boilers. While we have done bigger, our comfort level is right around 2 million BTUs.

I have a deal with my friend Nick Holman, owner of Capitol Boiler Works, in Springfield, Va. If I run across a high pressure steam boiler or anything bigger than 2 million BTUs, I send it his way. Likewise, he sends me the smaller commercial and residential boilers that he runs across. This has worked out well for both of us for a number of years.



*Foley Mechanical technicians assembling V-9 cast iron steam boiler sections.*

The niche that has worked out best is the many apartment buildings that were built in the Washington, D.C. metro area between 1890 and 1930. Most of these apartment buildings were heated by steam – both one-pipe and two-pipe. Fewer and fewer companies are willing to



*Foley Mechanical technician using a gauge to check the steel push nipples in the cast iron boiler sections.*

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work on these old systems or replace the boilers when it is time. This is a good thing for me and for my company. I have also found out that you must be very careful when working on old commercial steam systems, especially when the boiler is being replaced.

Along with two case studies, I will share with you some of the lessons I have learned the hard way. Even after attending just about every steam seminar available and reading many books on the subject, I have still run into things that were not covered.

### Do your homework

Before you jump into a commercial steam project, I advise you to do your homework. My number one resource is the bible on steam systems, “The Lost Art of Steam Heating,” by Dan Holohan.

I have lost count of how many times I have read it, yet, I still learn something every time I crack it open. I have worn out at least half-dozen copies. Just about everything you need to know about commercial steam boilers can be found between the covers of this book. There is not a steam job we do where I do not consult this book.

### Wet returns

This one I learned the hard way. Wet returns must be replaced. They are full of mud, sediment and rust that have accumulated for as many as 80-100 years. In most cases, it is all but impossible to flush out this muck. In the past, it was a pain to replace the wet returns. No one wants to cut and thread 2-inch black steel pipe. With MegaPress and similar steel press fittings now on the market, it is a snap to replace the wet returns.

While I would not advise press fittings for headers and steam mains, even though allowed by some manufacturers, I have no issue using it on wet returns which are below the water line. These fittings will never see steam pressure.

I was on one job where I was told it was impossible to replace the wet returns because they ran below a concrete

➔ Turn to FOLEY on p 50

## | FROM THE FIELD | CONTINUED FROM PAGE 48



Lead technician Brian Golden fabricating one of the header risers in the V-9 steam boiler.

slab. In this case, we found a way to run the returns through a mechanical room, down a basement corridor, and into the boiler room. Fortunately, we did not have to cross any door openings.

It is possible to cross a door opening by busting out the concrete with a concrete saw and rotary demo hammer. Then, dip below the door opening and back up the other side. This is a case where L copper would be better than black steel. If you do use black steel, paint it with two coats of silver dollar, let it dry, and then wrap it with closed cell insulation or cork tape to keep concrete and moisture from touching the pipe.

It is necessary to install isolation valves on each side of the doorway before the pipe dips below the concrete floor. Purges on each side allow the trap to be flushed out on a regular basis. Skip this step and the trap will fill with sediment in no time.

### Headers

We always follow the manufacturer's instructions to a T when it comes to near boiler piping. This piping is critical to the operation of the system and to separate the steam and the condensate. Good dry steam is what heats the building. In many cases, we will go one size larger on the header to help dry out the steam. In low basements, a drop header, like the one pictured, can help to separate the steam and condensate.

We can thread up to 4 inches black steel. If the system requires a header bigger than 4 inches, we bring in a welder. Whatever you do, do not be tempted to use copper. I see it on occasion in the field. Each time I have run across copper, it has a leak in at least one of the joints. The soldered joint cannot handle the torsional stress created when the header goes from room temperature to 215 degrees in seconds as the steam comes up. To that end, I would not use press fittings (black steel or copper) in the header either.

### Low water cut-off safeties

I have seen the results of a dry fired boiler many times. It is not a pretty sight. Once, I saw a dry fired boiler with sections still glowing cherry red. I don't think I have ever been that scared in my entire life. The plastic gauge glass cover was dripping down the front of the boiler. The plastic hand holds on the boiler jacket lay in black gobs on the floor. This is a sight I don't care to ever see again.

We now use two low water cut-off safeties on residential boilers and three on commercial steam boilers. We often use different types (float/probe) and different manufacturers to ensure redundancy. As a contractor, it is your responsibility to install a boiler with the appropriate safety controls.

### Vents and traps

We replace all main vents, radiator vents, F&T traps and steam traps on our replacement jobs. In most cases, these are decades old. In some cases, they are the original. Even if they are newer, I replace them. I have tried it the other way. Whatever parts you try to re-use, will invariably fail at the most inopportune time. Then you are in the position of replacing them free of charge. I prefer to build trap and vent replacement into the original job and get paid for my hard work.

I realize trap replacement is a pain. They are hard to get to and difficult to replace. In many cases, there are enclosures built around the radiators or convectors. F&T traps and main vents are in locked basement storage areas. When your radiator spud wrench snaps off inside the radiator, you must carefully remove the brass and steel with a Sawzall and chisel. This takes time and patience and you must account for it in your selling price.

You can leave the traps alone and hope the system works properly. I can advise that hope is rarely a good strategy. Better to replace the traps and promise your client a system that functions properly.

### Cleaning

I allow a minimum of one full day to properly flush the returns, and to clean and skim the boiler. In many cases, these systems are over 100 years old. There is a lot of dirt, mud, sediment, and oil in these systems. The new boiler



Brian Golden finishing up the drop header on the Burnham V-9 steam boiler.

and fittings have oil from machining and thread cutting. The steam will not release from the water line if the water is dirty and there is oil at the water line. I follow the manufacturer's I&O manual as well as that outlined in, "The Lost Art of Steam Heating."

There is no way to speed up the process of skimming the water line. Often, a return trip is required after the boiler runs for a week or two. This step is a necessity and cannot be skipped. Chemicals cannot replace this step and I use them sparingly.

➔ Turn to FOLEY on p 52



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| FROM THE FIELD |

CONTINUED FROM PAGE 50

Case study

An example of a small commercial steam replacement job is pictured on the previous pages. The 21,000 square foot, 16-unit apartment building located in Alexandria, Va., was built in 1914. Originally coal fired, the boiler was converted to oil in the 1950s. When we were called in, the existing boiler was leaking and oil usage was excessive.

We replaced the boiler with a Burnham V-9 cast boiler fired by a Beckett CF-800 oil burner. A tekmar 269 steam control with indoor feedback controls the firing rate. All of the radiator steam traps were replaced. A boiler feed pump and control replaced the existing condensate pump.

We ran into two unexpected issues. The first was the wet returns which originally ran under the concrete slab and rotted out. In the past 20 years, they were replaced with copper and ran around the basement wall about halfway up the wall. The old boiler had a higher water line and the returns were under water. With the new boiler, the water line was about a foot lower, partially exposing the no longer wet returns. This caused steam to slam into the water in the horizontal run creating horrendous water hammer.

We dropped the returns to the floor which sealed the wet returns from live steam. This solved the problem.

The second issue we ran into was system performance. With new main vents, the steam shot around the steam mains, which circled the building. The problem was that the radiators were very slow to heat as the steam slowly crept through the radiators. Was it bad traps? Broken radiator valves? No, those checked out. We cracked the trap union and steam immediately filled the radiator. It wasn't the traps or valves.

After carefully investigating the piping, lead tech, Brian Golden, found the cause. The dry returns dripped down into the wet returns but there were no air vents. The air could not get out of the radiators or returns. After cutting an air vent into each return, the issue was resolved. All the radiators quickly heated up, the air vented from the system, and the condensate drained back to the boiler feed pump through the wet returns.

The client reported back that oil usage, adjusted for degree days, was reduced by almost 40 percent. In addition, radiators that never heated before were now heating and tenant complaints regarding the heating dropped to almost nothing.

Stay tuned next month as I detail the steam boiler replacement in an historic 50-unit D.C. apartment building that is over 100 years old. ●

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