Water Hammer in Your Steam System?

Maybe a false water line will fix that…

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As this column is being written for publication, we have been experiencing a very strange Winter in the Northeast area with some fairly wild temperature swings. One weekend in February, it was -12°F in Gloucester, MA, on Saturday morning and by Sunday, the temperature had climbed to 45°F. All the while, heat is still required and heating systems need to operate to maintain certain indoor air temperatures regardless of the outdoor temperature.

One of those systems was an older steam system that experienced banging noises whenever the thermostat called for heat. It all started when the old boiler finally quit. The replacement boiler was considerably smaller physically and consequently held less water. This created the need to install a boiler feed tank, which acted as a reservoir for the new replacement boiler and helped prevent the boiler from shutting down due to low water conditions (or flooding the boiler if a water feeder is present). This occurred when the automatic feeder became overactive due to the lack of water in the replacement boiler. With the boiler feed tank, all the system surges took place in the receiver, allowing the boiler to maintain a steady water line. This by itself isn't uncommon, but trying to install the new boiler feed unit into these older systems can be treacherous and expensive if you are not careful—especially considering that the original system was not intended to have a vented receiver attached to it.

This particular system was a two-pipe air vent system. Due to its age, these systems were installed when one-pipe steam would have been the popular method of heating. In fact, at the time, steam traps hadn't yet been invented. The heat loss in large, old buildings was great, which called for extremely large radiators. It was also very common to bring in outside air to ventilate the building; this was accomplished with large indirect radiators located inside tin ductwork.

In one-pipe steam systems, the riser, which supplies the steam, also handles the condensate that forms in the radiation. There is a counter-flow action that takes place inside those pipes. For this reason, it was important to have the right size pipe to handle those large loads. If the pipe was too small, it would cause spitting radiator vents and water hammer. To prevent this, heating engineers had to use "sewer-like" pipe sizes and supply valves to handle the condensate that would form by these large radiators. Another option was to use a second pipe on the outlet side of the radiator to handle the condensate, thus eliminating the counter-flow problem. The system could be described as a one-pipe/two-pipe system because each radiator still used a steam vent. However, engineers had to ensure that the return pipe drained down individually to a wet return. This was important because the water acted like a trap, preventing steam from passing into the return side of the other radiators. Once steam is allowed into the returns, all kinds of problems can occur (condensate being held up in the radiators, spitting radiator vents and water hammer)!

When you install a boiler feed unit, all the returns *must* drain into this receiver. The only way water can then enter the boiler is by activating the feed pump with a pump controller located on the boiler. Since this receiver can't withstand any pressure, it is vented to the atmosphere. As a result, all of those former wet returns now have *no* backpressure from the boiler to offset the pressure from the supply side. Now the steam can reach down into those former wet returns and shove all that water back and forth in the piping, eventually showing up at the vent pipe, filling the boiler room with steam. Of course, in the process, the water hammer is incredibly loud.

The answer to this problem is to install F&T (float & thermostatic) traps at the base of each riser drip and at the end of each main, as well as radiator traps on each radiator. These traps will prevent the steam from entering into the return lines and pour out of the receiver's vent line. Unfortunately, sometimes it isn't economically feasible or even possible to install all those traps. The cost of removing the asbestos alone can be excessive, in addition to material and labor. When faced with these circumstances, many people will try to get away with installing one "master" F&T trap right at the inlet to the receiver. They figure this will prevent the steam from showing up at the vent pipe. It might, but it does nothing to prevent the steam from still reaching all the way down into those former wet returns, creating water hammer and other problems. Remember, the returns are now isolated from the boiler's back pressure because they all drain into the vented receiver.

There is one other way of getting the job to work with the new boiler and boiler feed unit without having to use a box full of traps. It is called creating a "false water line." By creating this false water line, you can keep the old wet returns pressurized and full of water just the way they were in the original system. This

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There are several methods used to create this false water line. The following is one of those methods: install a 2" F&T trap and hang it right near the boiler feed unit. You want the trap mounted so that its location closely mimics the water line of the old boiler. The style trap should have two inlet and two outlet tappings. Combine all the wet returns from the system into one common line. Pipe this line straight up from the f oor into one of the trap's inlet connections. Then, run a steam line from the steam main over to the *other* inlet connection of the F&T trap. This equalizing line puts pressure on the backside of the wet returns, keeping them wet and pressurized. This pressure acts to balance off the steam pressure from the supply side. Next, pipe a line from one of the trap's outlet connections to the feed tank's inlet connection. As the condensate forms in the system, the F&T trap will open to drain this returning condensate back into the receiver. It is important that the new water line be high enough to cover everything that was originally covered by the level of the old boiler's water line. At the same time, if it is established too high, there is a chance the water could back into the main, causing water hammer and damage any of the system's main vents.

The next time you are faced with replacing a boiler in an old building and the replacement boiler needs a boiler feed unit, check to see what type of piping arrangement the system uses. Creating a "false water line" may be the solution to that system!

If you have any questions or comments, e-mail me at *gcarey@f ainc.com*, call me at (800) 423-7187 or follow me on Twitter at *@Ask_Gcarey*. **ICM**