Water feeders and flooded steam boilers...hmm

By George Carey

"That damned feeder!"

How many times have you heard someone say that? The new replacement steam boiler went in over the summer and now, as the heating season starts, we are finding all the details that were overlooked when the weather was hot. As we approach the warmer months and replace those older steam boilers, let's try to look at the entire system for a moment.

See if this situation sounds at all familiar...

The burner on a replacement steam boiler is short cycling on the low water cut-off, the house is heating unevenly and the customer is on the telephone to the service department every other day. Someone proposes to install an automatic water feeder. Perhaps the salesman who sold the job explains to the customer that new, efficient steam boilers need feeders to produce enough steam to heat the house. Sounds logical to the homeowner (who, by the way, does not understand steam systems), and so an automatic water feeder is installed.

Now the boiler runs longer, producing enough steam to heat the house. However, the customer is *back* on the telephone complaining about a banging noise coming from his basement. He says he is concerned the system might explode. When the service technician arrives at the house, he notices that the boiler is flooded. Naturally, he curses that *damned* feeder!

It is only logical: the feeder feeds the water and the boiler is flooded with water. It *must* be the feeder. So the service technician rips out the *defective* feeder and installs a new one, thinking the problem is solved. And it is, until the next prolonged call for heat occurs and the "happy homeowner" is back on the telephone.

New boilers vs. old boilers

The problem could be that someone overlooked the difference between the old boiler and the newer, replacement boiler. The new boiler has the same heating capacity as the older boiler, but it is physically much smaller and holds less water. This might be the source of all our service technician's grief.

The new boiler is not attached to a new piping system, but rather is connected to piping that is probably 50-75 years old. Over the years, scale, dirt and sediment collect on the inner walls of the piping. It especially gathers in the return piping, and even more so if the return piping is a wet return. Those conditions can add resistance to the flow of returning condensate. Think about it—the return pipes are typically the lowest part of the system. All this crud settles in them, reducing the internal diameter of the pipes.

Another factor that affects the rate of condensate return is the pitch of the pipes. When the system was new, the piping had the proper pitch, which helped the condensate flow in the proper direction. However, over the years, the house may have settled or the pipe hangers may have loosened. In any event, the pitch isn't what it used to be, so the condensate returns at a slower rate.

This might not have been a problem with the old, large water content boiler. However, it became a problem when the modern, replacement boiler was installed. And the customer is *never* bashful of reminding you that before the new boiler, they never had *any* of these problems.

Water content a concern

This particular situation has nothing to do with the feeder, but with the water content of the new boiler. As the boiler makes steam, the water level in it drops because the water is in the system as steam. Eventually the steam condenses back to water and returns to the boiler. But how much water leaves the boiler? And how fast does it return? We can determine how much water is *supposed* to leave the boiler, but how quickly it returns varies from one basement to the next.

Water is converted into steam at a rate of ½ gallon per minute for every 1,000 square feet capacity of the boiler. This means that a boiler rated for 1,000 square feet will lose water at the rate of ½ gallon per minute for every minute the boiler is firing.

If the boiler runs for 10 minutes, five gallons of water will have left the boiler. The question is, how much water is in the new boiler (not the whole boiler, just the amount between the normal water line and the low water cut-off range)? Modern boilers are more efficient than their older counterparts, but they are also much smaller. Consequently, they hold less water. If the condensate takes too long to return and the boiler doesn't have an automatic feeder, the low water cut-off will shut the burner down, causing the boiler to short cycle. If the system has an automatic feeder, it will add water. Of course, the condensate that is out in the system eventually makes its way back, raising the water line in the boiler.

On the next call for heat, the steam leaving the boiler will drag the excess water up into the header piping and probably out into the mains, because the water

is so close to the exit holes in the boiler. This can be a great source of water hammer and service calls.

Near boiler piping Is critical

If the new boiler is not piped properly, it can create a low water condition, affecting the feeder. The near boiler piping around these new boilers has become critical to the success or failure of replacing a boiler. If piped improperly, water can be sucked out of the boiler with the exiting steam.

The reason is velocity. Most residential boilers today have a 2" tapping for the exit hole that connects to its riser. Most of the older boilers were tapped with 2½"-3" holes. The modern boiler produces the same capacity, but it is trying to pass it through smaller exit holes. (There are some modern boiler manufacturers that have supplied their steam boilers with larger tappings for this very reason!)

That is why near boiler piping has become so important. Its function is to "dry out" the steam by slowing it down and letting the water drain back down the equalizer pipe and into the boiler. When someone disregards the manufacturer's installation instructions, there is a good chance the system will experience problems.

The Problem, The Solution

Whenever a steam boiler is flooded, don't condemn the feeder immediately; test it by performing the broken union test. By doing this simple test, you can determine whether the flooding is caused by a leaking feed valve or something else.

The feeder might be the cause of a flooded boiler. However, the problem might be that the replacement boiler isn't piped properly or the water is dirty or maybe the new boiler doesn't hold enough water to offset the system's time lag. It's up to you to determine the true cause! Most current water feeders offer various delay settings. These delays can often help prevent the flooding from occurring. When they get the call from the low water cut-off, instead of responding immediately, they will sit and wait for a period of time. (Hence the delay.)

The idea is hopefully enough condensate from the system will return and either lift the float or cover the probe in the low water cut-off, allowing the burner to fire back up, making more steam. Selecting the amount of time of delay can become tricky; while the burner is off, the boiler isn't making any steam! Someone might notice that in the building. So there is a trade-off…having a lengthy time delay, thus preventing the flooded boiler but possibly creating an inconsistent heating system. Or selecting a shorter time delay and risking an over-active feeder that could flood your customer's boiler. You have to spend time with each system; you can't just wave the magic "wand"!

Feel free to call me at 1-800-423-7187 or email me at gcarey@fiainc.com if you have any comments or questions.