



What is a “Clean” Steam Boiler?

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By Patrick Linhardt

My desk dictionary is a compact paperback model that lost the front cover many years ago. I use it a lot because I am a terrible speller. In grade school I was great at math, but lousy at spelling. It never made sense to me to clog up my brain with the correct spelling of words when all you had to do was look it up in the dictionary. The brain cells of my youth in the 1960's were used for baseball stats.

Now there is spell check, so I don't get the old dictionary out much, unless I'm so far off that the computer doesn't

even recognize the collection of letters I am trying to form into a word. I pulled it out for this column to check the definition of clean. As an adjective, it means “free from dirt or impurities.” I also pulled out the old files from when I wrote my field guide. I thought I had a separate file folder with copies of old boiler manufacturer's reasons and techniques for cleaning steam boilers. I found it. I actually remembered something.

The boiler manufacturers of the early 1900's—which was the golden age of steam heating—were concerned with making dry steam. Dry steam heats much better than wet steam. Dry steam means it has a low water content and travels further before it condenses back to water. Wet steam means it has a high water content and doesn't get too far from the boiler, resulting in uneven heat because the steam doesn't make it to all the radiators.

One of their techniques for assuring dry steam was to keep the velocity of the steam leaving the boiler low. I will discuss the merits of low steam velocity in a column later in this heating season. The second technique for assuring dry steam was to “clean” the boiler after assembly. How to clean depended on the manufacturer.

The manual for a US Radiator Corporation steam boiler calls for “Blowing Off a Steam Radiator,” described as what we now call skimming a boiler. Two manuals call for acid vinegar (acetic acid) to be added to the boiler water. The manual for the Williamson Foundry Company says to dump into the boiler five to ten pounds of sal soda. Sal soda didn't come up in my desk dictionary, but the internet knew that it is “a sodium salt of carbonic acid.” Amazon sells it as Sodium Carbonate, a strong alkalizer and household cleaner. Not much agreement among manufacturers there.

The need to clean a steam or vapor boiler is universally agreed upon. The old books used to distinguish between a steam boiler and a vapor boiler. We don't hear about vapor much anymore, but it is my favorite. Vapor boilers and their distribution systems are designed to operate at less than a pound of steam pressure and being “clean” is just as important.

But what does clean mean? What dirt or impurity are we trying to get rid of? We are trying to get rid of anything in the water that can interfere with the release of the steam bubbles from the water in the boiler. The steam bubbles start to form at the bottom of the boiler heat exchanger, caused by the high heat of the burners. They rise up to the waterline as the water temperature approaches the steaming temperature. The bubbles want to burst out of the water like spawning salmon.

However, if there is anything on the surface of the boiler water that disturbs the natural release of the steam bubbles from the surface, the steam is going to be wet. Another consequence is an erratic or bouncy water line in the gauge glass. Wet steam and a jumpy waterline equal poor operation. Wet steam shows up in the gauge glass as water running down the inside of the glass from the top. All steam boiler waterlines move up and down to some extent,

but when the water in the glass disappears suddenly or the waterline moves up and down rapidly, the boiler needs to be cleaned.

The main culprit or impurity by a wide margin is oil. Oil and water don't mix well, like Democrats and Republicans lately. They also have different surface tensions. When the steam bubbles are rising out of the boiler water and they encounter different surface tensions, more steam releases in the area of less tension while less steam releases in the area of more tension. This causes the waterline to start dancing the jig, defined as a lively dance in triple time. We want the waterline to be doing a slow dance, a gentle rocking at best.

Where does the oil come from? All threaded fittings, male and female, elbows and pipe nipples, have some amount of residual oil from the manufacturing process. Add some site cut and threaded steel pipe to the mix and oil ends up in the boiler. Add heat and the oil in the boiler rises to the top.

Besides producing wet steam, the bouncy waterline plays hell with controls that are affected by changes on the waterline, like the low water cutoff. An ideal burner cycle during a call for heat is one that is not interrupted, in this case by the low water cutoff shutting the burner off on the low side of the bounce. Probe style low water cutoffs usually have a time delay, but float style low water cutoffs do not. It's hard to get up a head of steam with the burner being shut off prematurely.

The other waterline control is the automatic water feeder. Again, an electronic control will have a time delay to protect it from a bouncing waterline. However, the float style automatic feeders can overfill the boiler when they sense the low side of the bounce.

How do we clean a steam or vapor boiler? The skimming process still works, but can take a long time. I describe it more on page 36 and 37 of my field guide, available as a free electronic download at steamupairoutwaterback.com. It is one of the only sites on the internet not trying to sell something or have you donate money to help support. (My GoDaddy salesperson didn't understand that.)

Most contractors around here use the chemical method to clean steam or vapor boilers. There are a few products out there that isolate the oil from the water, so the oil can be drained from the system. This makes the most sense to me. The directions give you a timeline for how long it will take, most require less than two hours total time on site. Just make sure the chemical you choose is specific to removing the oil or impurities from the system.

If you just drain the boiler, the water comes out, but the oil stays in. With chemical treatment, the oil comes out with the treated water. Now the boiler is ready to produce dry steam. Always check for a “clean” boiler before proceeding with any troubleshooting, since a “dirty” boiler can be the reason for just about every steam system problem.

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