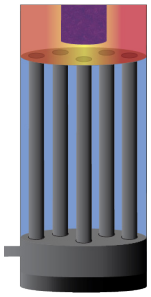
The Perils of Firetube Condensing Boilers

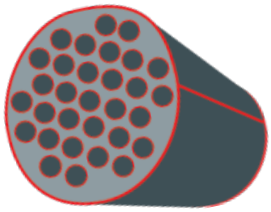
Lesson #2: The "Stress" Within

Objects naturally expand and contract as they are exposed to heat and cool down. It's Mother Nature at work. It can't be avoided, and it certainly should not be ignored…

Every vertical firetube places the burner on top, inches away from the top tube sheet. Initially benefitting the footprint, this design has put "Old Reliable Mr. Firetube" in an unreliable position. The design flaws of vertical condensing firetubes will leave you wondering why this arrangement is still being used at all.



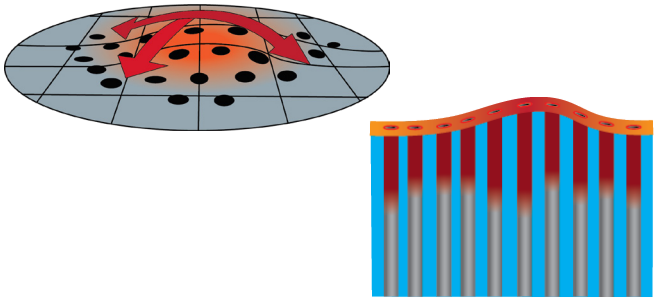
The hotter an object gets, the more it wants to move and in return, requires more force to be contained. In the case of Firetube Boilers, the top tube sheet is made of stainless steel grades varying from: 316, 316L, 404, or 409 with failures and manufacturers continually searching for a more forgiving material. That is 1400 degrees pumping right on the welds which are not only holding the top, but also each tube in its place – cool it down and repeat. How much strain can each weld handle and for how long? Hot and cold, hot and cold. Ask yourself, where does all this natural movement go?



Red lines depict welded seems.

The movement is absorbed by the material in the form of stress. There is no "room" for the expansion or contraction to go and this is "by design". Zero accountability for movement. The material must hold firm, not budge, not bubble. There is little bend or forgiveness in stainless steel. It is not pliable. Tube sheet, tubes, and welds vs. Mother Nature. On and off, cycle after cycle, 1400 degrees cooling to 70 degree room temp….. Mother Nature never takes a break in relentless, natural movement. ALL vertical firetube condensing boilers face this foe and yet no one is taking accountability? Thanks to our friends at YouTube we can better show you the PERILous movement plaguing vertical condensing designs.

Deformation by Temperature, one of "Peril's" favorites. Concentrated in high heat areas, the tube sheet of a vertical condensing firetube is right in the line of fire. Previous firetube designs with horizontal orientation placed the tube sheet further from the burner, greatly reducing exposure to intense burner heat. But not here, it's inches from it.



Example of welds and tubes stressed by deformation.

Linear Deformation forms from the intense heat and inability to control expansion. The flat tube sheet tries to hold against deformation but becomes inconsistent under the stress, forming concave warp zones. Stainless steel is not a good material to harness deformation, it was chosen because of its resistance to corrosion from flue gas condensation. The "bubble" formed in the warp zone signifies the beginning of the end, (the topic of Perils next segment) but really this process began the 1st day you fired it up.

Isn't it amazing the amount of stress vertical condensing boilers are placed under, and it's designed that way!!!??? Moving the burner to the top of the boiler to improve footprint, placed previously old reliable in a tug of war with Mother Nature condensing firetubes can't win. How do you ignore basic laws of physics? Why is this design the best the industry has to offer?

It's not. If longevity and reliability matter to you, come see our condensing line-up, made to move with- out all that stress, it's only natural.

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