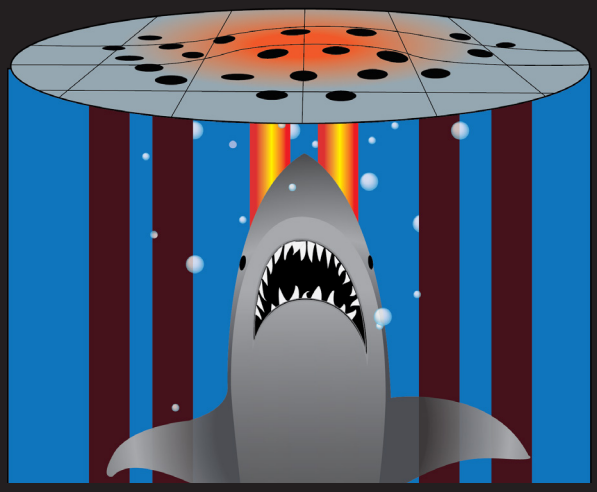
The Perils of Firetube Condensing Boilers

Lesson #3: The "Bubbles" Bursting

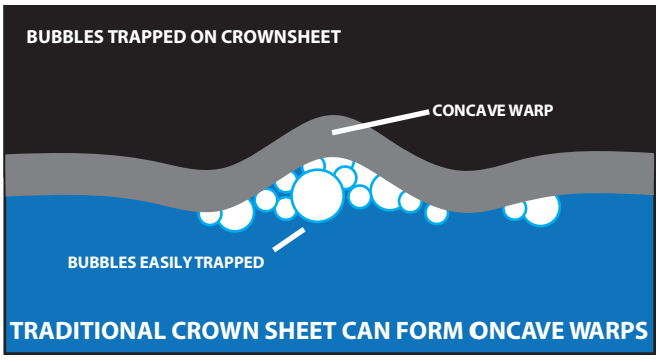
If you thought placing a burner firing 2000 degrees inches away from a tube sheet with no room for expansion was a questionable idea, wait to see the Peril that bursts below.



As if things weren't bad enough…for vertical condensing firetubes…Many recognize the "perilous" position on top of the tube sheet. Struggling to harness the immense heat and warping pressures, straining not to move or flex or change form. This natural movement places immense stress upon stainless steel and welds. BUT THERE IS MORE! Perhaps much more, circling up from underneath, from the waterside. This poor tube sheet is in a two sided war, attacked on both sides, and your firms reputation is tied to it.

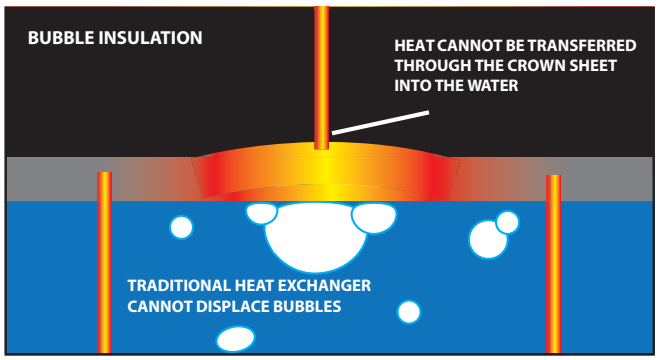
Air Entrapment

Thanks again to our friends at YouTube, we can show you the battle bubbling below the tube sheet. Bubbles sound cute, don't they? I can assure you, there is no association with innocent childhood memories here. The "peril" below is as reckless as above, and again self-inflected from design traits of vertical firetube condensing boilers. Fear, is more appropriate than bubble baths, the fear inspired by Jaws. The fearful chance you take with every commercial firetube.



Air will migrate out of water approaching 140 degrees and migrate to the highest point it can, for a vertical firetube this means the underside of the tube sheet. This condition occurs even in low temp condensing applications because of the temperature of the metal so close to that burner. The largest players in vertical condensing use a flat tube sheet that is unfortunately, absolutely perfect for trapping and collecting air bubbles. With air up against the underside of a tube sheet instead of water, a whole new set of issues ensue. Issues that come with choosing the design, issues that can be avoided.

With air bubbles naturally coming out of water and collecting at the highest point in a boiler, the tube sheet is the unfortunate benefactor of vertical firetubes. We know "Peril" from above makes this is an extremely hot area! This critical part (which cannot be repaired or replaced in the field) needs water here more than ever to ensure heat transfer. How can you get even heat transfer through pockets of air bubbles and water????? The answer is: you can't. Commercial vertical firetubes give you "Peril" in the form of hotspots and warping from below.



We know that condensing boilers run in high fire about 15% of the time, meaning 85% of the time a condensing boiler is running at a fraction of its maximum capacity. With increasing turndown this firing rate is capable of lower input rates, some firing at 20:1 or lower. This all sounds wonderful doesn't it? Lowering firing rates to match design loads, less cycling and greater fuel savings.

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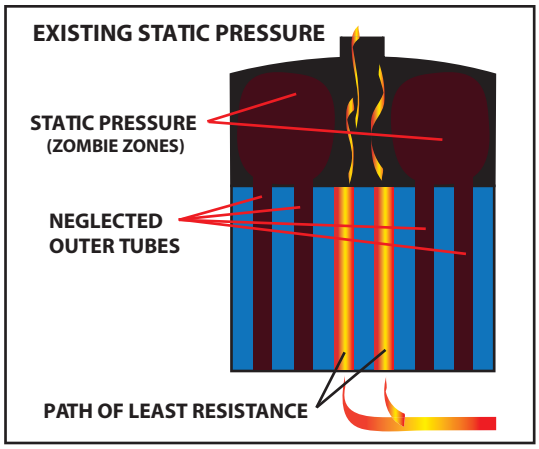
It does, unless you're a vertical firetube condensing boiler…prone to burner stagnation and static pressure. Once again, this is a trait of this design that some manufacturers choose to ignore. At high fire everything goes smooth, heat is evenly distributed across the entire tube sheet and evenly down through the tubes. But what happens when you're not in high fire? What happens about 85% of all the runtime when you not at max rate? Vertical condensing boilers give you ZOMBIE ZONES… Zombie Zones, are DEAD Zones of stagnant air. At lower firing rates the heat rushes down through the center of a vertical firetube, instead of evenly down all the tubes. It's easier to run down the middle and that's where it goes. The lower the firing rate, the more localized the heat transfer occurs right down main street of high turndown verticals as shown below.



This is not a good idea, higher temperature in one area of the same tube sheet promotes uneven heat transfer, localized boiling points near the hot zones, and increase conditions that cause tube sheet warping. YIKES. Doesn't this help explain why so many end users have to get new heat exchangers? Condensing manufacturers that put that burner up on top have placed the tube sheet in an uncompromising position. Blasted with intense heat from above but cannot move and self-inflected design traits are a catalyst for destruction from below. Look at these vertical condensing boilers, they are all the same, why on earth are manufacturers copying each other USING THIS DESIGN, and why are you using it?

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. You have found the solution.

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