

THE INVERTED BUCKET TRAP

by Jude Wolf

Everything else pails in comparison.

When you first hear the term "Inverted Bucket Trap", it sounds like something a coyote might use to catch a roadrunner. The truth is, though, an inverted bucket trap is actually a crucial piece of hardware that allows condensate to pass through it, but closes itself if too much steam is present. By operating this way, it conserves steam while ridding the system of problematic condensate. So the system can continue to operate efficiently.

Inverted bucket traps have been around a long, long time, and they're used throughout our industry. That's because they work. They're also incredibly reliable, due to their inherent simplicity. Inside an inverted bucket trap, there is, you guessed it, an inverted bucket resting on the bottom. That bucket has a tiny vent hole in the top.

The inverted bucket is mounted inside a housing that is inline in the condensate return line. The incoming condensate enters at the bottom of the trap, and exits out the top of the trap. With this

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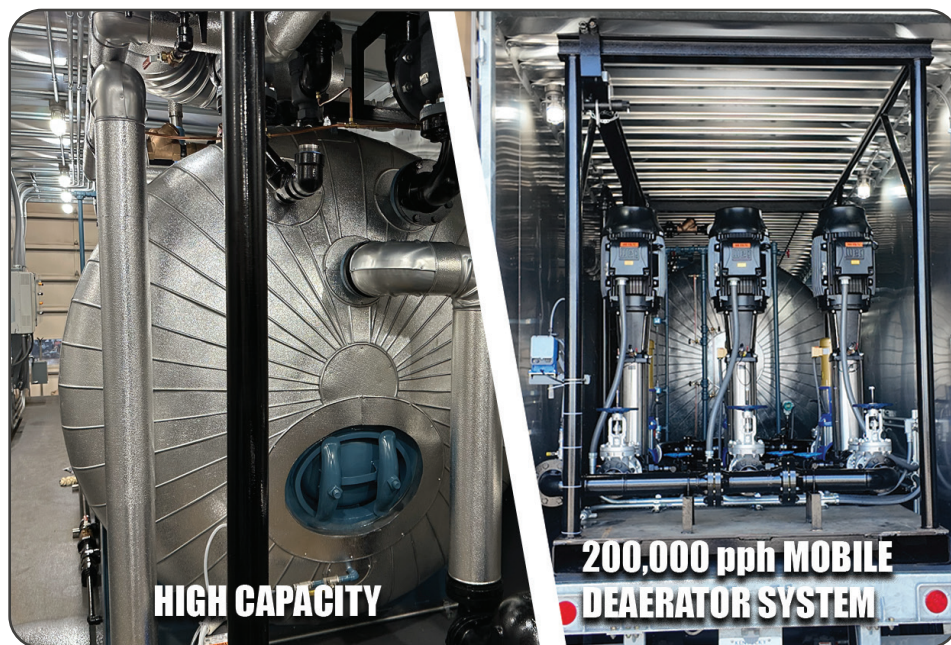
WARE GOES HIGH CAPACITY WITH A 200,000 PPH MOBILE DEAERATOR SYSTEM

by Steve Taylor

The 200,000 pph mobile deaerator system, allows even the largest rental boilers to operate with properly treated feedwater at all times.

Although it would seem at first glance that boilers and the work processes they supply

capacity boilers that convert a lot of water into steam, replacing that lost water with water that's been properly treated for boiler usage has been a difficult task in Mobile Systems. But that's no longer the case, as WARE has constructed a mobile water treatment and deaeration



operate on a closed steam circuit, the truth is, boilers convert water to steam. This steady water loss, therefore, necessitates the addition of new "makeup" water into the boiler's pressure vessel. For high-

system that can supply steam plants that generate up to 200,000 pounds of steam per hour.

While other manufacturers offer mobile deaerators that

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can supply a 200,000 pph boiler with deaerated water, the challenge of proper softening at that scale was once difficult to overcome. Now, WARE is the first to integrate a water softener and deaeration system into one single, portable unit that can be used to supply high-output boilers anywhere the demand arises, with up to ten minutes worth of water storage for high demand periods. And the water softener, included in the system, is designed for 100% makeup. There is no need for an additional piece of equipment or an additional water treatment trailer. WARE has taken that into account and included the water softener in the mobile package.

LOST WATER

Even the most modern and

“If the makeup water isn’t added, the low water level switches will shut the boiler down for safety and steam to the plant will cease. This is critical and often proves detrimental to the process that the steam is supplying.”

efficient boilers require makeup water. Some is lost to evaporation, some is lost in the end work process, and still more water is lost to the regular “blowdowns” that boiler operators perform to vent away the sediment, minerals, and other solids that collect on the bottom of the pressure vessel.

If the sediment, minerals, and other solids are allowed to collect, they will prove harmful to the boiler in two primary ways. First, they will solidify into “scale”, which will form a hard layer inside the pressure vessel that impedes heat transfer. If scale is allowed to

develop, the boiler will have to use more fuel to transfer the same amount of heat which will diminish operating efficiency and increase fuel costs.

The second reason these impurities must be removed is because they react with the heat and oxygen inside the boiler to cause corrosion. If left unchecked, this corrosion will eat away at the pressure vessel walls and the other internal components of the boiler, reducing its useful life.

HIGH DEMAND

Another important function of makeup water has to do with demand management. If the need for steam suddenly increases, the boiler will have to put more steam in circulation.

This means the water level in the pressure vessel will drop, necessitating the addition of makeup water. If the makeup water isn’t added, the low water level switches will shut the boiler down for safety and steam to the plant will cease. This is critical and often proves detrimental to the process that the steam is supplying.

PROPER TREATMENT

For optimal operation, the water inside a boiler must be softened before use. This process is done by an industrial water softener that uses ions suspended on a resin membrane to strip away the harmful calcium, iron, and

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setup, as long as the condensate keeps flowing in one side of the bucket trap and out the other, the bucket will stay at the bottom of the housing because it's held there by gravity.

WHEN STEAM HAPPENS

If steam should suddenly be introduced into the trap, though, everything changes. Since the steam will immediately displace the water in the inverted bucket, the bucket will become buoyant.

However, unlike steam, that air won't condense back into water, which might allow the bucket to sink and the valve to open. If a lot of air gets into the trap, therefore, the condensate valve will stay closed and the condensate will stop flowing.

That tiny vent hole in the top allows any air that might build up in the bucket to be pushed out by steam. It's such a tiny hole, though, that even if a little steam

impacts both the inside and outside of the float, this makes it more resistant than sealed float traps.

In addition, since the trap seat is mounted at the top of the float chamber, it experiences less wear from soils or solids traveling with the condensate. The final benefit, which is actually a big one, is this: If the trap fails, it tends to fail open. This may seem at first like a negative,



As the bucket rises, it closes a valve that seals off the outgoing condensate line. By doing this, it prevents any steam from escaping.

TINY HOLE, BIG ROLE

Remember that vent hole you read about? It's there to compensate for one of the inherent problems with the inverted bucket trap: its inability to remove air. Because air is just as buoyant as steam, any air that's introduced into the bucket will make it rise.

does escape before the bucket sinks back down, it's a negligible amount.

BIG BENEFITS

There are a few other great features of the inverted bucket trap beyond just reliability, though. It's also extremely resistant to water hammer, which is the impact that happens when steam encounters cold piping or condensate. This implodes the steam bubbles and creates shock waves. Since any shock

but for applications where it is critical for condensate to be removed, failing open is a plus that could save your equipment, your work processes, and your uptime.

If you need an inverted bucket trap, be sure to check out WARE's BoilerWarehouse.com. We also have the highly qualified techs to install them, too.



Watch

WAREboilers
INVERTED BUCKET TRAPS

A FIRESIDE CHAT

by Gerald Blain



Boiler technology has made some truly impressive advancements in the past few decades, but perhaps none are as impressive as automated flame control. Right now, we have sophisticated systems that can micromanage and adjust a boiler's air and fuel supply several times every second, to keep it dialed in to its most efficient settings. Advanced flame sensors detect the presence and quality of flame with unmatched precision. But it hasn't always been that way.

SEE IT

Detecting proper burner firing used to rely on the old sight window and a pair of human eyes. The problem with that method had to do with diligence. If something changed in the air or fuel supply when an operator wasn't looking, it might go unnoticed. That was especially dangerous during flameouts, because the affected burner might just keep on pushing more unburnt fuel into

the fire side, resulting in a small (or large) explosion once that fuel found a source of ignition. The other downside to visual inspection was that it didn't tell you a lot. While the flame does change color and shape based on combustion, there was only so much you could do to fine-tune efficiency by watching the burners.

ENTER AUTOFLAME

What the world needed was an automated way to keep track of the status of the burners, and one of the pioneers in that field was – and still is – AUTOFLAME. Located in Great Britain, AUTOFLAME was founded in the 1960s by Brendan Kemp, originally as a distributor for another line of systems. During the 1980s, though, Brendan created his own system to answer a need he observed for more accurate and precise flame monitoring. The first system was called the Micro Modulation System, and it gave boiler operators an unprecedented insight into, and

control of, the flame coming out of each burner.

Since its founding, AUTOFLAME has secured 45 patents for its innovative technology, as it continues to advance the science and implementation of flame control. Steve Kemp, the founder's son, is still active in the company, traveling the world to promote a better way to manage fuel/air ratios to maximize efficiency. But AUTOFLAME has expanded its offerings to now include complete boiler control systems.

"For the longest time," says Kemp, "we were the boiler control guys. My father designed our first product because he felt linkage was very restrictive as far as efficiency. England was going through an energy crisis at the time, and London was in the process of converting to gas. We needed a more efficient method of burner control."

"The majority of the world is still

on linkage systems,” Kemp continues, “but that’s just a lack of education. Rising energy costs are making it a necessity to burn fuel as efficiently as possible. AUTOFLAME also offers not only a safer way, but also a more efficient way. It’s also a more intuitive way to operate, with a touchscreen in front of you telling you everything that’s going on, giving you more information. It’s just a better way to run a boiler.”

WARE APPROVED

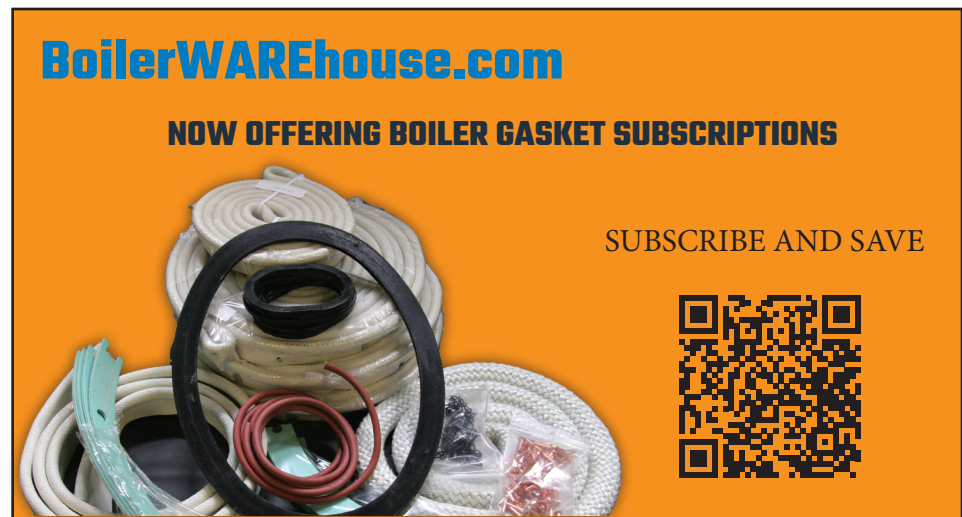
Gerald Blain, Director of Projects and Services for WARE, is an expert in all things AUTOFLAME, and highly recommends the manufacturer to his clients.

“AUTOFLAME systems are all about efficiency, certainly, and that’s one of their main selling points,” says Blain. “But they offer more safety features than any other control system out there. That’s important, because if you have a boiler operator with limited skill, the AUTOFLAME system can make up for that and keep your system running safely.”

According to Blain, AUTOFLAME represents the industry trend of increasing solid-state automation.

“Linkage-based systems are still the norm, because they’re cheaper, but AUTOFLAME is showing people there’s a safer, more efficient way to operate. It’s a completely linkage less system with solid-state sensors monitoring and adjusting gas pressure and air pressure continuously. Yes, it’s a more expensive system, but the benefits in


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A FIRESIDE CHAT page 4

safety and efficiency more than outweigh the cost. We're talking 8 to 12 percent fuel savings."

NEW TECH

Blain is also an expert in the ways that AUTOFLAME is harnessing new technology to further improve boiler operation. "Previous systems had sensors analyzing exhaust gases, and air and fuel pressure, and adjusting oxygen trim accordingly to optimize combustion. Now, with the AUTOFLAME Mark 9 that's about to be released, the whole game has changed."

According to Blain, the Mark 9's sophistication lies in its ability to preserve perfection.

"When you first commission a boiler for the first time," says Blain, "you get it fine-tuned to generate the ideal flame using an exhaust gas analyzer. Then the AUTOFLAME system uses a series of UV sensors to take a sort of 'snapshot' of what that

boiler's version of an optimized flame looks like. From that point on, the system uses that UV snapshot, in conjunction with the air and fuel sensors and exhaust gas sensors, to constantly compare the current flame to what it's supposed to look like, and adjust the fuel and air inputs to keep the flame in its sweet spot."

According to Blain, the Mark 9 system is not only more sophisticated and efficient, but also more generationally relevant.

"When you show young boiler operators a linkage system, it's not immediately intuitive how it all works together. But show them a touchscreen, and they can master it immediately."

THE FUTURE

Another advantage that AUTOFLAME systems bring with them is easy configurability, a point that Blain and Kemp both agree is going to become more

relevant as the fuel marketplace changes.

"The energy market is changing fast," says Kemp. "In the UK, we do a lot of work with hydrogen, we're almost a hub for hydrogen development. But it's not always easy to obtain. AUTOFLAME systems can burn hydrogen easily, but they can also switch to other fuel types on the fly, when the hydrogen isn't readily available."

"I'm interested to see how the hydrogen market shakes out," adds Blain. "WARE has been hydrogen-capable for years, but having an improved control system that can handle it so easily is great."



The future of burner controls

magnesium ions that are found in “hard” water. By removing these molecules, the water becomes “softer”, and less likely to cause scale and corrosion.

DEAERATION

Oxygen is extremely harmful to the internal workings of an industrial boiler. Therefore, removing it is key to safe, efficient operation. That’s where the process of deaeration comes in. By separating out the excess oxygen before the condensate enters the boiler as makeup water, the boiler’s life can be extended and its efficiency preserved. Depending on the type of deaerator, the oxygen can be removed in one of two ways. First, by spraying the condensate into a fine mist and allowing the oxygen to separate. The second method involves passing the condensate over a series of trays that allow the excess oxygen to separate from the water.

Both types of deaerators use heat to accelerate the oxygen removal process. Not only does heating the water help deaerate it, but it also helps pre-warm the makeup water before it is introduced back into the pressure vessel. Preheating helps reduce a phenomenon known as “thermal shock”, which occurs when the temperature between the pressure vessel water and the makeup water is too great. If the makeup water is at too low a temperature, it will not only cause the boiler to have to work harder to convert the water into steam, but it can actually damage the boiler’s pressure vessel and other internal components.

DEMAND VERSUS SUPPLY

The processes of water softening and deaeration are not instantaneous. Because of this, the supply of softened and deaerated water can be depleted over time. This is especially true of high-capacity boilers that require a substantial amount of treated feedwater. If the supply of softened and deaerated water runs out, the boiler still needs to be supplied with water. This will unfortunately necessitate the addition of untreated, oxygen-rich hard water, which will increase the likelihood of scale and corrosion developing inside the boiler.

BETTER OPERATION AT EVERY LEVEL

By introducing mobile water treatment equipment with such a high output, WARE has ensured that boilers of all sizes can have sufficient makeup water without sacrificing performance or longevity. It’s just one more way WARE continues to lead the field in keeping customers supplied with the equipment they need to maintain production and avoid costly downtime.



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