

Blowdown and Chemical Cost reductions using Superior Boilers

The volume of water in a Superior steam boiler is considerably larger than most other firetube boilers. That large volume of water PLUS Superior's superior steam disengaging area leads to lower chemical usage and reduced energy loss in blowdown.

Here is how that works:

When water evaporates into steam and leaves a boiler, impurities in the water that don't boil off remain in the boiler. More and more impurities enter the boiler to replace the mass of steam that leaves. The impurities obviously concentrate in the boiler. Chemicals are added to the boiler which makes a lot of those impurities clump together to fall to the bottom. Bottom blowdown is designed to remove them. However some of the impurities remain as "dissolved solids" and continue to concentrate in the boiler. The measure of concentration is called "total dissolved solids" (TDS).

When water boils off in a boiler what is actually occurring are millions of little bubbles being generated on the hot tube surfaces. The bubbles are much less dense than the water and so they migrate upward to the top of the water level.

Ideally they escape the water level like a leaping dolphin and explode so that pure, dry steam escapes from the boiler. But as the TDS level increases the "strength" of the bubble's shell increases, making them more resistant to breaking. You've experienced that phenomenon when you've washed dishes and then drained the water – millions of tiny bubbles remain on the bottom of the sink.

If the TDS level of the boiler water gets too high then the bubbles don't explode. It can become so bad that these bubbles vacate the boiler in the form of foam. If enough foam escapes, the increase in mass flow can cause a venturi effect and boiler water itself can rapidly flow out of the boiler resulting in a low water condition. That condition is called "priming." Even if only foam escapes there are unwanted consequences. The foam impinges on metal surfaces in the piping and a large amount of water collects. If it is severe enough the drip traps and/or collection header will not collect it all and water hammer results. Once that sort of foaming action is allowed to develop it is nearly a hopeless effort to maintain adequate chemical levels. There can also be a significant loss of overall efficiency depending on the way the rest of the system is piped and configured.

Typically the TDS level is measured by means of conductivity. TDS is controlled in a boiler by means of surface blowdown to obtain the desired conductivity. Water is taken from near the top of the water level, where the TDS is higher than elsewhere in the boiler, and then sent to drain. Obviously it takes a considerable amount of energy (a.k.a. dollars) to heat water to the boiling point. The less water that is needed to be blown down the less energy waste there is.

Therefore. . .

Boilers that can run well at higher TDS levels save a lot of money because less blowdown is needed.

There are two major factors that determine the TDS level for dry steam. One is the amount of time that a bubble has to spend before leaving the boiler nozzle. If the boiler's steam nozzle was a mile or so above the normal water level it wouldn't really matter how high the TDS level got because the foaming goo would certainly dissipate, leaving dry steam, by the time it left the boiler. If the boiler's steam nozzle was only a couple of inches above the water level there would obviously be no chance for the bubbles to burst.

Another factor of course is the surface area of the water surface. Obviously a small surface is going to have a much higher "bubble escape velocity" than a large one. Therefore the larger the surface area (disengaging area) is, the more the bubbles can burst before leaving the boiler.

**There are tremendous differences in surface area
AND
in the "bubble escape volume" (steam storage volume)
between various firetube boiler brands**

The difference translates into a simple fact.

Boilers with larger surface areas and larger bubble escape volumes can run at higher TDS levels.

Superior Boiler Works builds INDUSTRIAL grade boilers and so if you assume that the surface area (disengaging area) and the steam storage volume would be more generous in their boilers than other firms who tout themselves as COMMERCIAL; you would be correct.

Superior publishes these numbers to show their quality; others don't. You have to ask. So ask. The differences will impress you with Superior quality that leads to less blowdown and lower fuel bills.

Chemical usage is reduced in Superior boilers as well. Less blowdown means that less make-up water is needed. Therefore . . .

[Less chemicals are needed](#)

Since chemical suppliers don't give their products away . . .

[Superior boilers are less expensive to operate than other brands](#)