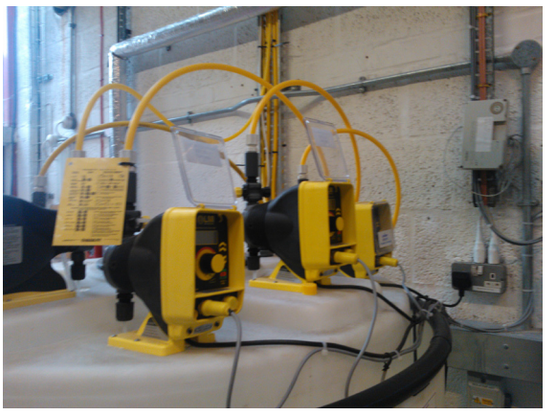
CONTROLS 4 STEAM

Know how 5

ACCURATE BOILER WATER QUALITY CONTROL



Boiler water testing is probably one of the most regularly undertaken tasks, but least understood areas of boiler operation, testing boiler water is necessary to protect the boiler and ensure that the boiler can deliver clean, dry process steam to the factory, but getting it wrong can lead to significant, but preventable, energy losses.

Liz Pengelly, Marketing Manager at Controls 4 Steam, explains:

Why is boiler water treatment needed?

Maintaining boiler water quality is essential to prevent scale build up and corrosion inside the boiler and steamdistribution system. In an atmospheric feedtank, the temperature of the stored feedwater is less than 100°C and therefore will contain dissolved gases of which Oxygen and Carbon Dioxide need to be treated. Sodium Sulphite is traditionally used to treat the Oxygen, Caustic for pH control and a touch of phosphate for hardness control. The amount of each chemical dosed depends on water quality and stored temperature and is site specific. As a boiler generates steam, any impurities in the boiler feedwater which do not boil off with the steam will concentrate up in the boiler. As they become more concentrated, the meniscus of the steam bubbles thickens and fail to burst when they reach the water/steam interface. As they accumulate a foam layer forms in the steam space and the propensity to carry over into the steam system increases.

To prevent carryover, on traditional steam boilers, a limit is set on the boiler water conductivity, normally between 3200ppm & 3500ppm. With a surface (TDS) control system installed and the limit reached a valve opens and boiler water is discharged to drain to reduce the concentration of contaminants. This high temperature boiler water is replaced with cold make-up water with a corresponding loss of energy.

How much energy is lost during blowdown?

The energy lost through blowdown is significant, how much depends on:

The amount of returned condensate
Quality of softened cold make-up water
Amount of chemicals dosed and
Volume of steam generated

In hard water areas, blowdown rates of 10% to 11% are not uncommon. Blowing down a 10,000kg/hr boiler running at 10 bar g with steam cost of £20/T 6000hrs/annum with 10% surface blowdown results in a total annual loss of £43,248.00 whilst a 7% blowdown rate the annual loss would be £30,273.00.

To reduce wasted energy there are heat recovery systems able to recover 80% of the lost energy. But you still lose 20% of the energy and 100% of the blowdown water. Which would reduce the annual loss to £19,700.00 for 10% blowdown. To prevent the losses chemical dosing needs to be automated.

The judicious application of feed and boiler water chemicals will eliminate scale and corrosion and reduce to a minimum boiler blowdown. Saving energy, reducing steam, maintenance, water costs, and carbon emissions.

How is the surface (TDS) blowdown rate calculated?

If, as is usually the case you follow the advice of the chemical supplier and for ease of application you dose all the chemicals direct into the feedtank, then blowdown calculations are relatively simple. It is a straight comparison between the conductivity of the feedwater, with a sample taken from the feedline against the maximum allowable conductivity inside the boiler.
% Blowdown = (feedwater TDS x 100) ÷ (Boiler TDS-Feedwater TDS).
With a feed TDS of 300ppm the blowdown rate is 10.32%.

Is it better to control feedwater dosing manually or automatically?

Manually controlled boiler water entails the boiler attendant taking samples at set intervals during the day and manually adjusting the pump settings when required. The problem with this method is that, almost invariably, boiler attendants will err on the side of caution and tweak the settings. Increasing the pulse rate adds more chemicals than is actually required. This additional dosed quantity is, in the trade, referred to as a ‘Buffer’. The consequence of over dosing chemicals is to increase the surface (TDS) blowdown, wasting energy, water and chemicals.

Compared with water and energy costs, chemicals are a minor expenditure only when you consider the real costs of poor water treatment do you begin to understand the true advantage of accurate boiler water quality control.

The real consequence of overdosing is the increase in boiler blowdown

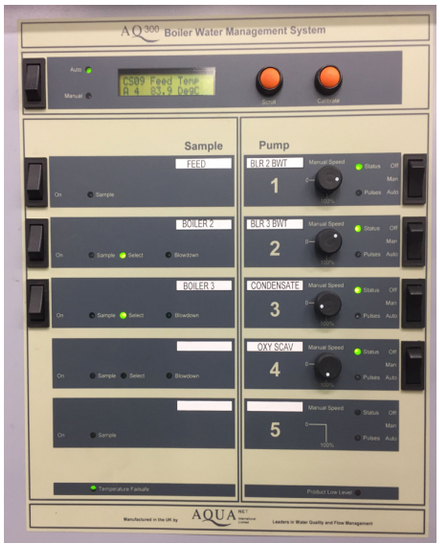
Much better is to install automatic sampling and control systems. These ensure the minimum dosing rate is achieved. Surface blowdown of less than 2% is achievable. Not only does this minimise energy and water loss, but it also eliminates the need for skilled boiler operators to be tied up performing this tedious, daily task.

Why automate chemical dosing?

Installing a control system that takes the guesswork out of feedwater chemistry control will ensure that the boiler remains scale and corrosion free, offering remote monitoring and archiving of all measured values whilst negating the need for daily manual tests.

Our **C4S AQ300** series of boiler control systems achieves this by sequentially sampling feedwater, individual boilers and condensate, measuring the pH, Conductivity, Oxygen content, Feedwater flow rate and temperature then automatically adjusting the chemical injection rates based on accurate, temperature compensated, measured values.

C4S AQ300 can be configured to take up to 5 individual samples, control 5 dosing pumps and 3 blowdown valves to control between 1 & 3 boilers ranging from 2 Ton 7 Bar horizontal, fire tube boilers up to 100 Ton 100 Bar water tube boilers.



Automatic dosing in action

When an elite British car maker was looking to improve even further the efficiency of its steam generation it turned to contract energy management company Engie to help identify where efficiencies could be made to the boiler operation.
The original boiler house relied on manual chemical dosing to the feedwater. Engie immediately identified this as an area where efficiencies could be made in terms of chemical consumption and heat loss as a result of over-dosing and excessive blowdown cycles. Ian Carder, project manager, of Engie approached Controls 4 Steam and invited them to put forward proposals for automating the feedwater chemical dosing and TDS monitoring.

In order to satisfy the requirements of a global carbon reduction policy by the car manufacturers parent company, the solution proposed by Controls 4 Steam would need to demonstrate an ability to improve overall boiler efficiency and lower fuel consumption leading to reduced emissions, while addressing the fundamental shortcomings of the existing manual dosing and the detrimental affect it has on TDS blowdown. The solution came in the form of **C4S AQ300**, a fully automated boiler feedwater monitoring and chemical dosing system. It scrutinises water quality to ensure chemical dosing is aligned to real-time water quality and the demands on the boiler. AQ300 comprises an integrated computer-controlled management system that removes the need to perform manual tests and mitigates the operator from deciding on the duration or frequency of blowdown.

Compared to average water consumption for the preceding six years before the installation of the AQ300, the car manufacturer has seen a reduction of almost 50 per cent, equating to approximately 9700m3 in two years. This, in turn, has meant a fall in energy consumption and water costs of some £47.5k in the same period.

Apart from the clear cost-saving benefits of retro-fitting **C4S AQ300** packaged systems to existing boiler house installations, reductions in chemical usage and handling, the potential for remote monitoring, and reduced carbon emissions resulting from improved boiler efficiency and long-term reliability, all combine to make this a practical, affordable and proven means of upgrading plant to the highest performance standards which are required on unmanned sites.

How much are these systems?

The cost of a system **C4S AQ300** is relatively low and are quickly recouped through energy and manpower savings.

Payback on installation of an automated **C4S AQ300** system is within 18 months - proven! Less when purchased as part of a new boiler installation.

For further information please visit:

www.c4s.co.uk

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