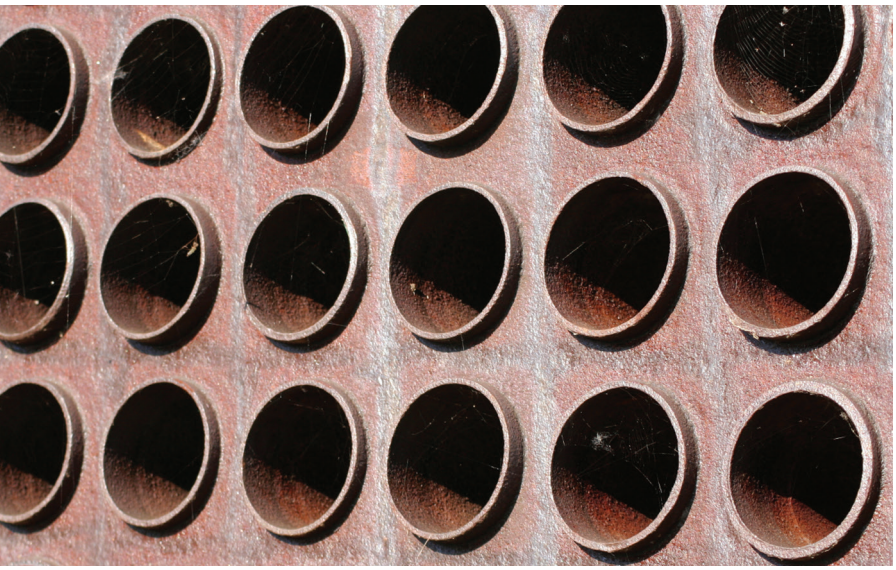
ABB MEASUREMENT & ANALYTICS | APPLICATION DESCRIPTION

Optimizing boiler chemistry through hydrazine monitoring

Using ABB's Navigator 500 hydrazine analyzer to reduce dissolved oxygen



Prolonging boiler operating life and reducing unplanned maintenance through accurate hydrazine dosing

Measurement made easy

On-line hydrazine monitoring

Introduction

Extensive on-line chemical monitoring of both the water/steam cycle and water treatment plant on modern power stations is now a very well established practice. This enables careful control of the water chemistry, to achieve peak efficiency and minimize down time due to excessive boiler corrosion or scaling.

Achieving well-balanced water chemistry is vital to optimizing the efficiency and availability of boiler plant in power station applications. If the plant chemistry is allowed to vary from specified limits, expensive plant outages can occur, potentially incurring costs of >$1,000,000 per day.

Accurate and reliable monitoring of water quality across a range of parameters is therefore critical in ensuring continuous and efficient operation of power generating equipment.

The application

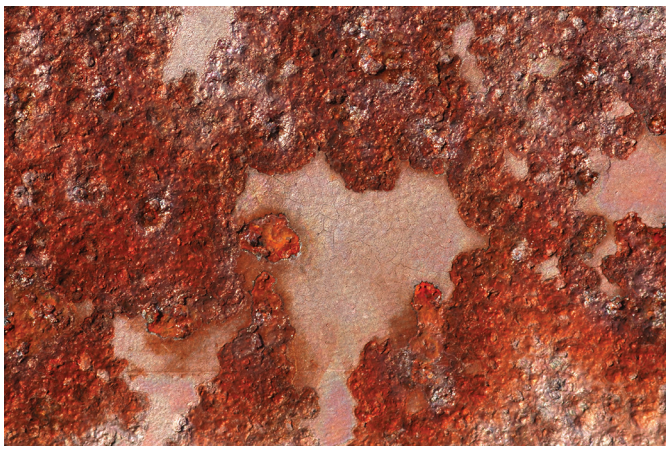
Accurate measurement of dissolved oxygen and hydrazine in boiler plants is critical for reducing unplanned downtime and achieving efficient and cost effective operation. Dissolved oxygen can have a major detrimental effect on boiler efficiency. Present in large quantities in the condensate and make-up water used to create the feedwater supply, dissolved oxygen must be removed as much as possible from the feedwater before it reaches the boiler.

If left unchecked, dissolved oxygen can quickly reduce the operational life of a boiler, corroding vital components and ultimately resulting in premature failure. It can also impair the operation of other equipment around the steam generation and distribution loop, including the feedwater heater and economizer.

Even small quantities of dissolved oxygen in boiler water can cause extensive pitting in the boiler tubes and surface. A form of localized corrosion, pitting can quickly cause extensive damage to a particular point or small area. This is made worse in situations where high levels of highly corrosive chloride are also present.

As the first step in reducing dissolved oxygen, de-aeration can help reduce levels from the parts per million to just a few parts per billion. During this process, the water is heated under vacuum to remove the oxygen, with efficient processes typically achieving reductions to around five parts per billion.

Even despite this, it will almost certainly be necessary to administer some form of post treatment in order to achieve further reductions.



In its dissolved form, oxygen is highly corrosive to most metals, especially the mild steel used for boiler tubes.

One way to do this is by dosing the boiler feedwater with hydrazine.

Hydrazine is a colorless liquid that is highly soluble in water. It is a powerful reducing agent and reduces oxygen to form nitrogen and water, with no resulting dissolved solids. At high temperatures and pressures, the reaction between hydrazine and dissolved oxygen also forms very small quantities of ammonia. This ammonia carries over into the steam and helps to reduce the acidity of the resulting condensate as it is returned to the feedwater system.

Hydrazine also reacts with soft haematite layers on the boiler tubes, forming a hard magnetite layer which then protects the tubes from further corrosion.

Normally used as an oxygen scavenger in boilers operating at pressures of 40 bar and over, hydrazine can also be used for lower pressure boilers suffering from oxygen corrosion

The challenge

It is important to accurately control the dosing process. Too little hydrazine will be ineffective in reducing dissolved oxygen levels. Administering too much will not only lead to unnecessary and costly wastage but can also lead to copper contamination in the boiler. This is particularly a problem in high-pressure boilers. It can typically be traced back to excessive use of hydrazine, which results in alkaline boiler water entering the de-superheater system and corroding copper and copper alloys. This copper enters the boiler, where it then starts to react with the boiler's steel tubes, causing corrosion.

The solution

Typically, dosing in a ratio of three parts hydrazine to the expected level of dissolved oxygen enables operators to achieve an acceptable concentration of below five parts per billion.

To help ensure the right level of hydrazine is present in the boiler feedwater, operators should measure both at the point of dosing and at the economizer feedwater inlet. This ensures that the correct amount of hydrazine is being added and that any fluctuations in dissolved oxygen levels are being treated correctly.

What can ABB offer?

ABB's new Navigator 500 Hydrazine is used for applications where hydrazine is used to dose boiler feedwater to reduce dissolved oxygen levels. The sensor uses an electro-chemical cell to accurately measure the amount of hydrazine in boiler feedwater. This accuracy is reinforced by automatic pH and temperature compensation, which, coupled with a fast response time, help ensure that readings reflect the actual feedwater conditions. The information provided by the monitor makes it possible to avoid expensive overdosing of hydrazine or the avoidance of more costly corrosion damage to the boiler plant due to the under-dosing of hydrazine.

Other features include automatic calibration and a user-adjustable constant head unit that removes the effect of changes in sample pressure and flow rate.

The Navigator 500 Hydrazine is part of ABB's Navigator 500 analyzer family, that brings a compact, reliable and accurate range of instruments for high purity water treatment and boiler chemistry monitoring applications. Providing continuous on-line monitoring of boiler feedwater quality, the Navigator 500 Hydrazine, Dissolved Oxygen and Sodium analyzers help ensure optimum efficiency of both boiler plant and ancillary equipment throughout the steam distribution loop.

A key feature across the range is its separate sensor and transmitter section design. All analysis and signal conditioning is conducted within the sensor section and transmitted digitally to the transmitter. Each transmitter can collect data from up to four sensing systems. This enables monitoring at multiple points without the cost associated with purchasing and installing separate transmitters. The four transmitter inputs can be used to collect signals on one parameter or can be mixed and matched, with multiple parameters being fed to one unit.

The transmitter is also available with the option of digital communications, including Ethernet capability, enabling data to be relayed to a central control room.

ABB's Navigator 500 and 600 on-line analyzers provide complete monitoring of all the key boiler chemistry parameters.

ABB's Navigator 500 Hydrazine

Navigator 500 Hydrazine

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