Power Generation

Perspectives in Pure Water Analytics

24 News

THORNTON

Leading Pure Water Analytics

Minimize Sensor Maintenance

Optical DO Probe for Cycle Chemistry

Maintaining a good water treatment strategy is not easy. And unreliable equipment adds to the burden. For a US generating station, a move to dependable optical DO measurement has almost eliminated sensor maintenance and improved water treatment.

DO control helps reduce corrosion

A US power company with plants in the northeastern US recognized dissolved oxygen (DO) measurement was essential to their cycle chemistry treatment strategy to control corrosion. However, their existing dissolved oxygen instrumentation was giving unacceptable performance and also required excessive maintenance. The galvanic design of the old sensors demanded frequent service and calibration and even then gave inconsistent results. At the same time, chemistry personnel were being stretched quite thin with no time for extra work such as rebuilding sensors.

One of their generating stations based on the Great Lakes decided to look into alternatives and found that the METTLER TOLEDO Thornton Pure Water Optical DO Sensor and M800 Transmitter solution had promising specifications.

Accurate, low drift optical technology

Unlike most DO measurement technologies, the Thornton sensor makes use of a phenomenon called fluorescence quenching to determine DO levels in sample water. A fluorescent chemical compound that can re-emit absorbed light is embedded in the sensor's replaceable OptoCap™. A detector in the sensor reads the emitted fluorescence and measures for intensity and lifetime. This information correlates with the DO level in the sample.

This technique is highly accurate and very low on drift. And as there are no electrodes, electrolyte or membranes involved, sensor

METTLER TOLEDO

maintenance is minimal, amounting to approximately annual replacement of the OptoCap.

Predictive diagnostics cut downtime

The Pure Water Optical DO Sensor also features Intelligent Sensor Management (ISM®) technology, which provides simpler sensor handling and advanced predictive diagnostic tools. The key tool for the sensor is the Dynamic Lifetime Indicator (DLI). This monitors the quality of the OptoCap after it has been calibrated and, together with the current process conditions, calculates and displays on the M800 Transmitter the remaining OptoCap lifetime. Unscheduled downtime due to sudden failure of the sensing element is therefore avoided.

Very rapid response

The METTLER TOLEDO solution provides especially fast response for close tracking of dissolved oxygen changes, whether due to upscale upsets or to rapid downscale deaeration, with 98 % response in less than 20 seconds.

In addition, the M800 multi-channel, multi-parameter transmitter accepts input from up to three additional sensors, with any combination of parameters, including conductivity, pH / ORP or TOC. It allows all key parameters for a particular sample to be displayed and re-transmitted simultaneously.

Over six months of problem-free operation

Engineers at the generating station installed the METTLER TOLEDO solution for evaluation. After more than six months of on-site operation of the system, engineers had no issues with the sensor's performance and no maintenance was required. More importantly, they found the DO measurements to be highly reliable which has allowed them to make improvements to their water treatment strategy.

As a result of this successful evaluation, a dozen additional measurement points at this and a nearby generating station are planned for replacement of the remaining older electrochemical sensors.

► **www.mt.com/opticalDO**

Pure Water Optical DO Sensor

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Ensure Optimum Measurement Performance
with Service from METTLER TOLEDO

Maintain accurate measurement of your processes and critical quality standards with our Service offerings. Our teams of highly-trained Service Technicians are ready to help you get the most value from your water analytics instrumentation.

Industry prefers service by the original manufacturer

In a recent survey of companies that purchase process measurement equipment, 75 % said they prefer to have services performed by the original manufacturer. This is not surprising since services provided by the manufacturer are aligned with the performance and accuracy standards of the equipment. At METTLER TOLEDO we are proud of our offerings through both products and services. Combined, we offer a complete solution no one can beat!

Good preparation includes a service plan

How do you know if your analytics are optimized for the most efficient measurements? A proactive service plan is the best way to maintain readiness, accuracy, and compliance to industry standards or guidelines. Service Plans by METTLER TOLEDO help ensure your success from setup to calibration, from preventive maintenance to up-to-date standard operating documentation, and everywhere in-between.

Service offerings to fit your business

METTLER TOLEDO provides many performance enhancing, cost saving services such as:

- Calibration for Conductivity / Resistivity Sensors and TOC Sensors
- Setup and Configuration for Sodium and Silica Analyzers
- Preventive Maintenance for TOC Sensors, Sodium and Silica Analyzers

Service tools created by the experts

Our Service Technicians are equipped with tools designed by the industry experts at METTLER TOLEDO. When it comes to calibrations and proactive maintenance tasks on your process measurement equipment, nothing but the very best will do. This is why our team of experts designs, manufactures, and equips our Service Technicians with the world's best in calibration and testing equipment.

Be ready

Ensure your process measurement equipment delivers peak performance and accurate results. Contact your local METTLER TOLEDO Representative or visit us online to learn more.

► **www.mt.com/pro-service**

"User-Friendly and Simple to Operate"
Silica Analyzer Impresses Thai Company

Silica in feedwater has to be minimized to protect boilers. When a Thai bio-power company was planning expansion, they turned to METTLER TOLEDO Thornton for a silica monitoring solution. Now the 2800 Si analyzer is providing dependable and hassle-free assurance of silica levels.

Sugar producer is a leading bio-power company

Khon Kaen Sugar is a sugar-manufacturing company based in Thailand. After many successful years of solely refining sugar, they upgraded one of their mills to also produce electricity from bagasse, a sugarcane by-product. Some of the generated electricity is used at the mill with the remainder being sold to the Electricity Generating Authority of Thailand. The Khon Kaen Sugar Power Plant Co. Ltd. is now one of the country's leading bio-power companies.

Reliable on-line analytics required for expansion

The mill is a long-term user of METTLER TOLEDO Thornton products for conductivity measurement in boilers. When co-generation became their focus, plant managers turned to METTLER TOLEDO to provide analytical measurement systems for their bio-power expansion.

We supplied on-line analysis solutions for measuring conductivity, pH, and dissolved oxygen. In addition the power plant laboratory manager, Ms. Witchayanee Puengking, was very interested in the benefits of silica measurement in boiler feedwater after membrane separation and ion exchange. Allowing water with a high silica level into the turbine leads to expensive and time-consuming maintenance needed for removing scaling from turbine blades.

Minimizing silica is vital

Ultrapure water monitoring at ppb silica levels can ensure the highest quality water is being delivered to boilers. Silica breakthrough of polisher anion resin is detected at very low ppb levels and contaminated water can be diverted before it reaches critical areas.

Pure water treatment anion exchange monitoring detects the first breakthrough of silica to trigger regeneration before contamination reaches subsequent treatment stages.

Power steam quality monitoring protects turbines from silica deposition and resulting imbalance, and loss of capacity and efficiency. Silica measurement and con-

trol may also be needed to meet turbine manufacturer warranty requirements.

Condensate polisher monitoring can detect the need for regeneration at low ppb levels before feedwater is significantly contaminated.

Easy to maintain silica analyzer

The 2800 Si is a highly reliable silica analyzer designed for boiler feedwater treatment. It detects trace silica contamination with minimal operator supervision and allows unattended automatic calibration at a user-configured interval. Large-volume reagent containers enable long-term operation before refilling becomes necessary.

A demonstration of the 2800 Si analyzer's performance, low maintenance and simple operation impressed Ms. Puengking and two units were installed at the plant. One is used for monitoring boiler feedwater and condensate, and the other is installed after the mixed bed ion-exchange columns in the makeup water system.

Khon Kaen Sugar's supplier of choice

Ms. Puengking explains why METTLER TOLEDO is her supplier of choice for analytical measurement systems: "The equipment is user-friendly, simple to operate, and easy to maintain. METTLER TOLEDO offers a high level of support and is a reliable partner for technical consultation."

The success of the 2800 Si units at the power plant has led to a further analyzer being used at another Khon Kaen Sugar facility, also for measurement after ion-exchange.

▶ **www.mt.com/Thornton-silica**

ORP Measurement
Helps Mitigate FAC and Its Hazards

Flow-accelerated corrosion (FAC) in power plant feedwater circuits is a major hazard. FAC has caused catastrophic failures with massive steam releases, in worst cases resulting in fatalities. Appropriate chemistry measurements and control can reduce this vulnerability and greatly improve safety.

Corrosive conditions

The phenomenon known as single-phase FAC occurs in water-touched lines operating at moderate temperatures (typically near 150 °C / 300 °F) with high flow velocities, turbulence, and in a reducing environment. These conditions exist in feedwater piping, economizers, attemperator (desuperheater) lines, and other locations, where the water has been treated with an oxygen scavenger / metal passivator such as hydrazine. For this reason, many plants with all-ferrous feedwater components have eliminated reducing agent feed to allow operation under carefully-controlled oxidizing conditions which are much less corrosive and ensure a safer environment.

Experience with conversion

Brad Buecker, process specialist at Kiewit Power Engineers, and a well-respected author and power plant chemistry expert, explains how he retrofitted METTLER TOLEDO Thornton multi-parameter instrumentation to monitor the conversion of a unit in a mid-western US power plant from reducing to oxidizing chemistry:

"The all-ferrous condensate / feedwater system of a pulverized-coal boiler was on an all-volatile treatment reducing [AVT(R)] condensate / feedwater program. We decided to switch to all-volatile treatment oxidizing [AVT(O)] to minimize the potential for single-phase FAC in the feedwater piping and economizer. At the same time, we had been in touch with Thornton about a multi-channel, multi-parameter instrument to monitor conductivity and dissolved oxygen on the economizer inlet sample. We included ORP as an additional monitoring parameter.

The combination of dissolved oxygen and ORP monitoring was excellent for evaluating process conditions. The instrument readings clearly showed that the conversion from [AVT(R)] to [AVT(O)] established the desired process chemistry. Subsequent lab analyses indicated very low iron corrosion rates in the feedwater system."

Where possible, conversions like this have given good results, although understanding of FAC and the techniques to minimize it continue to evolve.

ORP sensor

When reducing conditions are required

In plants with copper alloy-tubed feedwater heaters, an oxidizing environment is not acceptable since it would result in rapid copper corrosion and thus efficient deaeration and reducing agent feed are still required. These processes achieve the very low oxygen concentration (usually < 5 ppb) and reducing conditions that minimize copper corrosion by maintaining a consistent protective layer of cuprous oxide (Cu_2O) on the tubes.

It is precisely this environment that favors flow-accelerated corrosion of ferrous piping. Chrome-alloy steels placed in zones of high turbulence can reduce vulnerability to FAC, and primary examples are the pipe elbows in low-pressure economizers and evaporators of heat recovery steam generators (HRSG). However, in many cases it is not easy to identify all turbulent areas or what alloys are present in an existing plant. A chemistry approach, including accurate monitoring, is the only reasonable method to minimize FAC.

Measurement approaches

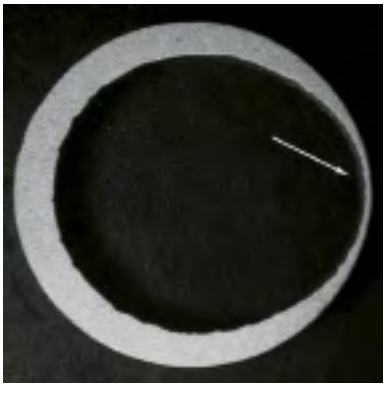
Dissolved oxygen (DO) measurement has long been used to confirm the proper operation of de-aerators and control of reducing agent feed. It is now known that even in oxidizing environments single-phase FAC may occur at locations where flow causes a mechanical depletion of oxygen. Thus, low-level DO measurement is not an exceptionally good measure of FAC-inducing conditions that might exist within the system.

Analyzers are also available to measure reducing agent concentration. However, they have historically been maintenance-intensive and do not accurately reveal the true feedwater environment. Conditions depend not only on reducing agent concentration but also upon metallurgy, pH, and the concentrations of dissolved oxygen, metal ions, and other impurities in the feedwater.

ORP measurement to the rescue

Studies have shown ORP (oxidation-reduction or redox potential) measurement to be valuable for monitoring reducing chemistry conditions in boiler feedwater. ORP is measured with an inert platinum electrode and a reference electrode identical to those used for pH. The platinum picks up a millivolt signal, which is related to the ratio of oxidizing and reducing species in contact with it. Under reducing conditions, the ORP goes negative and values between −200 to −350 mV (Ag/AgCl reference electrode) are common. Because every plant is different, it is important to determine an ORP range that achieves minimal iron and copper corrosion, and from that to set the reducing agent feed rate.

METTLER TOLEDO Thornton provides ORP measuring capability along with other common cycle chemistry parameters, including conductivity, pH and dissolved oxygen. A choice of several multi-parameter transmitter platforms enables matching application requirements for one-, two- or four-channels of measurement with any combination of the above parameters.



Feedwater pipe thinned by FAC

► **www.mt.com/Thornton**

One Conductivity Sensor
for All Stages of Water Treatment

Cutting edge technology allows accurate conductivity measurement over a very wide range. The same robust titanium conductivity sensor can now operate in all stages of make-up water treatment, without compromising reliability or accuracy.

Previous limitations

With conventional conductivity measurement, two or more sensors with different cell constants are needed to cover the range from brackish raw waters through the purification stages to pure water. This sometimes causes mix-ups in sensor types and locations and requires a greater variety and quantity of spare parts. Also with conventional sensors, the user must remember to manually enter the precise cell constant and temperature calibration data for each individual sensor into the transmitter's memory to achieve rated accuracy.

In addition, installations typically locate the sensor directly in-line in the system at a considerable distance from the transmitter and control panel. Over the years, Thornton has optimized the wiring and signal handling to minimize cable capacitance and resistance effects so that accurate measurements are provided. Nevertheless, these effects do cause some measurement limitations.

Unified, universal solution

Based on Thornton's technology-leading experience with conductivity and recognizing the opportunity to make significant improvements, Thornton engineers developed a miniaturized measuring circuit that could be embedded in the top of the sensor and send a robust digital signal to the transmitter. This unified design reduced the effective wiring distance between the sensor and the measuring circuit to a couple of centimeters! Without the effects of long cable capacitance and resistance, more sophisticated measuring techniques became possible. Because leadwire effects became negligible, electrochemical factors affecting the measurement could be dealt with more directly to improve rangeability. Measurement from pure water to brackish water up to 50,000 µS/cm can now be made with a single UniCond® sensor with excellent accuracy.

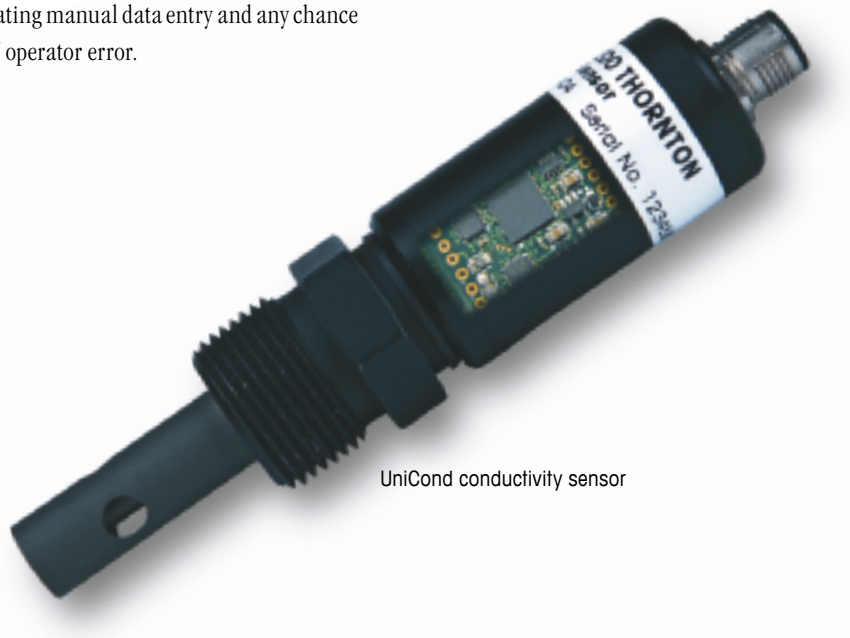
UniCond sensors utilize Intelligent Sensor Management (ISM®) technology, which maintains precise factory calibration data, as well as sensor identification, serial number, etc. in memory. This enables simple Plug and Measure startup, eliminating manual data entry and any chance of operator error.

Superior accuracy and reliability

The UniCond sensor is also more accurate because it is calibrated as a system, which includes the cell constant, the temperature sensor and the measuring circuits.

The advantages with UniCond conductivity sensors are quite significant: higher accuracy, wider rangeability for greater standardization, and easier, more foolproof startup.

www.mt.com/UniCond



UniCond conductivity sensor

Faster and Easier TOC Measurement
with the Intelligent 5000TOC i

Continuous on-line measurements with the 5000TOCi Sensor ensure you will never miss a TOC excursion. Its Intelligent Sensor Management (ISM®) technology improves performance and reduces maintenance.

Reliable, continuous TOC monitoring

For power generation makeup water treatment – from reverse osmosis to demineralizers – the METTLER TOLEDO Thornton 5000TOC i Sensor provides fast, reliable monitoring of total organic carbon contamination in the water system. Organic contamination can be detected before it enters the steam cycle where its breakdown to organic acids can accelerate corrosion and potential damage.

Multi-parameter advantage

Thornton 5000TOC i Total Organic Carbon Sensor with ISM delivers the power of an analyzer with the convenience of a sensor. The 5000TOC i Sensor with M800 multi-parameter transmitter provides a user-friendly and economical analytical package. It enhances operational performance with a dependable, sophisticated, intuitive TOC measurement system by combining a proven TOC analysis platform with an advanced user interface with extensive system diagnostics.

Mix-and-match sensor capability

The M800 transmitter is available in two- or four-channel versions. The two-channel version can accept one or two TOC sensors, or TOC plus one other parameter. The four-channel version can accept up to three parameters in addition to TOC, including conductivity, pH, ORP, dissolved ozone or dissolved oxygen, plus two pulsed flow sensors.

Benefits of the 5000TOC i Sensor:

- Improves the quality and reliability of calibration with a semi-automated process which assures consistent results.
- Enables proactive maintenance through convenient diagnostics and sensor status data on intuitive iMonitor user interface.
- Simplifies maintenance processes with in-depth diagnostic data, provided by detailed sensor status screens.
- Automated Flow Control improves the reliability of continuous, real-time TOC analysis by eliminating sensitivity to system pressure changes.
- 5000TOC i with M800 reduces overall cost, complexity and footprint of instrumentation.
- Multi-parameter capability integrates TOC measurement with a comprehensive UPW monitoring system with up to four sensors.

► **www.mt.com/TOC**

Faster Startups and Less Corrosion
Thanks to Degassed Cation Conductivity

With accurate and reliable conductivity measurements using UniCond® sensors, the new DCC 1000 System confirms water purity to minimize corrosion and can reduce startup time by an hour or more.

It can take several hours during large plant startups for water chemistry to reach required levels. This is often due to CO_2 interference in cation conductivity monitoring. The DCC 1000 System can reduce startup time significantly, helping you maximize production uptime while protecting your turbine.

The DCC 1000 System offers a new design for conductivity measurement for power cycle chemistry monitoring. By providing conductivity measurement in compliance with ASTM D4519, this system provides assurance of water purity to maximize power production and minimize corrosion. Unambiguous measurement of trace levels of corrosion-causing contaminants is enabled with minimal operator supervision.

Find out more at:
► **www.mt.com/DCC1000**

Your benefits

Easy installation
The DCC 1000 includes a counter-current sample heat exchanger, requiring no cooling water, which results in simpler, faster, and lower cost installation and more mounting location options.

Fast guideline compliance
High sample flow velocity and turbulence in the DCC 1000 cation resin cartridge ensure full exchange, and lowest readings, enabling fastest plant startup.

Greater process control
The M800 Transmitter in the system provides calculated pH and calculated ppm CO_2 display and outputs for more complete water chemistry control.

DCC 1000 System

Get in-line with METTLER TOLEDO

Save Time Programming
Your M800 Transmitters

METTLER TOLEDO Thornton's configuration tool is now included with each M800 ISM® Transmitter to enhance the value of simple and consistent programming. This tool provides a means to upload or download transmitter configuration and can store configuration files for later use. The transmitter configuration tool, with its bi-directional capability, greatly reduces the time required to program transmitters and assures consistency in programming for multiple transmitters or to duplicate existing configurations.

The M800 Transmitter measures conductivity, resistivity, pH, ORP, dissolved oxygen, dissolved ozone, TOC and flow. With four display lines and eight analog outputs, the M800 can provide full capability on all analytical measurement parameters.

► **www.mt.com/M800**

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