Power Generation

Perspectives in Pure Water Analytics

22 News

THORNTON

Leading Pure Water Analytics

Keeping Silica at Bay
with a Low Maintenance Analyzer

Silica in boiler feedwater can lead to unplanned shutdowns and extra maintenance. Brazil's biggest paper and paper-based packaging company has switched to a METTLER TOLEDO silica analyzer. Its accuracy, low maintenance, and easy operation are saving them many man hours.

Highly damaging deposits

Brazil's largest producer of paper and paper-based packaging, exports its products to over 70 countries. It has 14,000 direct and indirect employees across its 16 plants. At one of these, power plant engineers were having problems with silica deposition.

Silica has no significant corrosive effect on boilers, but its presence in water / steam is nonetheless very detrimental. It forms extremely hard coatings in water / steam passageways and on turbine blades leading to reduction in heat transfer efficiency and unbalanced turbine blades. If left unchecked increased silica build-up can result in unplanned shutdowns and extra maintenance.

Ppb level measurements best detect condenser leaks

Silica is in all water supplies and requires membrane separation and ion exchange for its removal. Direct, continuous silica measurement is the most effective means to protect against contamination from silica escape due to spent anion resin.

Silica is always present in cooling water so ppb level silica measurement provides excellent sensitivity in detecting small condenser leaks and for monitoring concentration of silica in the water / steam cycle.

Moreover, a growing number of turbine manufacturers are requiring ppb level silica limits in incoming steam as a warranty condition.

METTLER TOLEDO

Time-consuming maintenance can be avoided

A competitor's silica analyzer was installed at the power plant to monitor boiler feedwater, but its performance was not as good as instrument engineers were hoping for and it required regular, time-consuming maintenance. Having heard of METTLER TOLEDO Thornton's 2800 Si Silica Analyzer, the engineers asked for a demonstration unit to gauge the analyzer's capabilities and maintenance requirement.

Low maintenance analyzer

The 2800 Si is a highly reliable on-line instrument designed for power cycle chemistry monitoring. It provides early detection of trace silica contamination with minimal operator supervision. In addition, the 2800 Si allows unattended automatic calibration at a user-configured interval. Its large-volume reagent containers enable long-term operation before refilling becomes necessary.

Trouble-free operation

Over the test period, plant engineers were delighted not only with the analyzer's measurement accuracy, but also with its trouble-free operation and low maintenance. They also highly appreciated the automatic calibration feature which would save them many man hours.

After the successful test, three 2800 Si Analyzers were ordered for the paper plant. Instrument engineers report that since installation in early 2014, the analyzers have performed without any issues and their reliable data has led to improved production efficiency.

For more information visit:
► **www.mt.com/Thornton-silica**

Features and benefits

- Large reagent containers enable a long service interval and reduce maintenance time
- The full enclosure safely protects reagent containers and components from the plant environment
- Simultaneous display of silica and measurement timing provides convenient analyzer status at a glance, saving operator time
- Continuous reaction chamber temperature monitoring ensures reliable operation

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Three Ways of Retaining Plant Integrity
Thanks to TOC Measurements

Boiling Water Reactor nuclear plants wage a constant battle to minimize corrosion and radiation exposure while maintaining plant integrity. To meet these goals simultaneously, adjustments to water chemistry must be carefully chosen to avoid unwanted side effects.

Methanol evaluation

In some plants methanol has been evaluated for its ability to reduce radiolysis induced corrosion. To implement this kind of evaluation, the concentration of methanol has to be carefully monitored and controlled. Continuous and fast responding measurements are also important in achieving the correct balance.

A European nuclear power plant installed a METTLER TOLEDO Thornton TOC analyzer for evaluation of the methanol injection technique. It provides rapid, continuous analysis of the methanol without reagents, membranes, or moving parts. Its light weight, compact size, and user-friendly operation make it particularly convenient for that purpose.

Ascorbic acid determination

After successful completion of the methanol evaluation, the plant used the TOC analyzer during a plant shutdown for an outage. Ascorbic acid was dosed into the reactor water to reduce volatility of radioactive iodine species. The TOC analyzer provided ascorbic acid concentration measurements to ensure proper lay up.

Continuous, simple operation

TOC analysis is made by using high intensity ultraviolet light to oxidize to bicarbonate the organics in a continuously flowing sample. The additional bicarbonate ions raise the conductivity of the sample. Continuous conductivity measurements before and after UV exposure are compared. From the difference between these two values the organic content is determined. The simplicity of this technology yields a low maintenance, rapid, and continuous measurement.

Reliable contamination detection

The same measurement technology can be applied to detect contaminating organics in any nuclear or non-nuclear steam power plant. These can come from various sources, the most significant of which are the makeup water and deteriorating or poorly rinsed ion exchange resins.

The worst contaminants are organic compounds that include halides or sulfur. Un-ionized organic compounds cannot be detected by conductivity alone. However, they typically break down into highly cor-

Key features of the 450TOC

- Provides first results 80 % faster than traditional methods
- Simultaneous data log and print means profiling and troubleshooting can be achieved on the spot as well as at a central data collection and analysis location
- Rugged design and ease of access to internal assemblies leads to low and easy maintenance

rosive chlorides and sulfates in the steam generator or boiler at which point it is too late to remove them. Detection earlier in makeup water treatment by TOC measurement is key to preventing such organics from entering the cycle. Again, the simple, continuous, and fast responding analysis from Thornton TOC instrumentation provides an excellent means of protecting power generation components.

Thornton process-mounted TOC instrumentation with multi-parameter capability and now also in a portable version, the 450TOC, provide an especially convenient way to detect the various organic contaminants that may appear in pure water systems.

Find out more about TOC analysis, at:
► **www.mt.com/450TOC**

Transmitter Software

Save Time and Cost
Easy to Use Transmitter Configuration Tool

Configuring transmitters can be time-consuming and complex: a task which is particularly frustrating if the same configuration has to be saved to more than one transmitter. A utility for METTLER TOLEDO Thornton transmitters makes the task simple and fast.

Software for METTLER TOLEDO Thornton transmitters

Transmitter Configuration Tool (TCT) software is included with all Thornton M200, M300, and M800 transmitters. This PC-based program enables users to configure the transmitter and download, upload, save, or print configurations specific to their applications using a USB port on the transmitter connected to a PC or laptop. This functionality – exclusive to Thornton – can save considerable time and effort when setting up multiple transmitters with custom configurations, time after time.

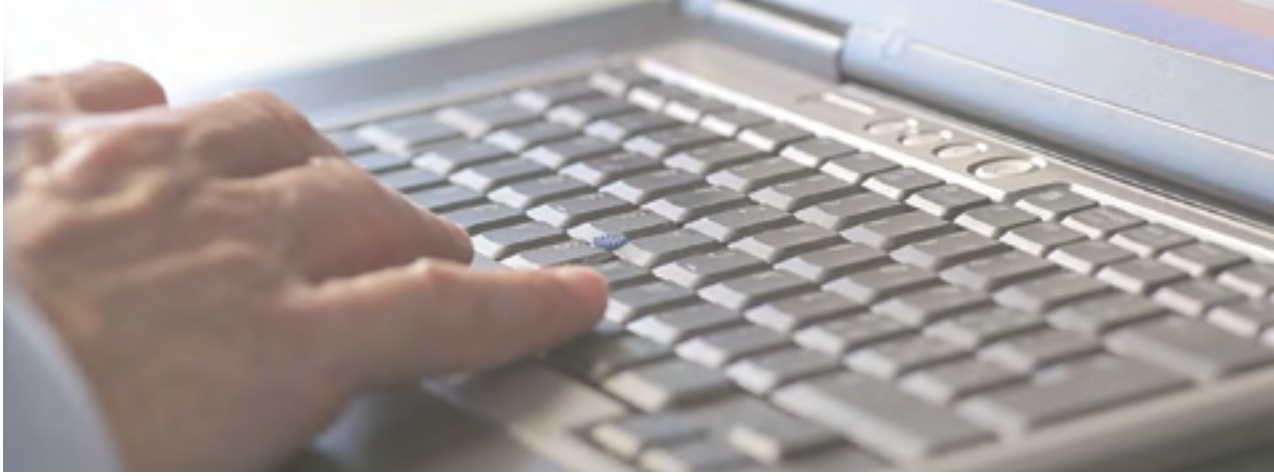
Once a configuration file is created, TCT software permits a user to upload it to all transmitters using any PC or laptop computer, eliminating all configuration at the transmitter and thus greatly reducing setup time. Separate application configurations can be saved and uploaded from a library of previously developed configuration files.

In addition, with the TCT, data can be logged and reviewed at the computer and stored in Excel files for review, troubleshooting or graphing at a later time.

Easy, accurate, and consistent transmitter configuration

Convenience: If a process engineer needs to configure ten transmitters with identical settings, at an average of 10 – 15 minutes each, the potential for error or inconsistency is considerable. However, once a file is created on a PC, TCT software enables the user to upload it accurately to each transmitter, either in a central location before installation, or after mounting on the water system.

Flexibility and consistency: Multiple configurations may be stored for future use.



For example, a configuration for a reverse osmosis / deionization application may include many conductivity, pH, TOC, and flow sensors connected to a single transmitter. All measurement range settings and limits, alarms, outputs, etc., can be set and saved for this specific application, while another variation using different sensors or settings can be configured and saved separately. These custom applications can be pre-configured and loaded to transmitters whenever they are needed.

Security: TCT software serves as a security backup to save application-specific configurations in a library folder on a separate computer for future use, in the unlikely event the configuration is inadvertently altered or deleted, or the transmitter is replaced.

Summary of TCT software advantages

- Ensures consistent configuration of several transmitters with the same settings
- Saves time individually configuring multiple transmitters
- Saves time uploading application-specific configurations from the user-developed library
- TCT software is bi-directional – data may be transferred from PC to transmitter and vice-versa
- Transmitter configuration can be completed at a convenient time and location – even remotely or in an office
- Enables real-time data collection
- Data can be logged and reviewed at a computer and stored in Excel™ files for review, troubleshooting or graphing

For further information about TCT software, contact your local METTLER TOLEDO Thornton sales office, or visit:
▶ **www.mt.com/pro-tct**

Prevention of Ion Exchange Breakthrough
with New Water Monitoring Tool

Methods exist for detecting DI resin exhaustion, but they are inaccurate if feedwater varies in composition. A new tool on the M800 Transmitter monitors the exchange capacity of DI systems and accurately predicts resin exhaustion before breakthrough, regardless of water quality.

The high cost of resin regeneration

During the water purification process, deionization resins eventually reach their exchange capacity, become exhausted, and must be regenerated. The costs of regeneration including acid, caustic, rinse water, and labor are substantial. Anything that can be done to extend run cycles, regenerate more efficiently, or accurately determine the need for resin restoration or replacement can provide significant operating savings. Beyond the cost of regeneration, if the resin is not properly monitored and ionic breakthrough occurs it can cause major upsets downstream that can affect final water quality.

Detecting resin exhaustion

When ion exchange resin capacity is being reached, the resin will begin to leak weakly held ions. This initial leakage needs to be detected immediately, preferably before it even occurs. Conventional monitoring for resin exhaustion uses sodium measurement for cation breakthrough and silica for anion breakthrough. While these are sensitive measurements, they can only detect exhaustion after breakthrough has already happened. The system downstream begins receiving contamination at the same time the measurement detects it. Prediction of exhaustion would enable systems to be taken off-line and regenerated before breakthrough.

Variable feedwater needs to be considered

Predicting resin exhaustion can allow more reliable scheduling of operations; enable longer running; and avoid premature regeneration which would waste time, system capacity, and expensive regeneration chemicals.

Common methods for predicting exhaustion are based on monitoring elapsed time or totalized flow. If the flow rate is nearly constant over the run cycle, then a consistent run time before regeneration should provide an adequate prediction, but only if the water composition is also constant. If the flow rate varies through the run of the exchanger a total flow measurement can accurately account for this, but again, only if the feedwater composition remains unchanged. If the water composition alters, then a total flow value will not be a good predictor of resin exhaustion.

In today's environment of scarcer water supplies, various raw, recycled, and reclaimed water sources can create major variations in feed to the treatment system. As a result, variable composition is commonplace. Therefore, there is a need to account for a varying ionic load due to both flow rate and composition.

More accurate prediction of exhaustion

The capability to predict exhaustion that accounts for variations in both flow rate and composition has been implemented in the METTLER TOLEDO Thornton M800 multi-parameter analyzer / transmitter. The DI-Cap™ tool is a unique deionization capacity monitoring algorithm. Figure 2 illustrates how this method is implemented. First, feedwater conductivity is measured and converted to total dissolved solids (TDS). Flow rate is also measured and multiplied by the TDS value. The product of these is integrated over time to produce a measure of ionic load entering the deionization system as illustrated by the equation (Figure 1). The direct readout allows a choice of units of equivalents, grains, or ppm-gallons.

Ionic load (grains or equivalents) = $\int$ Flow × TDS dt

Ionic load (grains or equivalents) – cumulative TDS or ion load
Flow – flow rate entering the DI bed
TDS – total dissolved solids based on conductivity entering the DI bed

Figure 1: Algorithm for DI-Cap tool

With this system both variable flow rate and variable water composition are accounted for to accurately monitor ionic loading. Display, output signals, set points, and relays can be assigned to this computed parameter to enable continuous

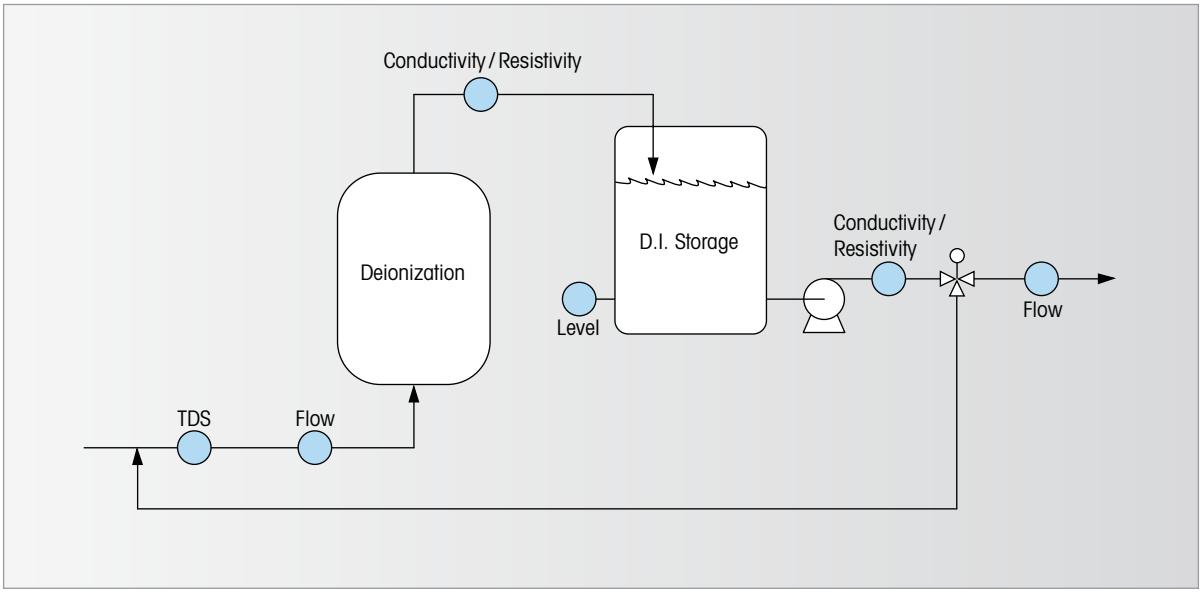


Figure 2: Schematic showing measurements required for the DI-Cap tool for predictive regeneration

monitoring and control. The total ionic load measurement can be reset manually or automatically by a remote contact closure at the beginning of each run. The METTLER TOLEDO Thornton M800 has additional channels that allow it to measure, alarm, and provide output signals for effluent resistivity as well as other measurements such as dissolved oxygen and TOC.

Assessing resin health

A further benefit from deionization capacity monitoring is for tracking resin bed working capacity over the long term to warn of capacity loss. Lowered working capacity can be due to incomplete regeneration, loss of resin, channeling, or fouling with organics or silica. If a DI bed is run to exhaustion, as detected by effluent conductivity or other means, and the total ionic load for each run cycle is logged, a good historical record of performance can be developed, which is more useful than simply a record of total gallons processed.

With this technique even a gradual deterioration in performance can be identified and corrective action taken before a major loss of efficiency occurs. This represents a substabtial improvement in DI system troubleshooting and maintenance, since the first loss of capacity will be more visible and will allow timely diagnosis of the problem. Issues that continue undetected become harder to pinpoint, and can result in more damage and inefficient operation.

Greater efficiency of DI systems

Deionization capacity monitoring with the unique DI-Cap features on the METTLER TOLEDO Thornton M800 provides a significant contribution to the efficient operation and troubleshooting of large DI systems. Whether deionizing raw water, reverse osmosis permeate, or condensate systems can benefit from this water treatment monitoring tool.

Discover more about the M800 at:
► **www.mt.com/M800**

Combatting Corrosion in Power Plants
with Analytical Sensors

In the US alone corrosion is a 10 billion dollar problem. Water cycle chemistry control via analytical measurements is vital for minimizing the effects of dissolved oxygen, sodium and other contaminants. METTLER TOLEDO Thornton's portfolio of sensors and analyzers with Intelligent Sensor Management technology help ensure ideal water conditions are being maintained.

Corrosion is a huge drain on profitability

Corrosion problems at power plants cost billions of dollars annually. Materials expenditure and loss of integrity and reliability are only part of the cost. The gradual loss of efficiency as corrosion products build up on heat-transfer surfaces gradually cause deterioration of heat rate and competitive generation capability. Contamination, corrosion and deposition of corrosion products are common problems in boilers and feed water piping and they are the cause of many forced outages and plant shutdowns.

Analytical measurements for water cycle chemistry control

Corrosion and deposits can be avoided through appropriate water cycle chemistry control which, in turn, depends on analytical measurements such as specific and cation conductivity, sodium, pH and dissolved oxygen. METTLER TOLEDO Thornton's product portfolio covers all these measurement requirements. Our sensors and analyzers for power plant water systems combine high operational performance with Intelligent Sensor Management (ISM) technology for ease of handling and simplified maintenance.

Benefits of Thornton instrumentation include:

High measurement accuracy

- Factory-certified and traceable conductivity cell constant and temperature calibrations
- Calculated pH from specific and cation conductivity, which eliminates electrode errors
- Industry-proven temperature compensation, especially for cation conductivity and pH

Measurement stability and reliability

- ISM sensors with built-in measuring circuit and digital output that eliminate electrical interference
- Conductivity sensors with wide electrode spacing with a relatively high 0.1 cell constant that resists fouling

Low maintenance

- Automatic, unattended calibration of sodium analyzer
- Predictive diagnostics give a dynamic indication of sensor time to maintenance or replacement
- Low maintenance pH sensors with self-pressurized reference electrode, with no electrolyte to refill
- DO sensor with simple drop-in replacement membrane

Discover more at:
▶ **www.mt.com/pro_power**

Simple Conductivity Sensor Calibration

Calibrator Helps Ensure Accuracy

UniCond® conductivity sensors have a very wide measurement range – from seawater to ultrapure water – making the same model of sensor suitable for a wide variety of applications. Now, UniCond has been improved further with a tool that allows calibration without removing the sensor from the process.

Why is accuracy important?

Conductivity is one of the best methods to detect ionic contamination in a makeup water treatment system. As a result its ability to repeatedly and accurately detect low levels of ionic contamination is critical in power plant water chemistry. Ultrapure water has a conductivity of 0.055 µS/cm at 25 °C; therefore, conductivity instruments must have the ability to accurately and repeatedly detect very small conductivity changes with a non-zero background.

New calibration option

The ability of makeup water system fabricators to produce water with lower ionic concentrations and the demand to reduce costs has benefitted from the introduction of a new generation of conductivity instruments. Today's digital transmitters and sensors are more accurate, are easier to operate, and provide more control over the water system than ever before. The METTLER TOLEDO Thornton UniCond sensor measures an expanded conductivity range from seawater to ultrapure water (0.02 – 50,000 µS/cm) and with up to 33 % higher accuracy than analog sensors. To supplement this, a unique calibration module provides simplified calibration of the internal measuring circuit without removing the sensor from the process.

Simple to use calibrator

Calibration practice in most plants requires at least annual calibration of conductivity sensors and often the measuring circuit as well, especially in nuclear plants. With conventional sensors and instruments, the measuring circuit must be calibrated against a series of precision resistors covering the range of measurement. METTLER TOLEDO Thornton has provided calibration modules containing all of these resistances, conveniently packaged and with traceable, certified accuracy.

Calibrate without removing the sensor

With new digital UniCond sensors, the measuring circuit is built into the sensor and calibration of the measuring circuit is also performed on the sensor. The procedure and UniCond calibrator, with switch-selectable precision resistors, supports this capability, with readout of results at the transmitter. In fact the measuring system even allows electronics calibration with the sensor still immersed in the sample.

Once the measuring circuits for conductivity and temperature are calibrated, then the complete sensor, including cell constant and temperature sensor, are calibrated based on a standard conductivity solution or by comparison with a certified reference instrument measuring the same sample. The temperature is calibrated by comparison with a standard temperature device.

UniCond sensors provide a definite step up in performance compared with previous generations of conductivity sensors.

For more information go to:
► **www.mt.com/unicond**

Predictive Maintenance
Intelligent Sensor Diagnostics

The multi-parameter, multi-channel M800 transmitter platform covers all major measurement parameters in one instrument. Intelligent Sensor Management (ISM) technology offers predictive diagnostics for proactive maintenance.

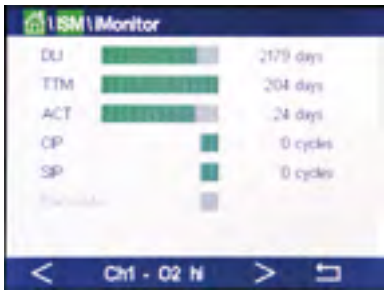
The M800 transmitter for ISM digital sensors incorporates a highly intuitive user interface, expanded measurement parameters and, most significantly, diagnostic maintenance capabilities.

iMonitor is an advanced sensor diagnostics utility. It anticipates maintenance intervals based on real-time sensor performance information rather than sensor failure alarms or imprecise estimates.

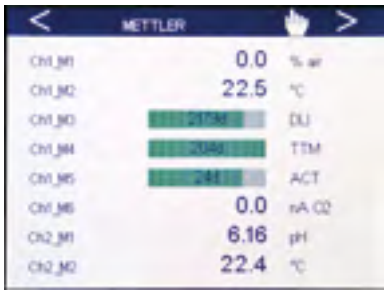
iMonitor evaluates each sensor's condition and calculates remaining sensor (or integrated consumable) lifetime to predict when service or replacement will be necessary. The number of days until maintenance should be performed is displayed on the M800 with a red, yellow or green indicator bar, providing at-a-glance information based on traffic light color coding.

▶ **www.mt.com/M800**

Your benefits



Intelligent diagnostics
With its unique iMonitor predictive diagnostics functionality, based on METTLER TOLEDO's ISM technology, the M800 tells you not only what is wrong with a sensor but how to fix it – before an issue arises.



Multi-parameter and multi-channel
The M800's multi-parameter abilities give you greater flexibility, less complexity, and less training and inventory. Two- and four-channel models provide multiple measurements from a single unit.

Color touchscreen
The color touchscreen provides simple, convenient operation. Just touch and follow the intuitive user interface.

M800 multi-parameter,
multi-channel transmitter

Get in-line with METTLER TOLEDO

Confidence in Ultrapure Water Systems
with a Pure Water Optical DO Sensor

Minimizing corrosion is vitally important in power plant cycle chemistry monitoring and generator stator cooling. The Pure Water Optical Dissolved Oxygen Sensor with Intelligent Sensor Management (ISM®) technology provides fast response, high accuracy, and increased stability in demanding, low ppb-level ultrapure water applications.

► **www.mt.com/opticalDO**

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