

Power Generation

Perspectives in Pure Water Analytics



19 News

THORNTON

Leading Pure Water Analytics

Pure Water Quality Assurance Self-calibrating Silica Analyzer

The presence of silica in boiler feedwater can very quickly lead to deposit formation in turbines. As it can only be removed during out-of-service cleaning, preventing silica from entering the water cycle is the best course of action. The new 2800Si Silica Analyzer not only quickly detects trace level contamination, the unit calibrates itself automatically, saving valuable operator time.

Highly damaging deposits

Silica has no significant corrosive effect on boilers, but its presence in water / steam is nonetheless very detrimental. It forms extremely hard coatings in steam passage ways and on turbine blades, leading to changes in steam velocities and pressure drops affecting turbine efficiency. If left unchecked, increased silica build-up can result in unbalanced rotors and cause damage through vibration at high speeds.

Silica is in all water supplies and requires membrane separation and/or ion exchange for its removal. Direct, continuous silica measurement is the most effective means to protect against contamination from spent anion resin and steam carry-over. Silica is always present in cooling water so ppb level silica measurement

provides excellent sensitivity in detecting small condenser leaks and for identifying exhaustion of condensate polishers. Silica has negligible conductivity and therefore cannot be detected using conductivity measurement.

Optimized design meets silica measurement challenges

The METTLER TOLEDO Thornton 2800Si Silica Analyzer is a reliable on-line instrument designed specifically for pure water treatment and power cycle chemistry monitoring. The analyzer provides assurance of water purity to optimize ion exchange in the treatment of pure water and to minimize silica deposition in turbines.

Early detection of trace contamination is enabled with minimal operator supervi-



METTLER TOLEDO



sion. The 2800Si Analyzer allows unattended automatic calibration at a user-configured interval. Large-volume reagent containers enable long-term operation before refilling becomes necessary.

Applications

Ultrapure water monitoring at ppb silica levels can ensure the highest quality water is being delivered. 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 control 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.

Features and benefits

- Large reagent containers enable a long service interval – reduce maintenance time
- Full enclosure – safely protects reagent containers and components from 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
- End of measurement relay signal – enables use with sample sequencer for multi-stream measurements.

For more information visit:

► www.mt.com/Thornton-silica

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2800Si
Silica Analyzer

New Products

Optical Dissolved Oxygen Sensor Monitors Ultrapure Water

Offers significant enhancement with simplified maintenance and faster response. Optical Dissolved Oxygen (ODO) sensors are used to monitor pure water in cycle chemistry applications. METTLER TOLEDO Thornton ODO sensors offer reduced maintenance – no electrolyte exchange or sensor polarization is required.

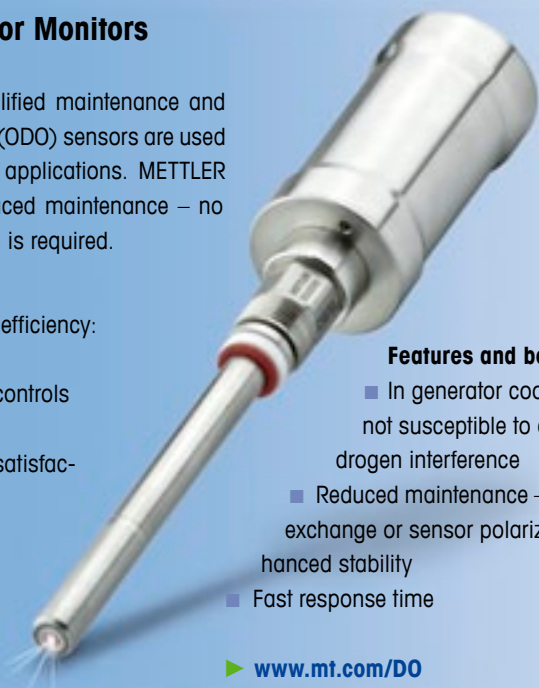
Recommended measurement points

- Deaerator outlet to monitor performance efficiency: DO range 0–10 ppb
- Feedwater with oxygenated treatment – controls passivation: DO range 50–100 ppb
- Feedwater heaters - optional to confirm satisfactory control within target regime.
- Condensate to detect air in-leakage: DO range 0–20 ppb
- Stator cooling to minimize copper corrosion: DO range 0–20 ppb or 0–5 ppm

Features and benefits

- In generator cooling ODO is not susceptible to dissolved hydrogen interference
- Reduced maintenance – no electrolyte exchange or sensor polarization for enhanced stability
- Fast response time

► www.mt.com/DO



ISM

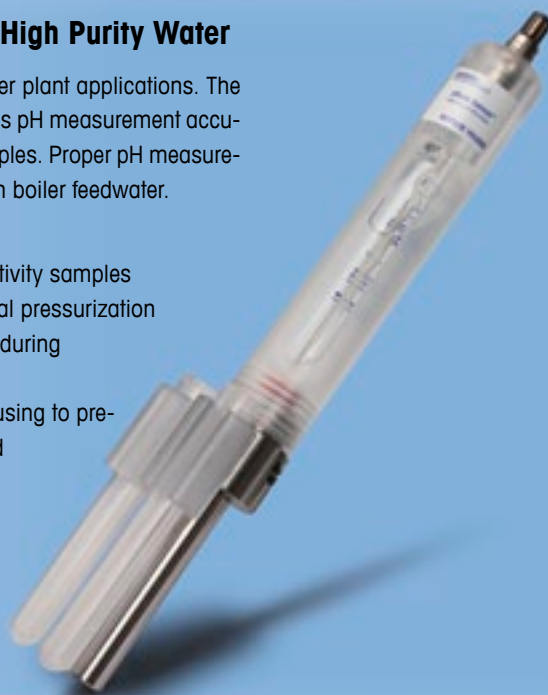
New pHure Sensor™ LE Option Measures High Purity Water

Provides high accuracy in low conductivity water for power plant applications. The new METTLER TOLEDO Thornton pHure Sensor LE increases pH measurement accuracy for higher performance in low conductivity water samples. Proper pH measurement and adjustment helps prevent scale and corrosion in boiler feedwater.

Features and benefits:

- Enables high accuracy pH measurement in low conductivity samples
- Free flowing junction operates by gravity without external pressurization
- Provides convenient buffer containers to hold electrode during calibration
- Uses a single probe electrode with very low-volume housing to prevent corrosion product particles from accumulating and slowing response

► www.mt.com/pHure





Reliable, Accurate, and Low Maintenance Thornton Instruments for Thai Power Plant

When a gas-fired power plant in Thailand was being planned, a Malaysian fabricator was contracted to supply the boiler sample panels. Panel instrumentation would have to be of very high performance to ensure water, steam, and condensate quality – the fabricator selected METTLER TOLEDO Thornton.

Experienced panel fabricator

Malaysia-based Kemtek Sdn Bhd is a mid-sized panel fabricator of sampling and monitoring systems for pure water, wastewater and recycling systems, providing its clients with a complete range of water treatment products, management and conditioning services and equipment.

Kemtek Sdn Bhd specializes in providing new and innovative water treatment programs with a dynamic technical approach. The company's capabilities encompass design, manufacturing, installation and commissioning in accordance with MS ISO 9000; compliant with international standards and supported by trained professionals. Ir. Chen Yew Seong, Chairman of the Board and founder of Kemtek Sdn Bhd, has over 20 years of experience in the power and energy industries, and has authored two books on industrial and boiler water treatment that have been recognized as reference textbooks for engineering students.

Kemtek was contracted by a Singapore engineering procurement contractor to design and build several boiler sample panel systems to be installed in a Thailand natural gas-fired power plant, scheduled to go online in 2012.

Monitoring instruments are specified exclusively from a qualified supplier

Kemtek designed and produced a sampling panel for the Thailand power plant cycle chemistry that consists of approximately 52 measurement points: 25 loops measuring conductivity, 14 measuring pH, and the remaining loops measuring dissolved oxygen in boiler feedwater, steam, and condensate. With continuous on-line monitoring of these parameters, the plant engineer can accurately assess plant conformance to cycle chemistry guidelines to minimize corrosion and release of corrosion products into the steam generation system.

The engineering procurement contractor was directed by the power plant to install only analytical instruments in the boiler water system that had been pre-qualified by the owner/purchaser. From this qualified list, Kemtek selected METTLER TOLEDO Thornton conductivity, pH, and dissolved oxygen sensors, and the M300 dual-channel transmitters for the water cycle chemistry skids supplied for the Thailand project.

Sensors calibrated with the highest accuracy and repeatability

The customer was concerned about loop calibration. Kemtek recommended using conductivity standard solutions to calibrate the sensors – Thornton provides calibration solutions with accuracy within $\pm 1\%$. Thornton also provides calibration systems that can be used as portable certified standards to measure the same sample stream and allow comparison calibration of the on-line instrumentation. Kemtek has expressed satisfaction with the quality



and performance of the Thornton instrumentation.

Multi-parameter transmitter capability offers flexibility and space savings

The M300 Series dual-channel transmitters combine robust construction and ease of use for pH/ORP, dissolved oxygen and conductivity measurements. An advantage of Thornton instrumentation is its multi-parameter capability, allowing mixing and matching of parameters as needed. For example, conductivity and pH (or dissolved oxygen) can be monitored on one M300 transmitter, and each channel is user-configurable. Supporting the two channels of measurement are four analog outputs, which enable temperature and

computed parameters, as well as the primary parameters to be transmitted for data acquisition and control.

M300 transmitters provide exceptionally accurate specific and cation conductivity temperature compensation. From these conductivity measurements, the pH can be computed. Within normal cycle chemistry and some stator cooling conditions, this calculation is more accurate and reliable than pH measured with a glass electrode. Similarly, carbon dioxide concentration may be computed from cation and degassed cation conductivity measurements.

On-line multi-parameter instrumentation is capable of measuring or computing all these parameters. M300 transmitters can

be used with the pHure Sensor™ for reliable pH measurement as a backup to the computed values. M300 transmitters can also measure dissolved oxygen with high accuracy and minimal sensor maintenance.

Multi-phase installation leading up to plant commissioning

The first of multiple skids has been delivered to Thailand through the engineering procurement contractor in Singapore, and commissioning is in process. In this multi-phase installation, the plant's six boilers are to be initially installed, and will supply process steam for the petrochemical plant's needs. As each phase of the plant is completed, additional sample monitoring panels will be installed leading up to the plant's commissioning scheduled for this year.

Find out more about the M300 transmitter:

► www.mt.com/M300



One of several water sampling panels utilizing Thornton M300 transmitters to monitor pH, conductivity and dissolved oxygen levels in a Thailand natural gas-fired power plant. This panel (partially shown) monitors two of the plant's six boilers.


ISM


Power Station Upgrades to Intelligent Solution Saving Costs and Reducing Inventory

Sensors and multi-parameter transmitters with Intelligent Sensor Management technology provide accurate measurement of multiple cycle chemistry parameters, saving cost and inventory.

Digital technology

Intelligent Sensor Management (ISM) is a new digital technology for METTLER TOLEDO Thornton sensors and transmitters. Through a range of advanced features, ISM expands sensor performance while simplifying installation, operation and maintenance.

Cooperative power producer

East Kentucky (U.S.) Power Cooperative (EKPC) is a not-for-profit, member-owned electric cooperative providing wholesale electricity to its 16 member-owner distribution cooperatives. It was formed in 1941 and currently serves about 519,000 homes, farms and businesses in 87 counties.

ISM sensors and M800 transmitters replaced older instruments

Cooper Station in Burnside, Kentucky has two coal-fired units producing a total of approximately 340 MW. Each boiler employs a water sample panel measuring pH, dissolved oxygen, and conductivity of condensate, feedwater and boiler water (blowdown).

When lab supervisor Tom Schoolcraft needed to replace water monitoring instruments from another manufacturer, he researched METTLER TOLEDO Thornton instruments. On the strength of a positive recommendation from associates at another power plant along with an on-site demonstration by Thornton sales personnel, he decided to replace thirteen of the old single-input transmitters with just five Thornton M800 four-channel multi-parameter transmitters.

ISM sensors offer Plug and Measure convenience

“By using two to four sensors per transmitter, we’re measuring multiple parameters with just one transmitter per water category,” commented Mr. Schoolcraft. “The M800 transmitter has a convenient touch-screen color display that’s simple to use and displays any or all parameters. If we need to replace or clean a sensor, it’s easy to pull it out of the panel, service and replace it – the transmitter automatically



Cooper Station, Burnside, Kentucky, USA

recognizes and configures the sensor immediately after it's reconnected." The M800 multi-parameter transmitter accepts up to four ISM analytical sensors plus two flow inputs.

UniCond® ISM sensors accurately measure across a wide conductivity range

With its advanced integrated measuring circuit, Thornton's UniCond sensor measures across a wide conductivity range, from brackish water (up to 50,000 $\mu\text{S}/\text{cm}$) to ultrapure water. This avoids the added cost and inventory of stocking multiple sensors with different measurement

ranges in makeup water treatment systems. According to Mr. Schoolcraft, "The pH and dissolved oxygen ISM sensors plug into the same multi-parameter transmitter, and we can get oxygen readings to the ppb range – they really do the job."

Upgraded sensor technology yields improved results

ISM capability in sensors and transmitters is a new technology for this power plant's water panel. However, Cooper Station has experienced positive results. "METTLER TOLEDO made it easy to upgrade our old instruments," reported Mr. Schoolcraft, "and with the sales support provided to

familiarize us with the new transmitter operation, we're pleased with the results, and will consider Thornton for our second boiler water panel upgrade."

For more information about the M800 transmitter and ISM sensors, visit:

► www.mt.com/ISM

Thornton is "the Preferred" Choice in Mobile and Stand-alone Water Systems

The tough conditions in the southwestern United States are demanding on mobile water trailers. For Puretec Industrial Water, the performance of Thornton instrumentation in this environment is a testament to their durability and reliability.

Independent water purification company

Puretec Industrial Water is an independently-owned, fourth-generation family business serving customers in the southwestern United States, an arid region with some of the strictest water use and quality standards in the world.

Puretec dates to 1965, when Mr. Jim Harris started an industrial division of his father's and grandfather's water business. They were originally franchisees of Culligan water softening, a service that removes minerals to improve the cleaning

properties and taste of residential tap water. Now run by father and son Jim and Jed Harris, Puretec employs 90 staff and is growing at the rate of about 15% each year. The company's water and desalination systems incorporate reverse osmosis, ultraviolet sterilization, microfiltration, TOC reduction and mobile trailers for on-site water purification.

Thornton – "the preferred" water quality instruments

According to general manager Jed Harris, Puretec customers are diverse and demand dependable, quality construction in their

water systems. Water delivered to customers' systems must often attain 18.2 $\text{M}\Omega \times \text{cm}$ resistivity (0.055 $\mu\text{S}/\text{cm}$) – instruments must function reliably, accurately, and be easy to calibrate.

"Thornton instruments work well," commented Mr. Harris. "We usually insist on installing Thornton sensors and transmitters in our customers' water systems." Thornton M300 transmitters are used in Puretec's mobile water trailers and in customer installations, monitoring dozens of data points in the water system. Operation in mobile trailer water



treatment systems is a testament to the durability and reliability of Thornton instrumentation which travels thousands of miles over rough roads between the ultrapure water user and the Puretec service facility over the lifetime of a system. Despite this rough handling, Thornton instruments provide accurate measurements to confirm water quality within user requirements.

Richard Mays, electrical design engineer, reports that the state of California requires that power plants adhere to a zero discharge standard – all water must be reclaimed. Reclaiming and reusing water appropriately are key factors in system

design. Puretec provides pure water needs for all areas of the complex power plant cycle; from boiler feed water loops to combustion turbine feed to control of nitrogen oxide (NOx) emissions, and for cooling systems.

“Puretec systems monitor pH, conductivity, TOC, sodium, silica, and chlorine. Our water systems are often used in harsh environments, and the instruments must be rugged enough to withstand such demanding conditions. It’s vital to use products we can rely on, and that our customers find convenient to use. We have confidence in Thornton.”

Puretec is currently installing the new Thornton M800 ISM multi-parameter digital transmitter with touchscreen and unique iMonitor predictive sensor diagnostics capability. Mr. Mays reported that customers who have used the new multi-parameter transmitter are pleased with its user-friendly operation, and ability to monitor multiple parameters simultaneously.

Puretec contributes to improve the community

Owners of Puretec support charitable foundations to enhance quality of life in other countries. A portion of their operating profit goes towards supporting Global Water Foundation to develop wells and water sources for underserved regions in Central America.

To learn more visit:

- www.GlobalWater.org.
- www.mt.com/pro_power



Puretec service technician Tim Dowds inspects instrumentation on a water system control panel in its Oxnard, California facility.

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 $0.055 \mu\text{S}/\text{cm}$ at 25°C ; therefore, conductivity instruments must have the ability to accurately and repeatedly detect very small conductivity changes with a non-zero background.

Calibration options

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 ($0.02 - 50,000 \mu\text{S}/\text{cm}$) 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 re-

sults 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



Safeguard Water and Steam Purity with an Advanced Sodium Analyzer

Reliable, automatic, on-line analysis of sodium in water and steam samples helps prevent damaging corrosion and deposits in power plant pure water systems and steam turbines. Thornton's new sodium analyzer provides the highest confidence in water/steam purity.

The Thornton 2300Na Sodium Analyzer offers a new design for a traditional measurement for pure water treatment and power cycle chemistry monitoring. This analyzer provides assurance of water purity to minimize corrosion and maximize water production. Early detection of trace contamination is enabled with minimal operator supervision.

The analyzer uses a particularly simple automatic calibration method and also provides the ability to measure grab samples easily, in addition to measuring pressurized samples from process streams.

Its implementation with an operator interface common to other parameters including conductivity, dissolved

oxygen, pH, TOC, and ORP makes it especially convenient for installation and operator training.

Find out more at:

► www.mt.com/Thornton-sodium

Your benefits



Automatic calibration

Fully automatic, unattended calibration ensures reliable operation and saves operator time.



Sample status at a glance

Simultaneous display of sodium, adjusted pH, temperature, and calibration progress.



Choice of enclosure

Fully enclosed and lockable for dirty plant environments or partially-enclosed with accessible controls for clean sample rooms.



2300Na Sodium Analyzer

Get in-line with METTLER TOLEDO



NEW 5000TOCi Sensor with ISM Continuously Monitors for TOC Contamination

The new Thornton 5000TOCi sensor with Intelligent Sensor Management™ provides continuous, fast, and reliable monitoring of TOC levels down to sub-ppb levels.

- Maximizes uptime with a robust, reliable design virtually free from moving parts
- Intelligent Sensor Management capability enables predictive maintenance with convenient diagnostics and sensor status

With continuous on-line measurements, the 5000TOCi sensor helps ensure against TOC contamination in plant cycle chemistry.

► www.mt.com/TOC

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