THORNTON

Leading Pure Water Analytics

Semiconductor

Pure Water and Process Analytics for the Semiconductor Industry

METTLER TOLEDO

Mettler-Toledo Thornton
Providing measurement solutions

Over forty years ago, Thornton designed and manufactured the original analog resistivity meters for high purity water. Thornton later pioneered microprocessor-based resistivity instrumentation with the first computed high purity temperature compensation in this new, demanding and innovative industry. Over the years, Thornton has become the resistivity measurement standard in the semiconductor manufacturing industry.

Thornton instruments are specified in the majority of semiconductor manufacturing facilities worldwide to monitor and control ultrapure water systems. Thornton has intimate knowledge of critical measurements needed for ultrapure water production.

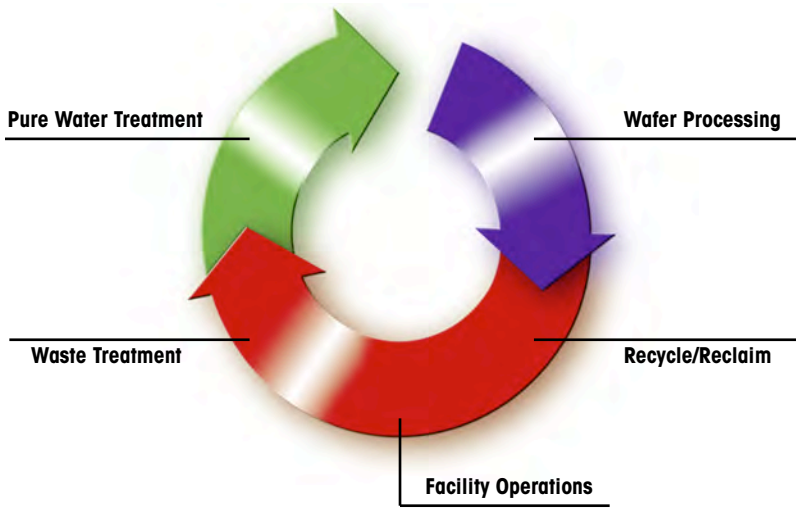
Our expansive measurement capabilities mean Thornton products are used throughout a plant's complete water cycle in areas such as wafer processing tools, recycle/reclaim, waste treatment and various facility operations.

Today Thornton continues to provide innovative solutions, offering expanded measurement capabilities and a greater array of products to meet global microelectronics industry requirements. As part of the Mettler-Toledo Process Analytics Group, Thornton has gained world-class technology in the areas of pH, ORP, dissolved oxygen and ozone measurement. Our expanded global support infrastructure provides local sales and service for all Thornton products in many regions around the world.

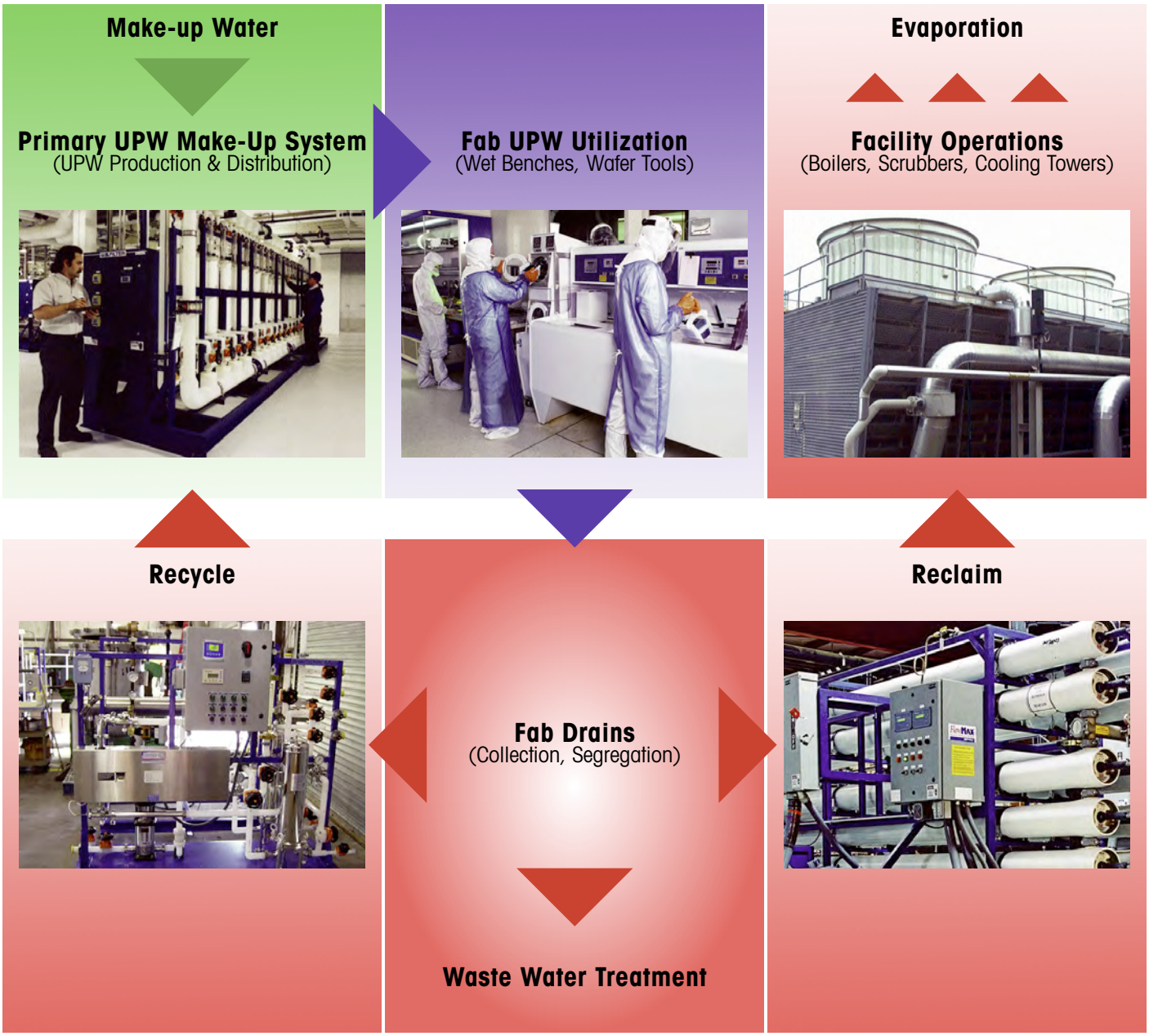
Thornton Industry Participation
As a technical leader in pure water measurements, Thornton staff members participate in the following semiconductor and microelectronics-related organizations and conferences:

- ASTM D19 Water Committee, Task Group Chairman
- Semiconductor Pure Water & Chemicals Conference, Committee Member
- SEMI Member & Ultrapure Water Task Force, Participant
- Ultrapure Water Conference, Participant and featured Industry Expert

In addition, Thornton shares its years of measurement experience and industry knowledge by offering on-site technical training sessions that provide valuable product and application information to users. A wide variety of curriculums are available and are often tailored to specific needs.



Capabilities to meet the specific needs of the Semiconductor manufacturer



Instrumentation designed for exacting industry requirements

Thornton's line of instruments demonstrate proven performance far beyond ultrapure water measurement applications and are found in many areas throughout today's semiconductor facility. Innovative instrument technology allows us to offer many application specific features on all standard products. This provides end-users with the flexibility to configure a measurement system to their specific process needs.

Our multi-channel and multi-parameter instrument platforms are designed with industry applications and unit processes in mind. The key to this concept is the ability to mix and match different measurement parameters on a single instrument, while maintaining individual measurement quality and performance.

The 770MAX is Thornton's most advanced instrument for on-line measurement. It offers six-channel multiparameter measurement capability for resistivity/conductivity, TOC, pH, ORP, dissolved oxygen, ozone and temperature plus flow, pressure and level. The configuration flexibility of the 770MAX is unmatched, allowing up to 16 measurements from the 6 input channels with unique features such as specialized temperature compensation modes and derived measurements.

The M300 Series instruments provide one and two channel measurements of resistivity/conductivity, pH, ORP, dissolved oxygen, ozone, plus temperature.The Flow version provides one or four channels of flow measurement using a variety of sensor types.

Thornton's M300 and 770MAX measurement systems provide outstanding performance to monitor and control membrane-based filtration skids and other unit processes used to produce UPW. Additionally they are used in wafer processing tools, spent UPW water processes such as recycle/reclaim, waste neutralization and other facility operations such as scrubbers, cooling towers and boilers.

Continuous on-line TOC monitoring
to measure critical organic levels

Studies have demonstrated that even trace levels of TOC can negatively affect wafer production yields. TOC is among the list of critical parameters monitored throughout a semiconductor manufacturing facility. Extremely low levels of organics, down to the sub part-per-billion range, are required by most semiconductor fabs and foundries. Additionally, there is an increasing need to monitor TOC levels of spent rinse waters slated for reuse.

The 5000TOC Sensor provides continuous monitoring of total organic carbon levels in pure and ultrapure water applications. The sensor's compact, industrial design is easily integrated into UPW make-up systems, distribution loops, and other unit processes. The sensor can be wall or pipe mounted, making it ideally suited for process monitoring in these environments. As part of the 770MAX family of smart sensors, installation and setup are fast and simple. The combination of innovative sensor technology and 770MAX multiparameter analyzer transmitter capabilities makes the 5000TOC measurement system a powerful process monitoring tool.

Another TOC measurement option is Thornton's 550TOC Analyzer. This portable unit uses proven UV technology to rapidly measure TOC in pure and ultrapure water applications. It can be used throughout the microelectronics facility to monitor TOC levels in UPW make-up processes and final polishers, wet bench processes, UPW points of distribution and spent rinse water recycle applications.

Unique benefits of both the 5000TOC Sensor and the 550TOC Analyzer include continuous on-line monitoring, point-of-use and portable monitoring capability, no reagents or chemicals, and no moving parts.

Mix & match sensors
offer accurate, reliable options

Resistivity/Conductivity

Thornton resistivity instrumentation is a semiconductor standard for measuring the quality of pure and ultrapure water. Each sensor is supplied with individually calibrated and certified cell constant as well as temperature elements, traceable to ASTM and NIST standards from our ISO9001-certified factory. Our line of sensors includes 2-electrode, 4-electrode and inductive technologies to fit a wide range of applications. Designs incorporate a variety of fittings and material options to meet specific requirements.

pH/ORP

Ultrapure water and high purity chemical mixtures are used to etch and clean wafer surfaces. Characteristics of spent rinse waters from these processes include low-to-moderate conductivity and TOC levels and varied pH levels. Under these conditions, pH measurement is a challenge. Thornton's pHure Sensor™ provides reliable pure water measurements using a specialized electrode with self-pressurized gel reference, low resistance glass membrane, integral temperature compensator and convenient VP connector. Semiconductor manufacturing processes contain numerous wafer cleaning and etching steps where varied concentrations of Hydrofluoric Acid (HF) are used. The Mettler-Toledo Thornton HF-resistant pH sensor offers both the benefit of greater accuracy and extended service life in these applications. Extended sensor life reduces the cost of these measurements.

Flow Rate

Wafer cleaning tools used in semiconductor chip manufacturing processes–such as photoresist strip and post-ash clean, oxide etch, nitride etch, and wafer reclaim–require accurate flow measurement for the transport of ultrapure water, chemicals, or combinations of both. Flowrate, and the amount of fluids used, are critical to efficient wafer tool operation. The 317 Series PFA Vortex flowmeter is ideally suited for this application. A molded PFA body offers excellent thermal and chemical resistant properties with no metal in contact with the fluid. No moving parts assure there is no particle shedding. Flaretek end connections are also available.

Dissolved Oxygen

Industry guidelines recommend that dissolved oxygen levels be reduced and maintained at very low levels to limit effects on wafer manufacturing processes. Unit processes such as degassification or deaeration can drive oxygen content to very low levels during the manufacture of ultrapure water. DO measurements provide assurance that these processes are working effectively. Some wafer processing steps require DO levels in the single digit part-per-billion range. This safeguards against potentially detrimental effects to wafer surfaces and oxide layers.Thornton's high-performance DO sensor provides highly accurate ppb measurements plus exceptionally fast downscale response of 98% in 90 seconds.

Ozone

Some UPW treatment systems rely on disinfection using ozone. Thornton sensors provide consistent monitoring of ozone disinfection levels to assure complete microorganism destruction. After disinfection, residual ozone is typically removed by UV lamps to prevent any oxidizer from reaching the distribution system. Thornton sensors monitor after ozone destruction at the near-zero ppb level to be sure it has been eliminated.

Outstanding training & technical services empower the Thornton user

On-Site Instrument Operation & Calibration Training Workshops
Thornton's Operator Training Courses are tailored to each customer's requirements. The course is conducted in a classroom setting where interaction between instructor and participants is encouraged. Each attendee is supplied with material detailing the course content. Instruments are provided for hands-on participation.
The areas covered in this training program focus on Thornton instrumentation, calibration, and maintenance specific to your facility. Additional technical topics may be added or substituted as requested.

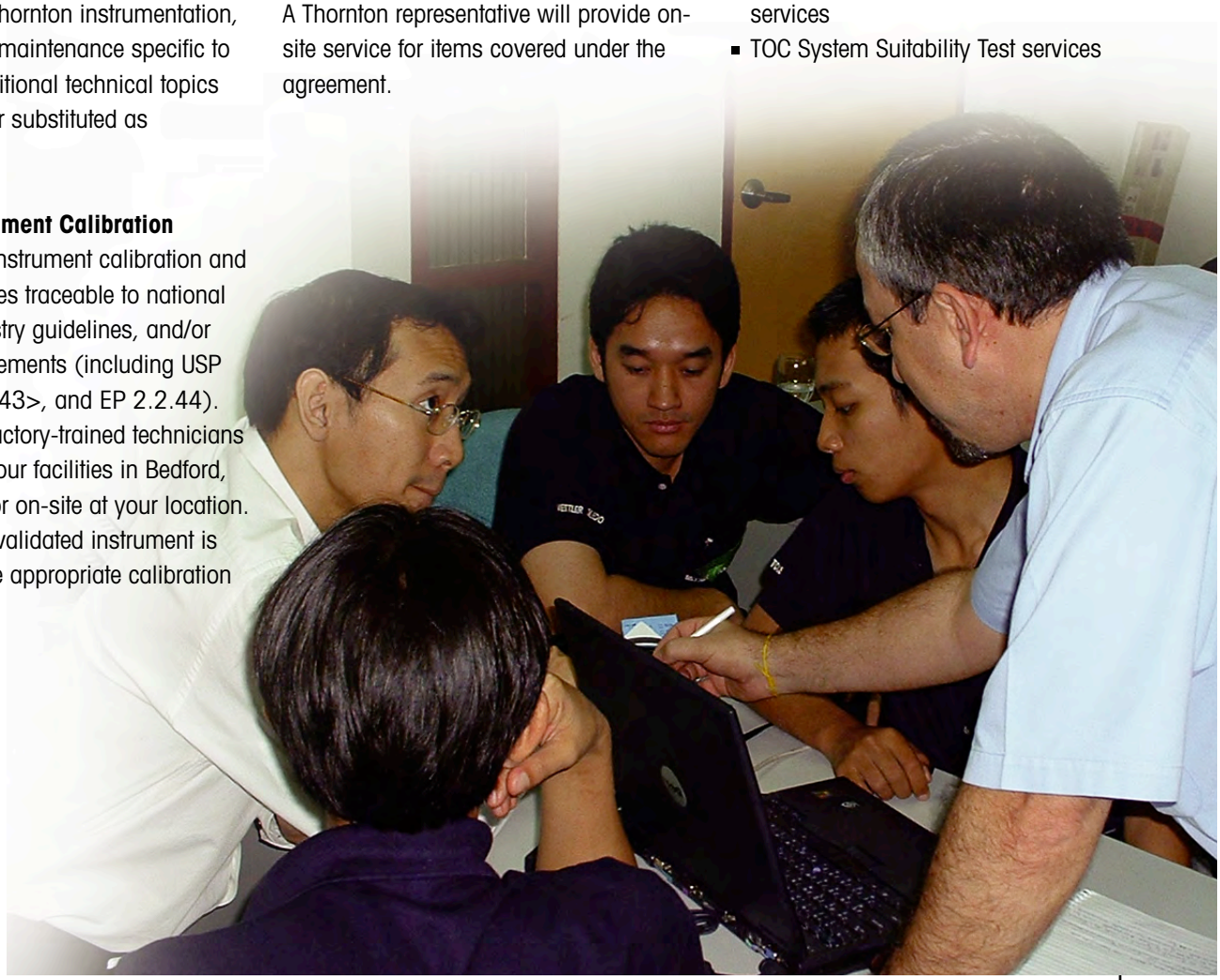
Traceable Instrument Calibration
Thornton offers instrument calibration and validation services traceable to national standards, industry guidelines, and/or regulatory requirements (including USP <645>, USP <643>, and EP 2.2.44). Services using factory-trained technicians are available at our facilities in Bedford, Massachusetts or on-site at your location. Each calibrated/validated instrument is supplied with the appropriate calibration documents.

Specialized Conductivity Calibrations
Choose one of seven unique conductivity calibrations to fit your application needs, from standard calibrations to customer-specified temperature and ASTM verification points. System calibrations are also available where the instrument and sensors are calibrated together, optimizing system accuracy.

Service & Calibration Contracts
A Thornton representative will provide on-site service for items covered under the agreement.

These services include, but are not limited to:

- Calibration/validation of instrument and sensor system
- Issuance of appropriate documentation
- Identification and verification of all software revisions
- Minor repairs or adjustment of instruments at a discounted labor rate
- Installation and validation support services
- TOC System Suitability Test services



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