MOKON®

Designed to Perform. Built to Last.

Custom Engineered Temperature Control in the **Semiconductor Industry and Manufacturing**

The semiconductor industry is ever-changing with demanding requirements, but one thing has stayed constant: the applications in this field have specific needs that necessitate low defects and precise temperature control. Navigating this landscape and maintaining exact temperature control over process fluids, molds, vessels, heat exchangers, and packaging equipment requires having an experienced engineering and design team on your side.

More than a product manufacturer, Mokon provides custom-engineered solutions to the challenges of the semiconductor industry. Our practical, intensive approach to these applications results in optimized process heating and cooling solutions. Dedication to quality and superior knowledge of a wide variety of application designs is what sets us apart. For over 70 years, Mokon has been a dependable, collaborative partner, ready to answer your questions and build your custom solutions.

Our Full Range water system provides heating and chilling all in one package from -23°F to 380°F (-31°C to 193°C).

Thermal Requirements in Semiconductor Manufacturing

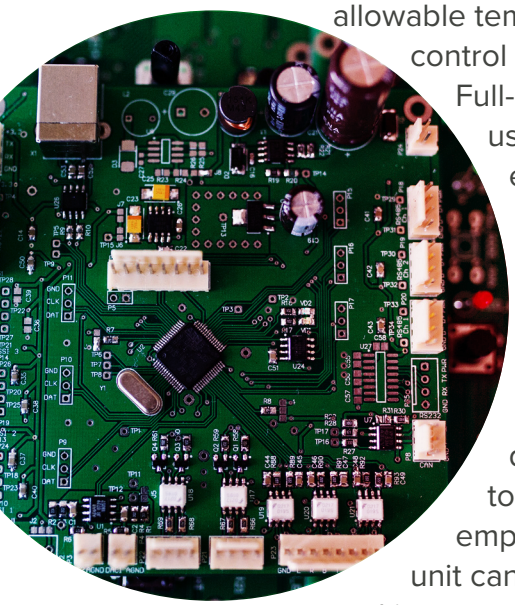
Within the global semiconductor industry, temperature plays a crucial role in chip production. Across manufacturing stages such as prefabrication, deposition, and final testing, deviations from the required temperature range can result in material defects, reduced uniformity, or complete part rejection. Temperature control units (TCUs) must be tailored to maintain stable conditions under both steady-state and transient heat loads. This includes accounting for heat input from process equipment, environmental losses, and required cooldown rates. Unit performance is dependent on correct sizing of heaters, cooling capacity, and flow rates.

Minor fluctuations in thermal management can lead to contamination and warping. Achieving maximum yield requires maintaining temperature stability within ±0.01°C, as even the smallest deviation can cause defects or unwanted reactions. This level of precision is essential when managing the heat generated by electronic components through dissipation, ensuring proper cooling. Mokon engineers our control systems with this in mind.

Our control systems are typically based on PID architecture. Performance is dependent on proper tuning of proportional, integral, and derivative terms relative to system response characteristics. Systems with higher thermal mass or longer transport delays may require cascade control, where a secondary loop (fluid temperature) is used to stabilize the primary process temperature.

Oxidation and chemical vapor deposition require controlled ramp rates and stable soak temperatures. Without accurate control temperatures, inconsistencies can arise, weakening material properties. By combining precise heating and cooling, each step of semiconductor manufacturing can stay within strict thermal limits, ensuring process stability and maximizing overall yield.

Controlling processes at temperatures below 250°F (121°C) is typically achieved using a Mokon water/glycol temperature control unit. As operating temperatures increase, allowable temperature deviation becomes more impactful, requiring tighter control of unit response and stability. Mokon's thermal oil TCUs and Full-Range TCUs are designed for wide operating ranges and are used where glycol-based units are not suitable. These units are engineered by us to account for fluid properties, including viscosity fluctuation, as well as heat transfer and flow requirements.



Without a custom-engineered TCU tailored to the demands of a semiconductor application, companies may depend on generic equipment that does not precisely match their operational requirements. This mismatch can lead to decreased control during manufacturing, difficulty maintaining tight temperature tolerances, and increased material losses. Ultimately, these issues emphasize the importance of customization, as a properly engineered unit can operate within narrow thermal limits, provide stable processing, and improve overall yield.

Mokon's Product Solutions

Since 1955, Mokon has been the manufacturer of choice for high-quality circulating liquid TCUs for thousands of customers all over the world. For over 70 years, we have challenged ourselves to meet the evolving needs of industries like semiconductor, plastics, die casting, food processing, pharmaceutical, chemical processing, rubber, printing, converting, and more. Our experienced team of engineering, sales, and service professionals is dedicated to designing and supplying the safest, highest-quality products available. We are a quality-driven manufacturer that delivers practical engineering solutions through our superior customer focus and support.

Duratherm water system offers precise and accurate temperature control up to 250°F (121°C).

Our HTF HF-2 oil system thrives in applications with large flow and higher heating requirements up to 650°F (343°C).

Mokon's Expertise and Capabilities

- Custom designed/engineered units
- Single, dual, or triple zone heating configurations
- Air- or water-cooled condensing chiller
- TEFC motors
- Heavy-duty chiller insulated plastic reservoir
- Energy efficient insulated heater manifold
- Automatic air purge
- Suction and discharge pressure gauges
- Heavy-duty ball bearing casters
- Powder-coated carbon steel cabinet
- cULus 508A Control Panels
- Audible and visual alarms
- UL, CSA, CE and EAC certifications
- NEMA/Type 4, 4X, 7, and 12 rated panels
- Heat exchangers and heat remover designs
- Remote start/stop and control panels
- SCR and solid-state relays
- Cleanroom environments

Wide-Operating Range Temperature Control Units

Mokon's TCUs maximize performance with temperatures up to 650°F (343°C). Paired with a Mokon chiller, the Full-Range TCU offers a combination heating and cooling unit, all in one package. Mokon's units are available in multiple sizes and configurations. These include heating capacities up to 144 kW, pumping capacities up to 120 GPM, and rapid cooldown capabilities.

A Mokon oil unit in tandem with an Iceman chiller combines heating and cooling in a single process loop, enabling precise control of heat input and removal. Units are engineered and configured with appropriate cooling, heating, and pumping capacities to meet the specific demands of semiconductor manufacturing applications.

The Right Design, Every Time

All Mokon TCUs are qualified for service by rigid, simulated field tests, and are 100% factory-calibrated and run tested. Control systems utilize microprocessor-based controllers designed for closed-loop PID control, configured based on system-specific thermal dynamics. System configurations can be adjusted to meet most application requirements, including variations in heating and cooling capacity, pump sizing, and integration with customer control systems.

Mokon has made it our mission to surpass the needs of our customers across a variety of industries, especially in the semiconductor field. That's why we offer the ability to custom engineer any of our units to meet an application's specific requirements.

Full Range oil system is ideal for multi-zone processes from 50°F to 650°F (10°C to 343°C).

Our Iceman portable chillers provide process cooling down to -23°F (-31°C).

Mokon is available to help you navigate the semiconductor industry and create the custom oil-based temperature solution that's right for you. Reach out to us at any time using our website, www.mokon.com/contact.

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