

Cleanliness Chain

When it comes to semiconductor manufacturing, you need to know that every supplier process, from raw materials selection to final inspection of installed components, is designed to get you from source to exhaust with maximum cleanliness and no contamination. And how you get there is the Swagelok difference.



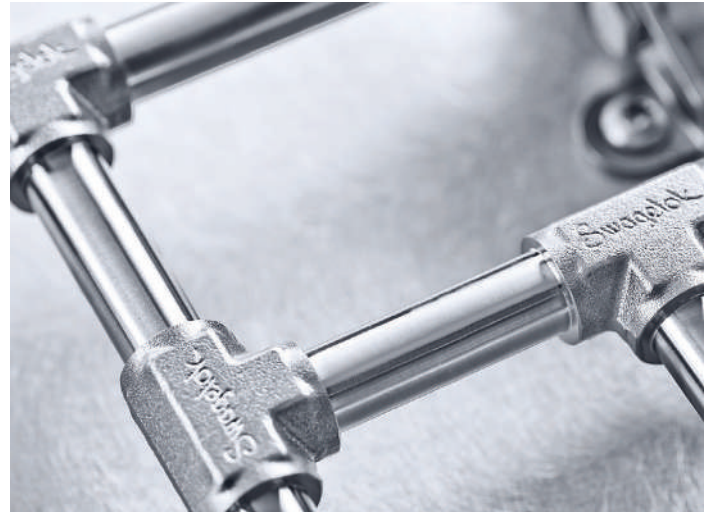
How Are We Different?

Cleanliness starts with our commitment to ultrahigh-purity materials, followed by our manufacturing processes, cleaning specifications, and quality control procedures. With these tools, you can trust Swagelok to provide the products you need so you can manufacture products with confidence.

Where Do You Want to Go?

The path to success just got shorter. Swagelok high-purity and ultrahigh-purity offerings help ensure clean manufacturing. Not only do we have the products, but we provide customized solutions too. We consider your operating environment and account for factors such as corrosiveness, the need for repeatability and throughput, and eliminating contamination. Innovations like our ALD valve enhance manufacturing efficiency of semiconductor components. Swagelok's ongoing commitment to quality ensures speed, consistency, and cleanliness—every time.





Design

From Wafer to Die

When it comes to semiconductor manufacturing, you know best what you need. High yield and throughput. Maximum cleanliness and reliability. Swagelok helps you get there with our innovative products, manufactured to the highest standards of cleanliness and customizable for your application.

- Smooth internal surface finish reduces the risk of particle entrapment and material contamination
- Innovative designs promote fewer areas for entrapment, rapid purging, and less stress in high-cycle applications

We don't stop there, though. We back our products with support for your high- and ultrahigh-purity applications, from fabrication to finished product

From Idea to Installation

How do you make a great product even better? When you customize it to meet your exact requirements.

Swagelok Engineered-to-Order Products

We know our products, and we know what they can do for you. Swagelok design experts help you customize our products to meet the demands of your application, then we build it, test it, ship it, and warranty it.

Swagelok® Custom Solutions

We go beyond components to provide a complete, customized solution that brings together your idea and our expertise. And like our products, our solutions are backed by our limited lifetime warranty too.

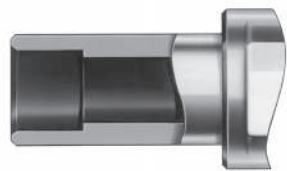


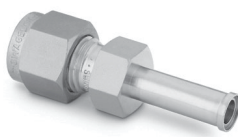
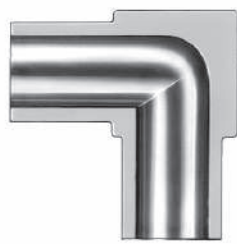

Support and Service

We support you with ongoing technical assistance and field engineering services to ensure your processes are operating exactly as you need them, when you need them to. Swagelok® fluid systems evaluation and advisory services bring the technical expertise, application experience, and industry knowledge of Swagelok field engineers to your facilities, helping you get the most from your fluid systems. Rely on these certified, locally available specialists to help you improve operational performance, reduce cost and labor time, and help mitigate safety, quality, and environmental risks.

Choose The Right Fittings And Valves For Your Application



Weld Fittings

Provide high-quality, permanent connections.

Weld Fitting Type	How Does This Product Meet My Application Needs?
<div></div> <p>Tube Socket Weld</p>	<p>Especially suited for areas in which entrapment and potential corrosion are not a risk. Welded design may create entrapment areas, resulting in increased dry-down times and potential corrosion.</p> <p>Nonautogenous weld requires filler material. Care should be taken to ensure filler material is compatible with requirements of the manufacturing process.</p>
<div></div> <p>Automatic Tube Butt Weld</p>	<p>Design facilitates reduced entrapment area.</p> <p>Autogenous weld; no filler material required.</p> <p>Alignment enhanced by integral filler ring.</p>
<div></div> <p>Butt Weld</p>	<p>Constructed of materials especially suited for ultrahigh-purity applications.</p> <p>Autogenous weld; no filler material required.</p> <p>Especially for installation in small spaces where compnent spacing is minimal.</p> <p>Designed for enhanced alignment and precise fit; full tube penetration avoids entrapment, corrosion, and leakage.</p>




ALD Valves

Ultrahigh-purity valves for atomic layer processing

Valve Type	How Does This Product Meet My Application Needs?
 <p>ALD3 and ALD6 Valves</p>	<p>Diaphragm designed for ultrahigh life cycle.</p> <p>Pneumatic actuator for high-speed performance, repeatability, and flow consistency delivers precise chemical dosing.</p> <p>Optional thermal actuator limits conductive heat transfer from the body to the actuator.</p>
 <p>ALD20</p>	<p>Ultrahigh-purity bellows designed for high flow and ultrahigh cycle life.</p> <p>Broad range of chemical compatibility; fully temperature immersible.</p> <p>Pneumatic actuator for high-speed performance, repeatability, and flow consistency delivers precise chemical dosing.</p> <p>Optional high-temperature optical position sensor.</p>

Regulators

Provide chemical compatibility.

Regulators Type	How Does This Product Meet My Application Needs?
<div><p>Pressure Regulator KPR Series</p></div>	<p>Metal-to-metal diaphragm seal for integrity against leaks.</p> <p>Free poppet operation, especially suited for inert gases and point-of-use process gases.</p> <p>Two-piece cap design provides linear load on the diaphragm seal.</p> <p>High-flow filter reduces contamination on the seat.</p>
<div><p>Compact High-Flow Gas Regulator HF Series</p></div>	<p>Innovative gas-actuated pressure-sensing assembly results in low droop, which eliminates the need for adjustment in many systems.</p> <p>Self-centering, tied poppet for clean operation and positive shutoff; minimizes creep.</p> <p>All-welded design—no seals to atmosphere.</p> <p>Compact, high-flow design allows close spacing of system components and process lines.</p>
<div><p>High-Flow Manual Gas Regulator HFE Series</p></div>	<p>Welded diaphragm assembly maximizes pressure-sensing area.</p> <p>Spring-loaded design allows manual adjustment of outlet pressure.</p> <p>Less than half the size of conventional.</p>



Purity

Swagelok's ultrahigh-purity solutions provide clean, reliable changeover and greater thermal control; help prevent contamination; and promote safe containment.



Our Commitment To Manufacturing

Swagelok components are manufactured to ensure consistent quality, ultrahigh purity, corrosion resistance, and weldability. What begins with material selection is carried out in our stringent and highly controlled manufacturing processes, which include surface processing to help enhance corrosion resistance and minimize contamination by removing surface imperfections. Swagelok materials are electropolished and finished with passivation.



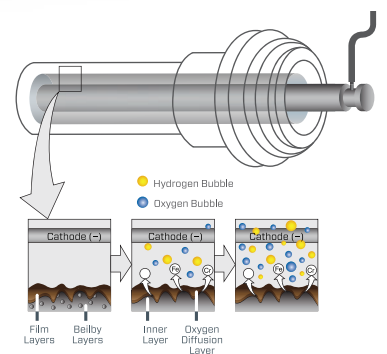
Electropolishing

Electropolishing is essential for creating a smooth inner surface for tubing to be used in gas distribution systems. Electropolishing is an electrochemical process that strips away metallic impurities

and smooths imperfections, leaving a much cleaner surface. This process is superior for semiconductor applications as the potential for embedded abrasives left in the surface does not exist as with mechanical polishing.

How Electropolishing Provides a Clean Surface

During electropolishing, a viscous film forms on the anode, and the base metal surface dissolves through the film. Corrosion resistance is improved as a result of an enhanced chrome-to-iron ratio on the treated surface. This process results in a smoother surface and less area on a microscopic basis, which improves dry-down and system purge times. Swagelok's tooling is designed to make sure the proper amount of current is applied as uniformly as possible to ensure optimal electropolishing.



Passivation

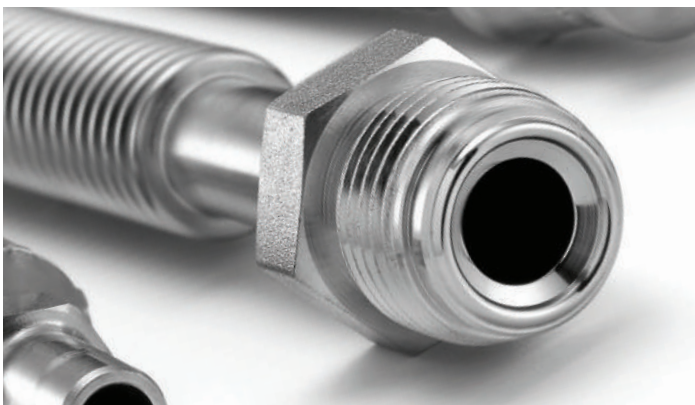
Passivation further cleans the surface and promotes the material's corrosion resistance by creating a chromium-rich passive oxide layer.



Our Commitment To Cleaning And Packaging

We stand behind our product offerings with our commitment to ultrahigh-purity manufacturing. We understand the UHP industry's unique requirements for cleanliness, so we can help you meet or exceed industry standards.

Process Specifications



Various contaminants, such as machining oils/coolants, finishing media, and electropolishing electrolytes, can compromise purity if not thoroughly cleaned. Swagelok is the author of process specifications that encompass industry-leading requirements for performance and cleaning of components used in UHP manufacturing:

SC-01 Ultrahigh-Purity Process Specification

specifies guidelines for surface finish and materials of construction to help our products resist impurities and corrosion, resulting in less likelihood of contamination in semiconductor manufacturing.

SC-06 Photovoltaic Process Specification

offers both electropolished and standard finish components in specific products for ultrahigh-purity applications.

SC-10 Standard Cleaning and Packaging Specification

defines the cleaning, lubrication, assembly, and packaging requirements for standard products and describes the practices used to meet these requirements.

SC-11 Special Cleaning and Packaging Specification

specifies cleaning and packaging requirements for wetted system components that exceed standard cleaning and packaging requirements. This specification helps to ensure that no lubricants enter the wetted stream or other critical paths in semiconductor manufacturing.

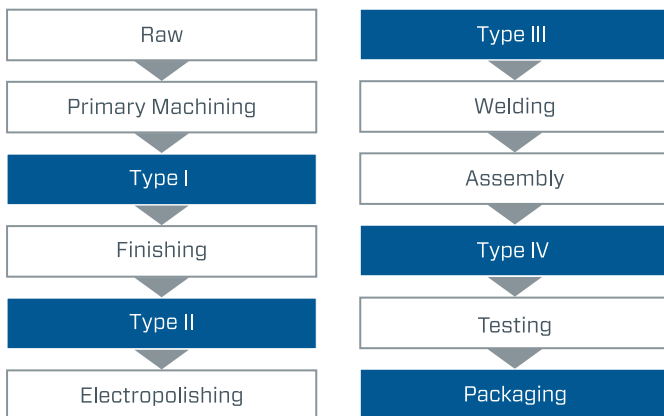


Typical Cleaning Processes



Swagelok cleans material at several stages of its manufacturing process to ensure product integrity.

Some products move through a series of ultrasonic washings, some are solvent-cleaned, and some are cleaned via multistage water rinse tanks to a drying chamber. In SC-01 cleaning, all components of the washing and drying process are closed to the outside environment to limit particle contamination.



Type I cleaning is performed after the component is initially processed and before it undergoes finishing operations. This type of cleaning includes bulk removal of machining contamination, such as coolant fluids and chips and other particulates.

Type II cleaning is performed after material finishing operations are complete and before the component is electropolished. This process removes visible contamination from finishing operations, such as residue from lapping and electrolytes. This type of cleaning is typically done by both chemical and mechanical methods.

Type III cleaning is performed after the component is electropolished and welded. Since this is the final cleaning prior to assembly, this process establishes the final part cleanliness level.

Type IV cleaning is the final nitrogen purge prior to packaging valves cleaned to the SC-01 standard. This process ensures product cleanliness after assembly.

Packaging Once products have been finished to our exacting standards, end connections are covered with clean caps and plugs to protect threads and other critical surfaces and to maintain cleanliness. We then package them to protect them from contamination and damage during shipping and storage.



Our Commitment to Throughput and Repeatability

Throughput means you get more material through your manufacturing system faster, with less downtime.

Repeatability means that the product you produce is the same, every time.

With Swagelok, you get these benefits and more when you select products based on their suitability for your high-purity application. Innovations like our ALD valve enhance semiconductor manufacturing efficiency.

- Cobalt-based super alloy (UNS R30003) material for strength and corrosion resistance
- Optimized, patent-pending design for ultrahigh cycle life
- High-speed and repeatable actuation
- Suitable for thermal immersion operations
- Capable of valve opening or closing time of less than 5 ms

Our Commitment to Quality, Reliability, and Safety



Swagelok's ongoing commitment to quality and reliability ensures our products last a long time, so you replace them less frequently. Our verification processes confirm the suitability of our products for use in the harsh extremes of the semiconductor industry—so you and your processes stay protected.

Commitment to Quality Assurance



Swagelok's quality processes and metrics assure the high value of our products. Our Swagelok Quality System (SQS) is compliant with the requirements of ISO 9001:2015. We employ various methods to verify the quality of our materials, components, and assemblies to ensure fitness for ultrahigh-purity manufacturing. This commitment to quality translates to fewer chances of leakage or interruption of the flow path, so your processes stay clean as well. Our design process validates that our products are well-suited for the long cycle life demanded of products used in semiconductor manufacturing—even in highly corrosive or toxic environments.

Eddy Current Testing



Incoming stainless steel bar stock is checked via eddy current testing. Eddy current testing uses electromagnetic induction to detect surface flaws in conductive materials. A circular coil carrying current is placed in proximity to the steel. The alternating current in the coil creates a changing magnetic field that interacts with the steel and generates eddy current. Variations in the electrical conductivity or magnetic permeability of the steel, or the presence of flaws, will cause a change in eddy current and a corresponding change in the phase and amplitude of the measured current.

Immersion Ultrasonic Testing



Once the steel is manufactured, it is subjected to immersion ultrasonic testing to detect internal flaws. With this testing method, short ultrasonic pulse waves are transmitted through a couplant, such as oil or water, to detect internal flaws in the stainless steel. The material being examined is coupled to the part by a liquid column or is totally submerged in the couplant. Because of the penetrating power and sensitivity of this test, small flaws deep in the steel can be detected.

Scanning Electron Microscope Inspection



Material can also be inspected with a scanning electron microscope equipped with X-ray spectroscopy, ensuring material integrity for safe, reliable performance.

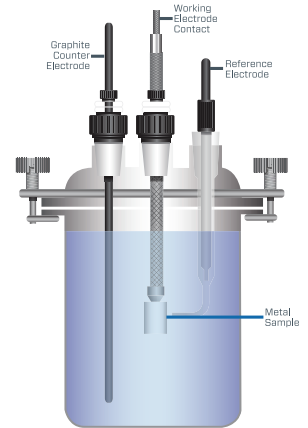
Critical Pitting Temperature (CPT) Testing



The Critical Pitting Temperature test can predict susceptibility of stainless steel to pitting corrosion by testing the entire wetted surface of the stainless steel (rather than just selected testing points) for a breakdown in the protective passive surface oxide layer of the stainless steel. CPT values are the lowest temperatures at which pitting corrosion occurs during testing.

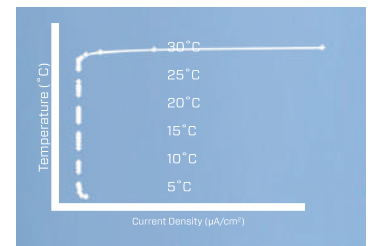
Performing the Critical Pitting Temperature (CPT) Test

1. Masking is performed on actual product samples to isolate internal wetted surfaces to test exposure.
2. Component immersed in ASTM standard test solution.
3. A constant anodic potential is applied to an electric current across the part at an initial temperature of 0°C.
4. The temperature is ramped up at a rate of 1°C/min. Continue temperature ramp until the CPT is determined, a rapid increase in current density surpasses 100 $\mu\text{A cm}^2$ for at least one minute. This increase in current density demonstrates stable propagating pitting is occurring.
5. The sample is removed and visually examined to confirm the presence of pitting and absence of crevice or undermasking attack.



Interpreting the Critical Pitting Temperature (CPT) Values

The chart shows the relationship of temperature and current during a typical test. As the temperature ramp ensues, a stable passive behavior at low current density is exhibited.



Upon breakdown of the passive surface, a rapid increase in current density is shown. Once the current density exceeds the 100 $\mu\text{A/cm}^2$, the critical pitting temperature is determined.



Get There With Installation Training

How to bring your quest for cleanliness full circle? With complete installation training from Swagelok. In ultrahigh-purity manufacturing, system components must work together to maintain leak-tight seals on toxic, corrosive fluids and gases while maintaining system integrity and purity under a wide range of operating conditions. Understanding how to optimize the performance of Swagelok products with training in proper installation helps you meet your manufacturing goals and ensures your processes and personnel operate safely.

List of Available Training Courses:

- Thread Identification Essentials
- Swagelok® VCR/VCO Fitting Installation Essentials
- Hose Essentials
- Valve Essentials
- Tube Fitting Installation Essentials
- Swagelok® M200 Welding
- Tube Fitting Installation & Tube Bending Training
- Tube Bending Essentials

For more information about our training, contact us at malaysiaenquiry@swagelok.com





Stronger Together

Let's work together to strengthen your ultrahigh-purity manufacturing.

Select the right products.

Our team is here to help you choose the exact product for your job.

Dynamic processes require continuously available products.

Swagelok Malaysia can provide customized inventory management services as well as just-in-time delivery for optimum stock levels.

We're global. And local.

Isn't it good to know you can count on Swagelok for availability and support? A world-class manufacturer with global representation and over 200 local sales and service centers. So expertise and support are always close at hand—wherever in the world you are.



www.malaysia.swagelok.com

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