GESemi

ASM Epsilon 2000 Refurbishment Services Brochure

GESemi is proud to offer comprehensive refurbishment services for the ASM Epsilon 2000 platform. From acquiring used tools to providing full refurbishments and onsite user training, our goal is to deliver systems that not only meet original performance specifications but often exceed them through upgrades and enhancements. Whether you are seeking a turnkey solution or support for specific components, GESemi provides a reliable, cost-effective path to extending the useful life of your E2000.

The following pages outline the full scope of our refurbishment program. We begin with a detailed Systems Review List, showing the components and subsystems that undergo inspection, testing, and replacement during the refurbishment process. This ensures transparency and demonstrates the depth of care that goes into every system we deliver.

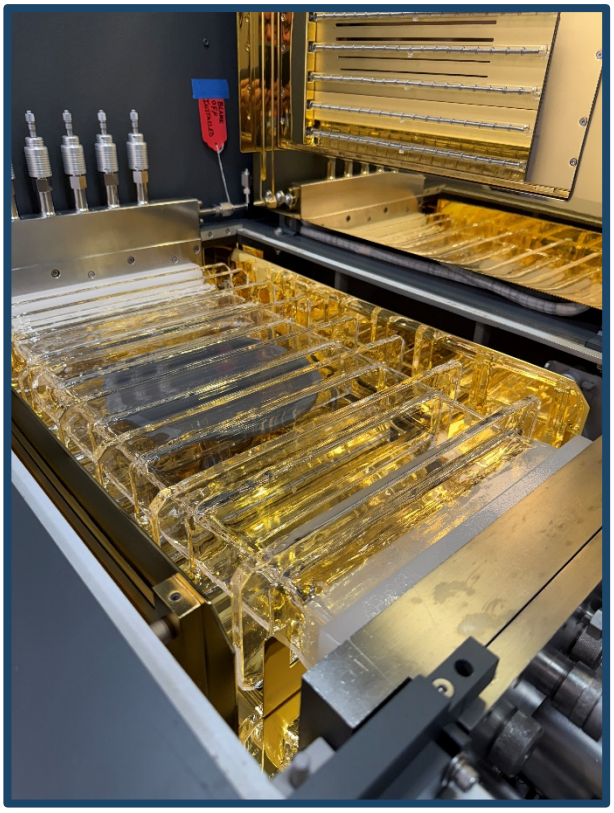
Next, you will find configuration and upgrade options tailored to your operational needs. From controller enhancements to software and process-related improvements, these options allow you to customize your system to align with today's performance expectations. Each upgrade is designed to improve reliability, throughput, and ease of use, helping you get the most value from your equipment.

Following the upgrade overview, dedicated sheets provide details on each available option. These include technical descriptions, expected benefits, and how the upgrade integrates into your existing workflow. Taken together, this document serves as both a guide and a resource for understanding how GESemi can deliver an ASM E2000 solution that is every bit as capable as when it was new—often better.

GESemi can source an ASM Epsilon 2000 for refurbishment or we can refurbish one you already own. We currently have the following reactors on hand ready to be refurbished and configured to your requirements.

	GESemi 1	GESemi 2	GESemi 3	GESemi 4
Serial Number	880110	WA-093430	WA-093400	WA-093440
Supply Voltage/ Freq	480/ 50	480/ 50	480/ 50	480/ 50
System Hand	Left Hand	Right Hand	Left Hand	Left Hand
Current Wafer Size	200mm	150mm	200mm	200mm
Maint Console	Mini Maint	Mini Maint	Mini Maint	Mini Maint
CPU	68040	68040	68040	68040
Software Version	7.65	7.65	7.65	7.65
RP/ ATM	RP	RP	RP	RP
Vacuum Load Locks	No	No	No	Yes
RP Orientation	Bottom Feed	Bottom Feed	Bottom Feed	Bottom Feed
Gas Panel Orientation	Top Feed	Top Feed	Top Feed	Top Feed
DCS Cabinet	Yes	Yes	Yes	Yes
TCS Mini Bubbler	10L LPE	10L LPE	10L LPE	10L LPE
Gas Detection	Gastec H2/ HCl	Gastec H2/ HCl	Gastec H2/ HCl	Gastec H2/ HCl
Temperature Controller	Foxboro	Foxboro	Foxboro	Foxboro

ASM Epsilon 2000 Refurbished Pictures



Refurbishment Details

Every ASM E2000 refurbishment GESemi performs consists of a complete disassembly and rebuild from the frame up. Each system includes a standard six-month warranty, with extended warranty and service contract options available. This ensures our customers receive a system that is not only restored to OEM standards but is often improved beyond the original specifications and meets their long term needs and expectations . Below is an example of the typical systems and components that will be inspected, tested for either refurbishment or replacement and the tasks associated. In addition to the 121+ line items below, other systems and components can be included, based on your upgrade choices.

Section	Item/Task
Front End	Replace any missing and/or damaged items.
	Install new shelf on front end & align.
Gas Panel	Deliver Gas Panel to Swagelok for rebuild per customer specifications.
	We will provide Swagelok with the previously procured MFC's, Piezocon and Pressure switches.
	Install new pneumatic tubing and MFC Cabling.
	Install Gas Panel back in frame and install on Reactor.
	Horiba STEC Mass Flow Controllers
	SMC Digital Pressure Switches for H2, N2 and Reactor Vent Matching
	Veeco Piezocon - 25GR/Min SiHCl3 30slm N2
	New MFC Cables.
	Inspect all Electronic Valves and replace is necessary.
	Replace all Gas Filters, Regulators, Pneumatic & Manual Valves, Restrictor Gaskets, Gauges and all applicable Gas Lines.
H2 Detector	Inspect & clean H2 Detector Controller, replace if needed.
	4-20ma Transmitters, if needed.
	H2 Detector Heads
	Junction Boxes for Reactor and Gas Modules, if needed. Not needed
	HCL Detector in Reactor Cabinet & Gas Module.
Miscellaneous	New LED Cabinet Lighting
	System Leveling Pads
	All applicable paint & materials.
	Misc. Wiring & Cabling.
	EMO Switches
	Install new cabinet lighting
Power Module	Inspect all SCR Fuse Holders & Fuses and replace as needed
	Clean all Lamp Wiring & Blower Motor Terminal Blocks
	Replace Cooling Fans
	Inspect all Interlock Relays and replace as needed
	Inspect System Step Down Transformers and replace as needed
	Remove parts and clean extensively.
Systems Review List (continued)	
Power Module (contd.)	Install Lamp Wiring terminal Blocks, if necessary.
	Install SCR Fuse Holders & Fuses if necessary.
Procure parts	Parts required for the refurbishment

Reactor Section	Upper Lamp Bank Heat Shield.
	Replace all Gold Reflectors.
	Inspect Upper & Lower Lamp Bank Cooling Lines and replace if necessary.
	Install new TSS, INC. Linear Injector Cartridges.
	Inspect MPI Water Temperature Control Kit with Metering Valve & Temp. Gauge and replace any items if necessary.
	Install new Gas Filters for Injector & Shaft Purge.
	Inspect Flange Seal Cylinders and replace if necessary.
	Inspect Flange Seal & Plate Lock Pressure Switches & Pneumatic Speed Control Valves and replace if necessary.
	Replace Tubulation Bellows Assy
	Inspect Rear Exhaust Flange and Rear Cover and clean and/or replace if necessary.
	Inspect Rear Flange Eye Bolts and replace if necessary.
	Inspect Blower Motor Housing Vibration Dampeners.
	Inspect Blower Motor & Squirrel Cage and replace if necessary.
	Inspect Airflow Switch and replace if necessary.
	Inspect Air Temperature Switch and replace if necessary.
	Inspect Applicable Damper Control Parts and replace if necessary.
	Replace Ferrofluidic Feedthrough Assembly.
	Inspect Reactor Cabinet Door Switches and replace if necessary.
	Inspect Reactor Lid Shock Absorber Cylinder and replace if necessary.
	Inspect Tube Present Switch and replace if necessary.
	Inspect Center TC Transmitter and replace if necessary.
	Inspect Susceptor Height Dial Indicator Gauge and replace if necessary.
	Inspect Coiled Water Lines for Wafer Rotation Assy and replace if necessary.
	Inspect Gas Plumbing lines from Gas Panel to Reactor and replace if necessary.
	Replace Junction Box Terminal Blocks
	Rebuild Maintenance Panel if necessary
	Inspect Susceptor Home Sensor and replace if necessary.
	Install Reflector parts that were missing.
	Remove Water Cooling Heat Exchanger, clean, inspect & leak test.
	Install applicable parts on Susceptor Lift and Rotation Assemblies.
	Install Front and Rear Flange Assemblies.
	Install Air Flow Switch, Air Temp. Switch and Damper Control Parts.
	Install TC Transmitters and hardware.
Reduced Pressure	Remove RP Stack
Section	Remove components and clean conductance lines.
	Rebuild RP Stack with new and used components as applicable.
	Reinstall RP Stack into tool.
	Install new SMC Digital Pressure Switches.
	Inspect Differential Pressure Manometer and replace if necessary.
	Clean all RP Conductance Lines.
	Inspect all valves and replace if necessary.
	Inspect all Pressure Transducers and replace if necessary.
	Clean Pressure Balance Valve
System Controller	Replace Cooling Fans
	Replace old DC Interlock I Module with DC Interlock II Module if necessary.

Systems Review List (continued)	
System Controller	Replace old DC Distribution I Board with Distribution II Board Module if necessary.
(contd)	Replace old System Interface Board with newer System Interface Board if necessary.
	Inspect all Power Supplies and clean as necessary.
	Inspect all boards and clean as necessary.
	Install cooling fan.
	Inspect all boards, power supplies and cabling.
	Clean as necessary.
System Test	Perform complete system and subsystems tests including:
	Wafer Handling loading and unloading.
	Gas flow tests.
	Water/Airflow Tests
	Lamp check tests.
	Safety Interlock tests.
	Recipe execution tests.
Temperature Controller	Inspect all boards and clean as necessary.
Tool Cleanup	Remove all misc. parts lying inside reactor.
	Remove Front Flange.
	Remove all parts to be replaced in the Reactor Section.
	Remove all parts to be replaced in the Water Closet.
	Remove any remaining parts in Gas Module and remove gas panel.
	Clean all areas and paint as necessary.
Wafer Handling	Inspect & clean Wafer Transfer Arm Assembly & Gearbox, replace if needed.
	Install new SMC Digital Pressure Switch
	Install new Loadlock Laser Sensor Upgrade Kits, if needed.
	Inspect & clean Gate Valve, replace if needed.
	Replace Elevator Timing Belts
	Replace all Gas Filters.
	Remove all parts to be replaced.
	Remove covers, clean and replace any applicable O-rings and Seals.
	Install Wafer Transfer Arm Gearbox.
	Install Wafer Transfer Arms.
	Install Gate Valve
	Install Loadlock Laser Sensor Upgrade Kits if necessary.
	Perform wafer handling alignment.
Water Cabinet	Water Manifold Shutoff Valves
	Water Flow Temperature Gauges
	Water Flow Switch
	Manifold Drain Valves
	Source & Return Water Shutoff Valves
	Inspect TC Transmitters and replace if necessary
	Install standard Float Style Flow Meters
	Inspect Aux. Maintenance Panel and repair as necessary.
Water Closet	Install all applicable water control and flow monitor parts.
	Install TC Transmitters

Upgrade Options

The following upgrade options are available for your consideration. Please note that these upgrades are optional and, where selected, will be provided in place of the standard refurbishment components.

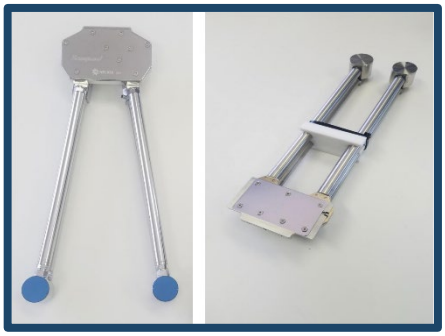
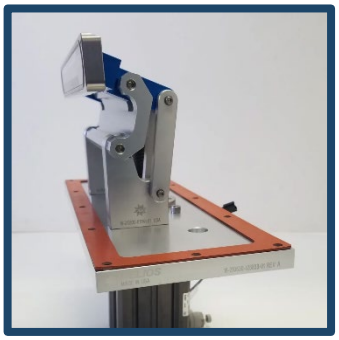
Upgrades may be selected à la carte, or we can recommend bundled upgrade packages based on your specific application, performance objectives, and long-term support requirements.

Outlined below are the upgrade options most frequently selected by our customers and generally considered to provide the greatest operational and reliability benefits.

- Helios Scorpion Robot Arm
- Ferro Seal Plate Lock Tubulation
- Helios Foxboro (all 4)
- H2 Detector Upgrade
- Helios Merlin Wafer Handling System
- Helios Gate Valve
- Helios TC Sentry System
- Helios SCR upgrade kit
- EPIC Controller

Details on the above upgrades can be found at the following:
Helios: https://heliostechnicalservices.com/
EPIC Controller: http://www.enadiumtech.com/epsilon.html

Pricing details can be provided upon request.



ASM Epsilon 2000 Refurbishment Options Overview

GESemi is proud to offer ASM Epsilon E2000's fully refubished with warranty, process qualification, user training and more. Below is a general outline of the options and upgrades we offer followed by detail sheets about each

Configuration Options

SYSTEM HAND	
	Right Hand
	Left Hand

SUPPLY VOLTAGE	
	480VAC 3PH 60HZ
	480VAC 3PH 50HZ

WAFER SIZE			
	200mm		125MM
	150mm		Other

CONTROLLER	
	Standard - 68040
	Upgrade Option - Windows Based Software

LOAD LOCK	
	Reduced Pressure (RP)
	Atmospheric

ROBOT TRANSFER ARM	
	Standard OEM Design
	Upgrade Option - Improved Robot Tranfer Arm

REACTOR GATE VALVE	
	Starndard OEM Design
	Upgrade Option - Improved Reactor Gate Valve

WAFER HANDLER ROBOT SYSTEM	
	Standard OEM Design
	Uprgrade Option - Improved Wafer Handler System

GEAR BOX	
	Standarad OEM Design
	Upgrade Option: Improved Gear Box

THERMOCOUPLES	
	Standard OEM type
	Upgrade Option - Improved TC's

INJECTORS	
	Standard OEM Design
	Upgrade Option - Vastly Improved Injectors

TEMPERATURE CONTROL BOARD	
	Standard OEM type
	Upgrade Option - Improved Temp Control Boards

BUBBLER	
	Standard OEM type
	Upgrade Option - Improved Bubbler Design

REACTOR CHAMBER	
	Reduced Pressure (RP)
	Atmospheric

REACTOR GOLD COMPONENTS	
	Refurbished Components
	Upgrade Option - Configured Components

GAS DETECTION SYSTEM	
	Standard OEM Type
	Upgrade Option - Customized Detection System

Additional Options

	Barrier bag and crate for land/air/ocean shipment		Facilitization Services
	Installation Services		Reactor Start up Services
	Process Qualification Services		Extended Warranty and Support
	User Training		On-Site Process Support
	Surplus Equipment Disposition / Acquisition		Upgrades To Existing Reactors

Facilitization Support

If ASM Epsilon 2000 refurbishment services are contracted with GESemi, facilitization support can also be selected by the customer as a separate agreement.

Based on the customer's specific requirements, GESemi can deliver a full suite of facilitization support and services designed to ensure a smooth, compliant, and efficient installation. The following outlines the three major steps of our typical facilitization process.

Step 1: Inspection
Timeline – One Day onsite, one week of post inspection analysis.
Cost – **No cost to customer**. *(GESemi provides as a free benefit when a refurbishment PO is placed)*

Prior to defining the required scope of service, GESemi can provide a no-cost, on-site evaluation of your facility. Our experienced engineer will review the designated installation area for the ASM Epsilon 2000 reactor and assess the existing infrastructure, including electrical distribution, cleanroom specifications, abatement systems, and gas and chemical delivery networks. The one-day evaluation will aid in determining any facility modifications necessary for full integration of the reactor and its support equipment.

Step 2: Scope
Timeline – TBD based on existing conditions
Cost – TBD based on existing conditions

Following the site evaluation, GESemi can be contracted to develop a comprehensive facilitization scope detailing all modifications and utilities required for the successful installation of the ASM Epsilon 2000 and its support equipment. This scope may include electrical, mechanical, and process utility schematics; exhaust and abatement integration; and cleanroom layout adjustments. Our goal is to deliver a clear, actionable roadmap that ensures all facility requirements are met in accordance with equipment specifications, safety standards, and customer timelines. The timeline and cost for this step will be based on the number of changes required to support the installation and operation of the ASM Epsilon 2000.

Step 3: Execution
Timeline – TBD based on requirements
Cost – TBD based on requirements

Upon completion of the facilitization scope, the customer may elect to implement the identified modifications internally or engage GESemi to execute the project in its entirety. The objective of the facilitization is to deliver a fully prepared installation site, with the ASM Epsilon 2000 reactor positioned with all associated utilities (electrical power, process gases, vacuum pumps, and abatement systems) installed, connected, and verified for operational readiness. When engaged in a turnkey capacity, GESemi can manage all aspects of project execution, including contractor coordination, installation scheduling, progress tracking, and final system qualification, ensuring compliance with site-specific and local regulatory requirements. The overall project cost and timeline will be determined based on GESemi's service fees in conjunction with approved third-party contractor costs necessary to achieve full facilitization and installation readiness.

Installation Services

The scope of the installation service includes the connection and alignment of all ASM Epsilon 2000 modules, verification that the system is level and properly positioned, and assembly of key components such as the

robot arm and reactor chamber to facilitate a Factory Acceptance Test (FAT). Our engineers will bring or procure all the necessary equipment and tools to perform the onsite service. Upon completion of these activities, the system will be fully assembled and prepared for process qualification and operation.

The typical duration for the installation is approximately two weeks. During this period, two GESemi engineers will be on site, working 8–10 hours per day, Monday through Friday, with weekend work (Saturday and Sunday) performed if deemed necessary to maintain schedule and ensure successful completion.

This service is offered on an all-inclusive basis, contingent upon the customer providing suitable facility access and utilities (power, gases, abatement, etc.). The price typically includes all travel time, installation labor, lodging, rental car, and per diem expenses. GESemi's turnkey structure mitigates the risk of unbudgeted or unexpected costs to the customer.

On-Site Training

Following the successful installation of the ASM Epsilon 2000, GESemi can offer a comprehensive on-site training program designed to equip your personnel with the knowledge and skills necessary to safely operate and maintain the system. The 5-day training follows a structured curriculum covering all essential topics, including system start-up and shutdown procedures, user interface navigation, basic process operations, preventive maintenance routines, and troubleshooting fundamentals.

If GESemi is selected to perform both the installation and training, the training can commence immediately upon completion of the installation activities. This approach provides a significant cost advantage, as the same engineer(s) who performed the installation will remain on site for an additional week conducting the training. This continuity ensures a seamless transition from installation to operation, allowing your team to receive instruction directly from personnel already familiar with your system configuration and site conditions.

Should the customer request an extended training period or wish to schedule training more than two days after installation completion, GESemi can provide a separate proposal for this service.

Process Support

GESemi is proud to offer comprehensive process support services for our fully refurbished ASM Epsilon 2000 reactors. Our Process Engineer brings decades of direct experience working for and alongside ASM, supporting customers worldwide across a broad range of applications.

GESemi's process support capabilities include troubleshooting and resolving process issues, optimizing existing recipes for enhanced performance and yield, and developing and implementing customized processes tailored to each customer's specific requirements.

Ideally, customers will have, or have access to, the appropriate metrology equipment necessary to perform process qualifications and data verification.

Below is a list of the typical recommended metrology equipment:

- Transfer tool – MGI or similar
- FTIR – for thickness
- Four-point probe – for resistivity
- Surfscan / SP1 – for defects
- SIRD or Nomarski microscope – for crystallographic slip
- Surface photovoltage (SPV) – for Fe contamination
- Ellipsometer – for Ge concentration / thickness
- SIMS – for concentration / thickness / O_2 background

Provided the ASM Epsilon 2000 is fully installed and ready for process and the necessary metrology equipment is readily accessible, we estimate five days on site for the Process Support. If the customer requires additional support days on site or would like to explore phone support options, those services can be quoted as well once a scope is determined.

Consumables

We have prepared the following recommended list of consumables and spare parts to ensure efficient operation of the ASM Epsilon 2000, minimizing delays due to lead times. The list also includes all necessary components to convert the tool from 200mm to 150mm wafers. The customer may request individual items from the list as needed or request a quote for a complete suite of consumables.

- Square RP Chamber - Quartz
- Susceptor Support - Quartz
- Square Susceptor Ring - Graphite
- Square Ring Support - Quartz
- Square Ring Support Pins - Quartz (Set of 12)
- Susceptor Shaft - Quartz
- Center TC - Quartz
- Front Bi-Junction TC - Quartz
- Side TC - Quartz
- Rear TC - Quartz

- 150mm Consumables
- 150mm Wand - Quartz
- 150mm Susceptor - Graphite

- 200mm Consumables
- 200mm Wand - Quartz
- 200mm Susceptor - Graphite
- 200mm Cassettes - Qty. 2

Crating and Shipping

We offer custom wooden crates that are meticulously engineered to ensure the safe and secure transport of your refurbished ASM Epsilon 2000. These crates are crucial for protecting the reactors sensitive components from potential damage during shipping and handling. Key features include anti-static barriers were appropriate to prevent electrostatic discharge, vapor barriers and desiccant to guard against moisture and contaminants, and shock-absorbing bases designed to cushion delicate electronics. With multiple shock watch and tilt

indicators, our crates offer enhanced security against impact and movement. Additionally, our crates can be cleanroom certified to maintain a contaminant-free environment and feature customized blocking and foam to securely position and protect the Epsilon 2000, and its components, during transport.

Crating costs vary based on customer requirements, including any additional components to be shipped (e.g., electrical transformer, external abatement system).

Upon customer request, an estimated shipping cost can be provided. Shipping is generally treated as a pass-through expense and is calculated and billed at the time of shipment.

Summary of Services

Our comprehensive, end-to-end solution is designed to maximize the performance, reliability, and long-term operational readiness of a refurbished ASM Epsilon 2000 system. GESemi's scope spans the full lifecycle of the tool, beginning with a complete frame-up refurbishment and extending through optional upgrades, crating and shipping, facilitization, installation, training, process support, and recommended consumables and spares.

Our refurbishment approach restores each system to OEM standards, or beyond, through detailed inspection, rebuilding, component replacement, and full system testing across all major subsystems. Optional upgrades may be selected à la carte or as bundled packages to further enhance performance, automation, safety, and serviceability, allowing customers to tailor the system to their specific operational and budgetary objectives.

GESemi also offers turnkey deployment support, including custom crating, shipping coordination, facilitization planning and execution, and on-site installation services. When engaged in a turnkey capacity, GESemi manages project execution across equipment preparation, facility readiness, and system commissioning, reducing risk and minimizing the customer's internal resource burden.

Post-installation services including on-site training, advanced process support, and consumables planning are available to accelerate qualification and support sustained operation.

We welcome the opportunity to review requirements in greater detail and to tailor this offering accordingly, and we look forward to supporting a successful and efficient ASM Epsilon 2000 deployment.

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