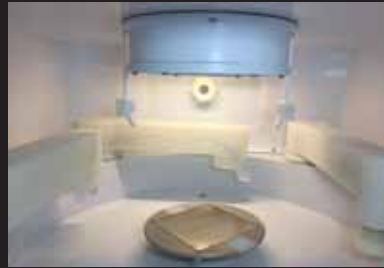
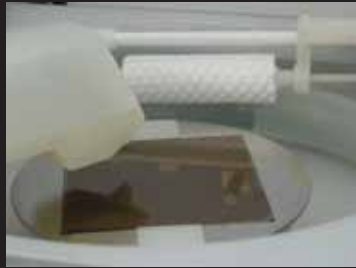


NANO-MASTER Cleaning Systems



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NANO-MASTER Cleaning Systems

Damage-Free Megasonic and Cleaning Technology

The latest developments in Megasonic and Cleaning Technology have opened up new horizons to achieve the cleanest wafers and masks used in MEMS and Semiconductor Industry.

NANO-MASTER offers Megasonic Single Wafer & Mask Cleaning (SWC) Systems and Large Substrate Cleaning (LSC) Systems for state of the art, damage-free megasonic cleaning of delicate patterned or unpatterned substrates including Pelliclized Masks. To achieve maximum cleaning optimization without substrate damage, the megasonic energy density must be kept slightly below the damage threshold at any point on the sample. NANO-MASTER's patented technology assures uniform distribution of the acoustic energy across the entire surface of the substrate allowing ideal cleaning by maximizing the distributed energy while staying below the sample's damage threshold.

The SWC and LSC systems provide controlled chemical dispensing capabilities. With this capability, the ability to remove particles from the surface is enhanced. The SWC and LSC utilize a Point-of-Use Chemical Dispense System designed for minimal use of chemistries. Utilizing the chemical dispense in conjunction with NANO-MASTER's megasonic cleaning technology, the tool's capability to remove particles is optimized. Afterwards, the released particles are removed from the substrate surface with the least number of reattachments by sweeping off the particles with the radial flow of the DI water. Without the advantage of radial DI water flow, stationary recirculation megasonic cleaning tanks allow a greater number of reattachments and therefore require additional time to remove these particles.

In addition, both NANO-MASTER cleaners offer an array of options. A PVA brush system provides a mechanical mean of removing stains and resist residues on unpatterned substrates. The ozonated DI water option allows removal of organics without the use of aggressive chemicals. Depending on the application, certain options will further enhance the tool's ability to remove unwanted particles and residues.

Both SWC and LSC tools are capable to do in-situ spin drying with heated N₂ or IPA. "Dry-In-Dry-Out" one step processing is possible with the lowest capital investment and Cost of Ownership. The process time for NANO-MASTER's cleaners can vary between 3-5 minutes per substrate depending in the substrate's size and additional cleaning options used.

NANO-MASTER's technology is also applicable to cleaning backside or alignment marks on the front side of Pelliclized Masks, reducing the need for unnecessary removal and re-pelliclization of these masks. It can also be used for removal of the pellicle frame-mounting adhesive and can prepare the surface for re-pelliclization. In addition, megasonic cleaning and spin drying of the full front surface of the pelliclized mask is conducted without damage and seepage condensation on the pellicle.

The SWC is the ideal tool with a small footprint and can be easily installed in any clean room where space is limited. The LSC's architecture is developed to deliver the most advanced capabilities for current and next generation wafer and substrate sizes. Both units deliver superior cleaning ability for a variety of substrates.

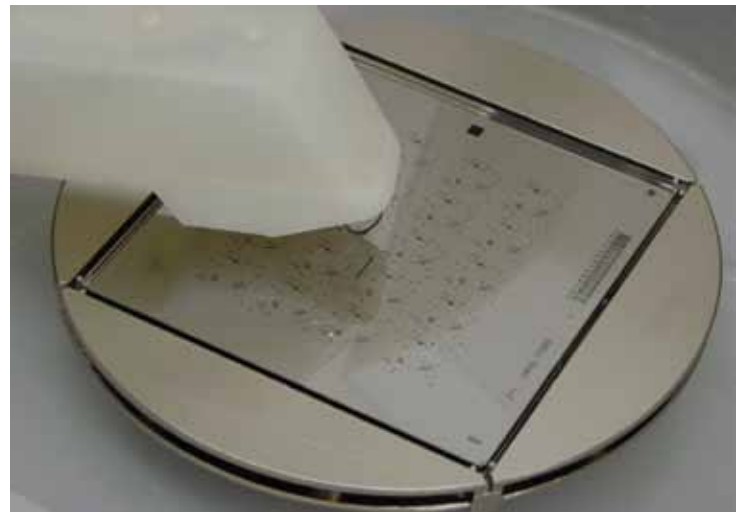
NANO-MASTER Cleaning Systems

NANO-MASTER's Response to Challenges in Cleaning

Cleaning Issues	Solutions
Damage	Patented Uniform Megasonic Energy Deposition
Delicate Substrates	Megasonic Cleaning, Vacuum Chuck
Particle Size	Megasonic Frequency
Particle Reattachment	Spin Processing
Organic Contaminants	Ozonated DI water, Piranha Clean
Inorganic Contaminants	Chemical dispense, pH Control
Metal Contamination	SC1, SC2 Cleans
Back Surface Defectivity	Back Surface Clean with 1 mm Edge Contact
Re-Contamination	Single Step Process: Dry In Dry Out
Passivation	In-situ

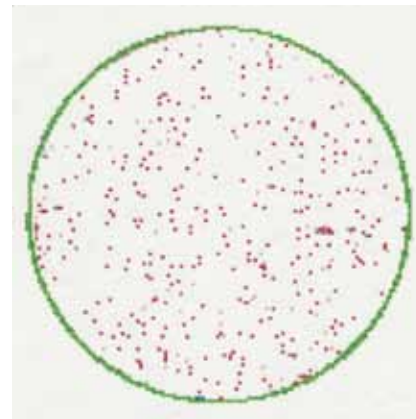
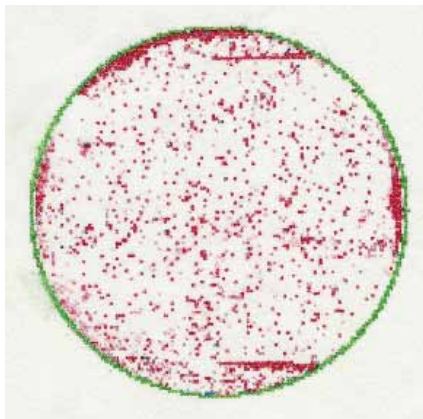


CMP Wafer Cleaning with Brush



Mask Cleaning with Megasonic DIW

SWC GERMANIUM WAFER CLEANING



The pictures above were taken from the surface of two Germanium wafers that were polished and cleaned in parallel to compare the standard tank wafer cleaning (left) with Nano-Master SWC megasonic cleaning with DI water (right). The standard cleaning produced non uniform cleaning and caused damage from spin drying (the cassette stress marks are evident). In other application such as ceramic substrates, AlTiC wafers and ITO cleaning, customer expectations were exceeded and yield improvements were experienced.

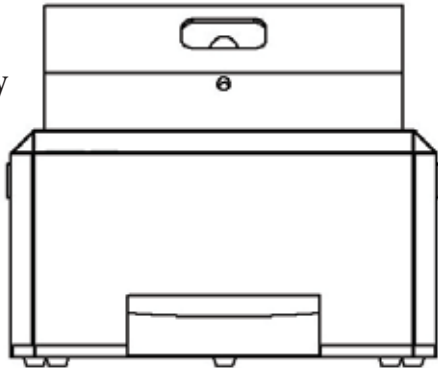
NANO-MASTER Cleaning Systems

Single Wafer/Mask Cleaner Model # SWC-3000

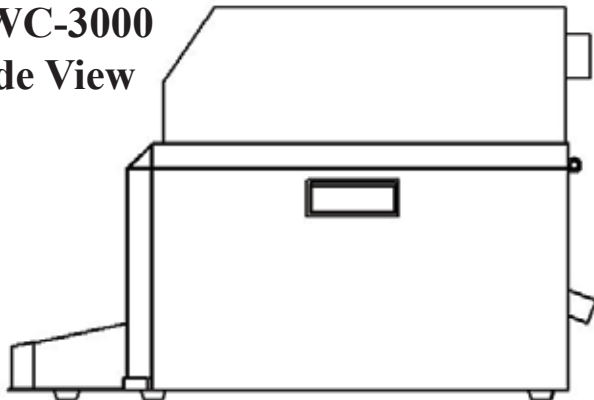


SWC-3000

SWC-3000
Front View



SWC-3000
Side View



APPLICATIONS:

- Patterned and Un-patterned Masks and Wafers
- Ge, GaAs and InP Wafer Cleaning
- Post CMP Wafer Cleaning
- Cleaning of Diced Chips on Wafer Frame
- Cleaning after Plasma Etch or Photoresist Stripping
- Mask Blanks or Contact Mask Cleaning
- Optical Lens Cleaning

FEATURES:

- 12" OD, 7" x 7" Substrates
- Table-top Unit
- Damage Free Megasonic, Chemical, Brush Clean and Spin Dry
- Microprocessor Controlled
- Chemical Dispense Unit
- Suck Back Valves to Prevent Drips
- Separate Solvent and Acid Drains
- Heated N₂
- 19"D x 26"W Footprint

OPTIONS:

- Mask or Wafer
- Brush Cleaning
- Top and Bottom Rinse and Dry
- Nitrogen and CO₂ Ionizers
- Fire Resistant Cabinet

DIMENSIONS:

	Width	Depth	Height
SWC-3000	19"	26"	16 1/2"
RF Power Supply	11 1/4"	17"	6"
Chemical Box	9"	23"	14"

NANO-MASTER Cleaning Systems

Single Wafer/Mask Cleaner Model # SWC-4000

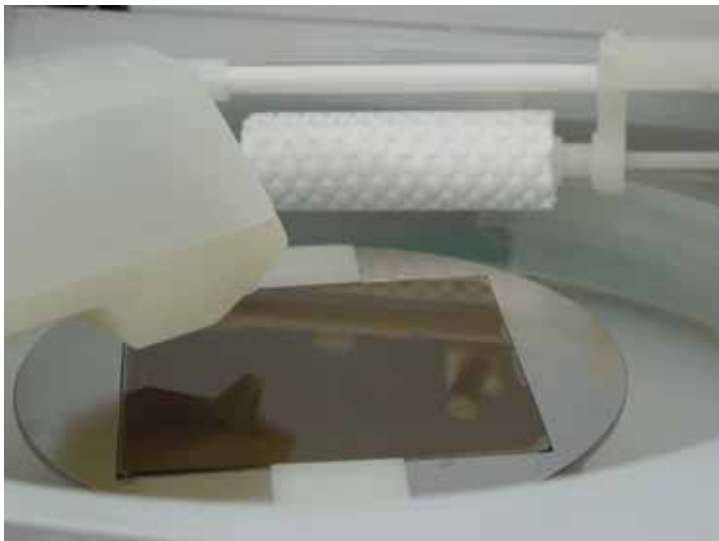


APPLICATIONS:

- Patterned and Un-patterned Masks and Wafers
- Ge, GaAs and InP Wafer Cleaning
- Post CMP Wafer Cleaning
- Cleaning of Diced Chips on Wafer Frame
- Cleaning after Plasma Etch or Photoresist Stripping
- Mask Blanks or Contact Mask Cleaning
- Cleaning of X-ray and EUV Masks
- Optical Lens Cleaning
- Cleaning of ITO Coated Display Panels
- Megasonic Assisted Lift-off Process

FEATURES:

- 12" OD, 7" x 7" Substrates
- Stand Alone Unit
- Venturi Powered Vacuum
- Damage Free Megasonic
- Independent Chemical Dispenses
- Spin Dry and Heated N₂
- Microprocessor Controlled
- Chemical Dispense Unit
- Dual Drain for Acids and Solvents
- Suck Back Valves to Prevent Drips
- Safety Interlocks
- 28"x32" Footprint



OPTIONS:

- PVA Brush Cleaning (100 RPM)
- Post CMP Brush (up to 400 RPM)
- Nitrogen Ionizer
- Bottom Side DIW and Dry
- CO₂ Inject with DIW Resistivity Monitor
- In-Line Heaters for DIW or Chemical
- Fill Sensors for Chemical
- FM 4910 Materials

NANO-MASTER Cleaning Systems

SWC-4000 GENERAL SPECIFICATIONS:

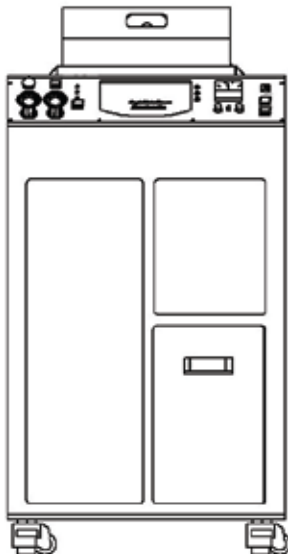
Maximum Wafer Size:	12"
Maximum Mask Size:	7"x7"
Typical Clean Time:	5 minutes
Megasonic Frequency:	1 MHz
RF Power Supply Maximum Output:	40 watts
Minimum DI Water Flow:	1.5 liter/minute
Maximum Spinner Speed:	2000 RPM
System Control:	Microprocessor controlled with PLC programming
Loading and Unloading:	Manual
N ₂ Heater (option):	70°C

FACILITY REQUIREMENTS:

Power Input:	110V, 15A or 230V, 15A, 50/60Hz
CDA Input:	2.2 cfm @ 70-80 psi for internal vacuum pump
Chemical Dispense Rate:	@15PSI of N ₂ , 83ccm @20PSI of N ₂ , 133ccm
Drain:	1" OD pipe
Nitrogen:	40 PSI
Exhaust (System):	1-2 cfm, 1" FNPT, 400mm Hg
Oxygen for Ozonated DI Water (option)	15 PSI

DIMENSIONS:

SWC-4000	Width	Depth	Height
	28"	32"	54"



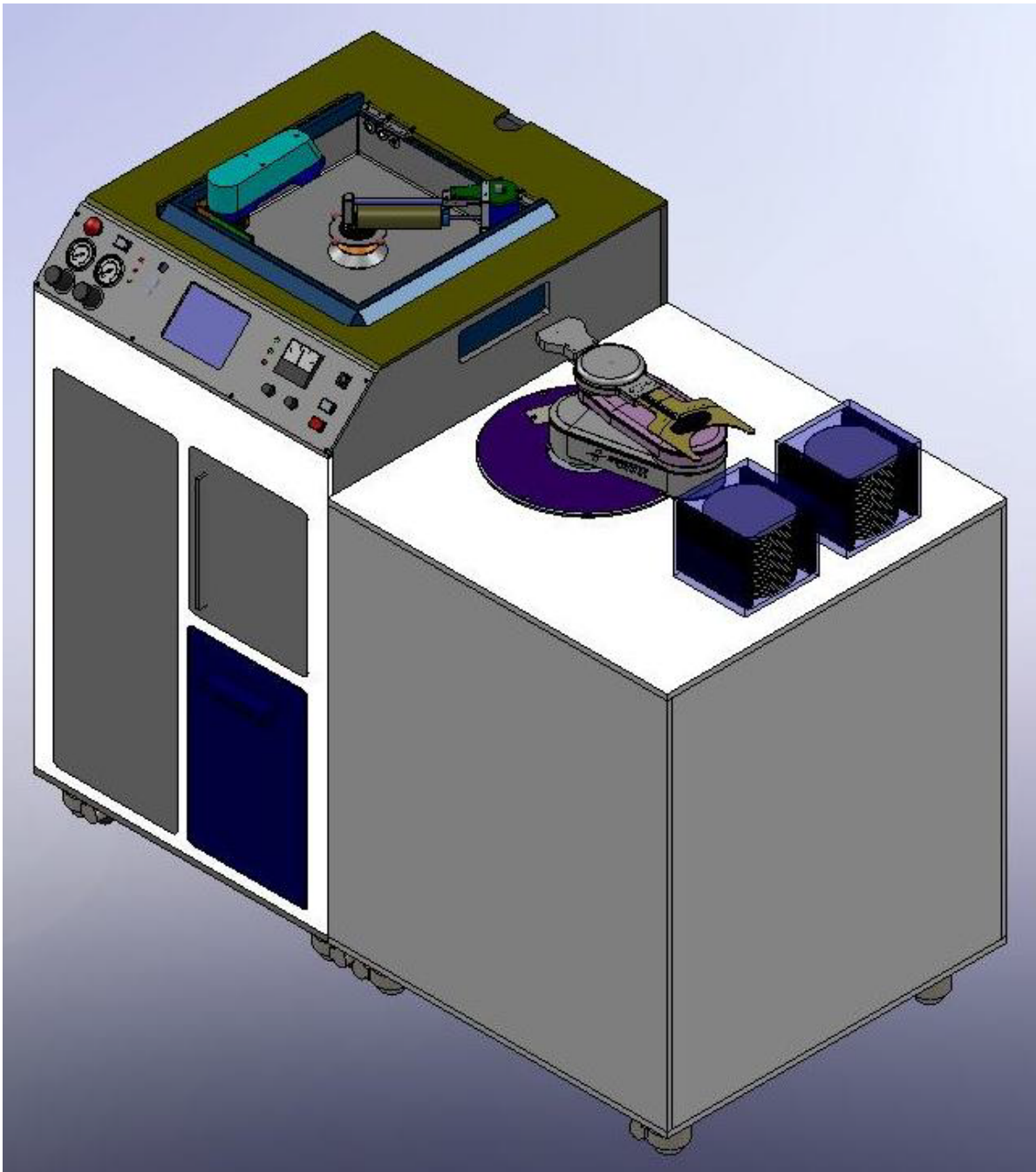
Front View



Side View

NANO-MASTER Cleaning Systems

SWC-5000 Robotic Load/Unload



NANO-MASTER Cleaning Systems

Large Substrate Cleaner Model # LSC-4000

APPLICATIONS:

- Si and Sapphire Wafers
- Post CMP Wafers
- Chips on Wafer Frame
- Display Panels
- ITO Coated Displays
- Patterned and Un-patterned Masks
- Phase Shift Masks
- Mask Blanks, Contact Masks
- Backside Cleaning of Pelliclized Reticles
- Cleaning of Pellicle Frame Adhesive

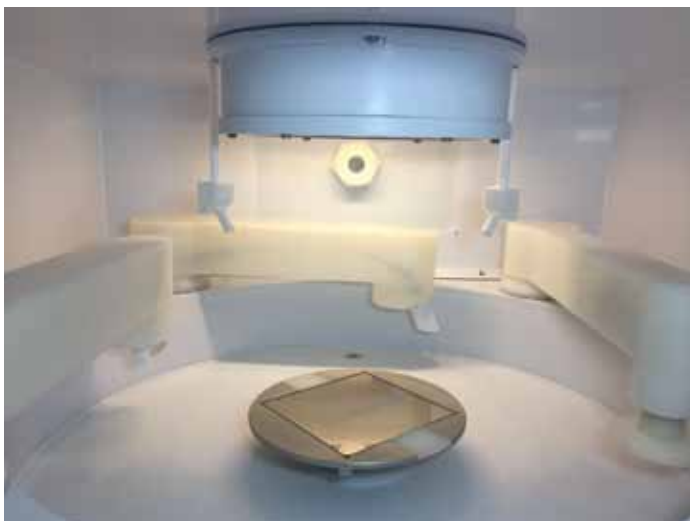
FEATURES:

- Up to 21" OD or 15"x15" Square Substrates
- 450mm Wafer Compatible
- Spinner with 2000 RPM and User Defined Ramp
- PVC Cabinet with Polypropylene Bowl
- 40W Megasonic Power Supply with 1 MHz Nozzle
- Dry with N₂ and IR Lamps
- Chemical Dispense with Suck Back Valves
- Variable Speed PVA Brush with DIW Dispense
- Separate Acid and Solvent Drains
- Inbuilt Chemical Dispense Unit with 3.8 liter Canisters
- Venturi Vacuum Generator
- PC Controlled with LabVIEW Software
- Recipe Driven with Arbitrary Number of Steps
- Three Level Pass Word Protected Access
- Touchscreen User Interface
- Manual Load and Unload
- Safety Interlocks and Alarm
- 32"D x 28"W Footprint



OPTIONS:

- Pelliclized Reticle Cleaning
- 3MHz Megasonic Power Supply
- CO₂ Ionization of DIW to Reduce Resistivity
- N₂ Deionizer
- Chemical Dispense through Brush
- Self-Cleaning PVA Brush with Megasonic Nozzle
- Double Sided Brush
- Bulk Chemical Mixing and Delivery Module
- Backside DI Water and N₂ Dispenses
- SPM Cleaning with Point of Use Mixing Nozzle
- Ozonated DI Water, 20 ppm of O₃
- Hydrogenated DI Water
- High Pressure DI Water, 1000 PSI
- Heated DI Water, 70 °C
- DI Water Recirculation
- Dry Cleaning with 172 nm DUV Lamp
- Automatic Chamber Cleaning
- HEPA Filtered Chamber Air Flow
- Pneumatic Door Actuation
- Front and Back Side Cleaning of Pelliclized Reticles
- Fire Resistant Cabinet with FM 4910 Materials
- Robotic Load/Unload with EFEM and SMIF Interface



NANO-MASTER Cleaning Systems

LSC-4000 GENERAL SPECIFICATIONS:

Maximum Wafer Size:	450mm
Maximum Mask Size:	15" x 15"
Typical Clean Time:	5 minutes
Megasonic Frequency:	1 MHz or 3 MHz
RF Power Supply Maximum Output:	40 watts
Minimum DI Water Flow:	1.5 liter/minute
Maximum Spinner Speed:	4000 RPM (typically limited to 2000 RPM)
System Control:	PC controlled with LabVIEW and touchscreen interface
Process:	Recipe driven
Access:	Three levels, password protected
Loading and Unloading:	Manual

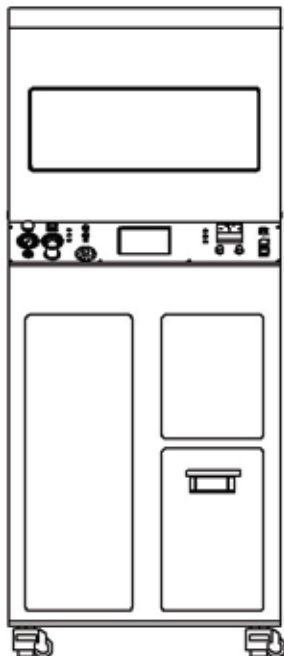
FACILITY REQUIREMENTS:

Power Input:	208V, 20A or 400V, 20A, 50/60Hz
CDA Input:	2.2 cfm @ 70-80 psi for internal vacuum pump
Chemical Dispense Rate:	@15PSI of N ₂ , 83 ccm @20PSI of N ₂ , 133 ccm
Drain:	2 x 1.0" male flare connections
Nitrogen:	40-50 PSI
Exhaust (System):	2.2 cfm, 1" FNPT, 400mm Hg
Oxygen for Ozonated DI Water (option)	15 PSI

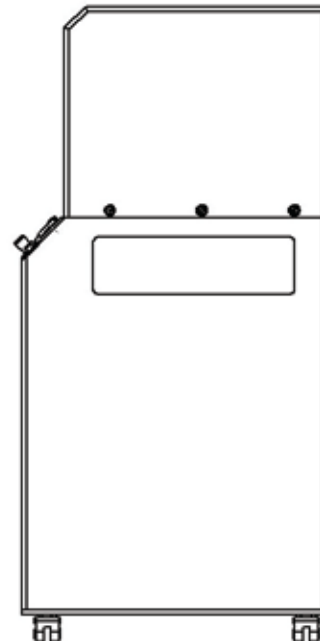
DIMENSIONS:

	Width	Depth	Height
LSC-4000	28"	32"	72"

Front View



Side View



NANO-MASTER Cleaning Systems

LSC-5000 Mask/Reticle System



The LSC-5000 is a state of the art auto load-unload reticle cleaning system. Featuring a low profile robot integrated with a SMIF pod opener and a barcode reader, the LSC-5000 can handle and clean 6" reticle in an ISO Class 1 environment while keeping footprint to a minimum as compared with other robotic cleaning systems. The standard cleaning capabilities include megasonic DIW dispense, independent chemical dispenses, and a PVA brush. A novel design integrates a megasonic transducer nozzle in the center of a PVA brush to further extend cleaning capabilities by optionally combining the acoustic energy with physical brushing. In addition to cleaning, this process keeps the PVA brush free of particle buildup, extending its lifetime and ensuring consistent cleaning performance. System control is computer based, providing a fully automated, flexible platform for recipe editing, modification and storage. Data logging capabilities facilitate process analysis and debugging. Multiple levels of password protected access allow for a safe operation of the system giving operators controls ranging from full editing privileges to simple run-stop recipe operation.

The LSC-5000 platform also allows for the unique capability of cleaning both sides of pelliclized reticles. Using a specially designed chuck and a pellicle protection cup, the LSC-5000 can clean and dry the back side of a reticle, then flip it and mount the protection cup. A linear motion arm with an extra brush and Megasonic nozzle then scans across the front side to clean the sides of the reticle. This unique technology can extend reticle lifetime by reducing the need of pellicle removal and re-application.

Other system options include chemical bulk fill, Ozonated DIW, High pressure DIW dispense, SPM (piranha) dispense, and DIW heating (up to 70°C). Clustering and multi-reticle cassette interfaces are also available.

The LSC-5000 provides the latest in photomask cleaning technology with a low capital investment and cost of ownership. With its conservative footprint, it is the best choice for your photolithography bay.

NANO-MASTER Cleaning Systems



FEATURES:

- Two Dual Dispense Arms:
 - Linear Arm Provides Uniform Cleaning of Front Side Alignment Marks for Pelliclized Reticles
 - Radial Arm Provides Uniform Dispense of DIW with Megasonic Energy for Back Side Cleaning
- Pelliclized Reticle Clean: Reticle is mounted face down on the chuck and the back side is cleaned with the radial arm. Reticle is then dried, picked up and flipped. The pellicle protection cup is then mounted onto the front side and the alignment marks are then cleaned with the megasonic nozzle, brush and chemical dispense from the linear drive arm. Chuck is then rotated 180° and other side is cleaned. The reticle is then dried and the protection cup removed. All of the manipulation is automatically done by the robot
- Megasonic Clean
- Chemical Dispense
- SC1 Clean
- Brush Clean with Megasonic DI Water Dispense through the Brush
- Brush Self Clean with Megasonic DI Water
- Dual Drain
- N₂/IR Lamp Dry
- Fully Automated with Touchscreen Interface
- Robotic Handling and Transfer from SMIF Pod
- Automatic Bar Code Reader
- Data/Error Logging
- CO₂ Injector with DI Water Resistivity Measurement
- Class 1 Cleanroom Compatible
- Footprint: 59"x45"



OPTIONS:

- Ozonated DI Water Clean*
- Bulkfill for Auto Mixing SC1
- SC2 Clean
- Piranha Clean*
- High Pressure DI Water*
- Heated DI Water
- Heated Chemicals
- Up to 9"x9" Reticle Clean
- 21"OD, 15"x15" Large Substrate Clean

* For Unpelliclized Reticles Only



NANO-MASTER Cleaning Systems

LSC-5000 GENERAL SPECIFICATIONS:

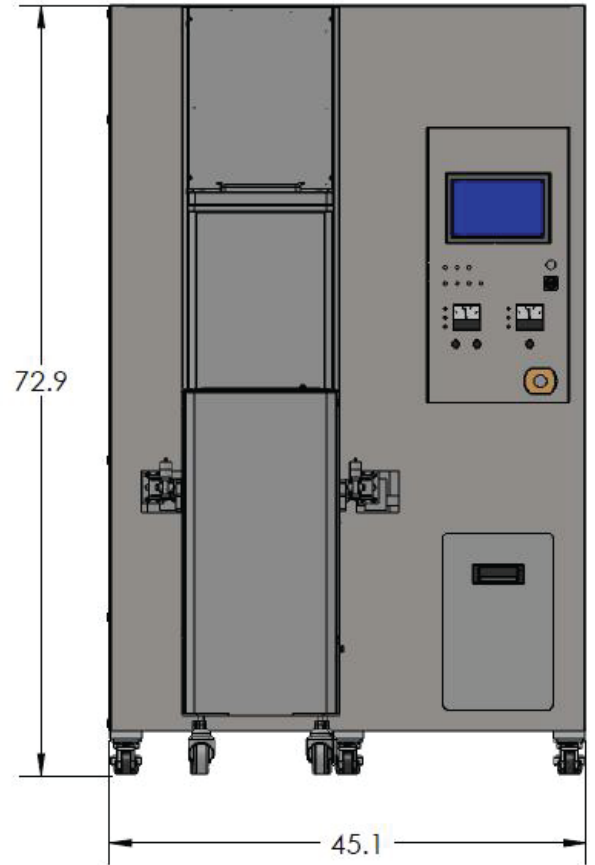
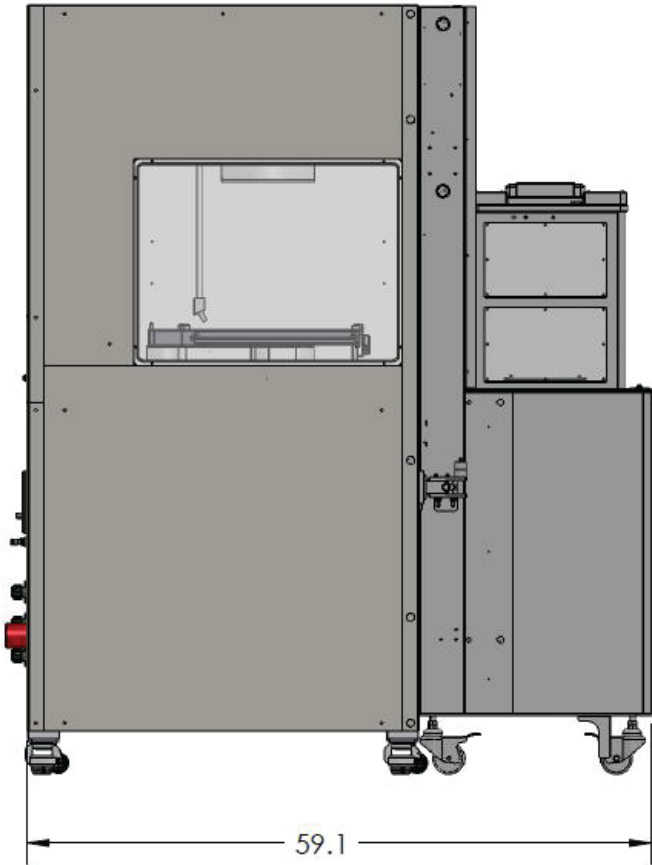
Reticle Size:	6"
Interface type:	SMIF pod RSP150 / RSP200
Typical Clean Time:	5 minutes per side
Megasonic Frequency:	1 or 3 MHz
RF Power Supply Maximum Output:	60 Watts
Minimum DI Water Flow:	1.5 liters / minute
System Control:	PC Controlled with LabVIEW and Touchscreen User Interface
Process Chamber:	CPVC chamber with HEPA filter and blower
Loading and Unloading:	Fortrend G4 plus robot with SMIF pod opening, automated load-unload and flip. Class 1 environment
Cleaning Arm:	Integrated PVA planar brush with megasonic nozzle and chemical dispense. Configuration allows for self-cleaning of brush
Pelliclized Reticle Cleaning (Option):	Linear arm with extra brush and megasonic nozzles and pellicle protection cup for cleaning front side of reticle
Other Options:	Chemical Bulkfill, Ozonated DIW, DIW Heater (70°C), SPM (Piranha) Dispense, High Pressure DIW (>1000psi)



LSC-5000 SOFTWARE:

- Password protected access levels
- Extremely easy to create, save, load and run recipes
- Continuous monitoring of safety interlocks
- Logs all important process information
- Automated robotic loading/unloading of reticle
- Automatic chemical bulk filling and chemical age tracking
- Reads reticle barcodes and saves them to disk

NANO-MASTER Cleaning Systems



LSC-5000 FACILITY REQUIREMENTS:

Power Input:	208V, 50/60Hz, 20A/phase
Chilled Water:	(2X) 3/8" Swagelok, H ₂ O Supply & H ₂ O Return
Compressed Air:	1/4" Swagelok, 80-90 PSI
Processed Gas:	1/4" Swagelok, 20 PSIG
Nitrogen:	1/4" Swagelok, 10 PSIG
Exhaust (System):	NW25

DIMENSIONS:

	Width	Depth	Height
LSC-5000	45"	59"	73"

NANO-MASTER Cleaning Systems

LSC-5000 for Wafers with EFEM and SMIF Interface

