

AGS Plasma - RIE Module Details



AGS Plasma Systems, Inc.

FIRST IN AFFORDABLE PLASMA SOLUTIONS
2290-G RINGWOOD AVE
SAN JOSE, CA 95131, USA

www.agsplasma.com
TEL: 408-432-9799
FAX: 408-432-9797

AGS Plasma is pleased to provide you with the following specifications for a Plasma Etching module.

- **CONSOLE ASSEMBLY**

Console w/casters, leveling pads, side panels, & doors.
Overall Dimensions: 22"w/50"h/40"d (plus ancillary equipment)
Panels are easily removed for servicing with safety interlocks

- **CHAMBER ASSEMBLY**

12" Diameter - 304 SST
Unique, modular, 3 piece design is simple to maintain, easy to upgrade
UV filtered wide angle operator observation port
KF-25 Accessories and 25mm LASER access port standard

- **RIE ELECTRODE ASSEMBLY**

LOWER RIE ELECTRODE Powered - 304 SST - Water cooled
Tray mounted - easily removable for cleaning and service
9" Diameter fully usable (no center pumping port)
RF Plasma dark space shield to focus plasma and prevent sputtering
Highly Uniform, balanced circumferential pumping path
Raised edge to prevent substrate movement
UPPER GROUNDED ELECTRODE - 304 SST - Water cooled - LASER ready
Easily adjustable spacing: 1" to 4" between upper & lower electrodes
2:1 area ratio with lower electrode for true RIE performance
Replaceable gas diffuser plate allows optimization of flow dynamics

- **VACUUM ASSEMBLY - CG/TP/DP**

High conductance balanced path utilizing standard fittings
304 SST vacuum valves and all vacuum connections are ISO/KF flanges
100 mm conductance path standard
TURBO PUMP PACKAGE - High vacuum performance - lower process operating pressure
200 lps Turbo power supplies, pump controllers
DRY PUMP PACKAGE - 8 cfm dry backing/roughing pump with remote starter
CONVECTRON GAUGE - Chamber (Foreline Optional)

- **PRESSURE ASSEMBLY**

CAPACITANCE MANOMETER - 1 Torr heated with temperature compensation & isolation valve
DOWNSTREAM PRESSURE CONTROLLER - Automatically adjusts vacuum conductance
100mm Butterfly Throttle valve for downstream pressure control
Adjustable phase lead and gain for smooth, precise control of process pressure
Vacuum interlock switch assembly & interconnects

- **GAS CONTROL ASSEMBLY**

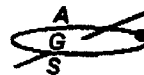
MASS FLOW CONTROLLER - VCR fittings, 100sccm/N2 Standard w/Isolation Valve
With Mixing Manifold and all lines in stainless steel
Expandable to a total of 8 MFC's per manifold
Includes Vent/Purge valves, solenoids & interconnects
Contained in 4 Lecture Bottle gas cabinet with regulators & Exhaust

AGS Plasma

- **RF PLASMA SOURCE ASSEMBLY**
 - 300 Watt -13.56 MHz - Solid State - Air cooled - Ultra fast tuning
 - Auto/Manual RF matching network with presets and position readouts
 - Quick-disconnect & close coupled for easy servicing
 - Digital DC Bias display and servo control of plasma voltage
- **POWER DISTRIBUTION ASSEMBLY**
 - Module Power Interface & Distribution Enclosure
 - Individual circuit breakers on power control panel for easy access
 - Emergency Off Switch (EPO) and safety interlocks on panels & doors
 - All components UL/CE listed
 - Lock-out/Tag-out safety capability
- **INTERLOCK ASSEMBLY**
 - Safety interlocks for RF, Lid, and H2O
 - Interlock switch assembly & interconnects
- **APC-2000™ AUTOMATIC PROCESS CONTROLLER - Windows® operating system**
 - PlasmOps™ Graphical user interface
 - BASIC language control software easily modified by user
 - Low noise Analog and Digital I/O modules
 - Easy to maintain and upgrade with common PC components
 - Automatic and Manual modes - Service access limited by login code
 - Batch and recipe editor - Event and Datalog with lot tracking features
- **FACILITIES ASSEMBLY**
 - Rear Service Panel for all Facilities service connections
 - CDA, N2, Cooling Water, Vacuum, Electrical, & Process Gases all located on rear of module
 - Water Flow & CDA pressure switches
 - Lock-out/Tag-out safety capability
- **RIE ELECTRODE LINER – Quartz, Graphite, Aluminum, Lexan (TBD)**
 - Easily interchangeable with no alignment procedure required.
 - One Liner provided – others available for additional charge
- **SEMI Specifications & Acceptance**
 - AGS meets SEMI S2/S8 & UL compliance
- **Installation, Training, & Warranty**
 - AGS provides 3 Days onsite installation & training
 - 12 Month Labor warranty
 - 12 Month Extended Service Contract
 - Includes Major PM's & Technical Support

i * It is the policy of AGS Plasma Systems to constantly innovate and improve our products. Therefore, these specifications are subject to change at any time.
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SERVICE CONTRACTS for RIE/CVD SYSTEMS

AGS Plasma Systems, Inc. provides assistance for maintaining a wide variety of plasma systems. There are different levels of support available – each tailored to fit a particular need. From answers to your technical questions, to monthly on site system checks, we can support any of your preventive and corrective maintenance needs. Among the service agreements available are Technical Support Plans, Major PM Services, Maintenance, and Comprehensive Service Contracts.

Technical Support Plan – As most of our users know, the System 900/1700 is one of the most reliable and easy to maintain plasma tools available on the market today. A quick phone call to our helpful technicians can isolate and even solve most malfunctions right then and there. So, we have tailored an economical support service designed to assist you whenever a problem or a question arises. For a flat rate, you have unlimited access to our staff during business hours (extended hours support is available too) with our "Gold" service. Privileges of signing up for the Gold TSP include:

- Toll free phone access
- Quick turn-around
- Generous discounts on selected parts and upgrade kits
- Huge labor discounts on PM's and emergency services

Major PM Service – By far our most popular option. The PM service provides for a service call to your site for a complete tear down and rebuild and recalibration of your plasma system. Recommended at least once per year, some users have found that it may be necessary to increase the frequency of the major PM to twice per year. However, due to the high reliability of our systems, this major PM is just about the only service you may ever need. Here is an outline of the tasks performed during a major PM:

- Inspection, utilization & failure analysis review
- Disassembly, cleaning, and rebuilding chamber & electrodes (and Load-Lock assemblies)
- Replacement of seals, viewports, oil, Ion Gauges, lamps, and relays (and Load-Lock consumables)
- Alignment, Recalibration, tuning & system checkout for peak operating performance

PM Service Contract – Fast becoming our most popular bundled program: we combine our technical support plan with a major PM service call for a 12 month service contract. Included with the PM Service Contract are the following:

- 12 months of Gold Technical Support coverage
- One Major Preventive Maintenance Service call
- Huge discounts on any labor during the coverage period
- Valuable discounts on selected parts and & upgrade kits

Maintenance Service Contract – Included with the Maintenance Service Contract are the following services designed to give you outstanding confidence in your plasma system for a full year:

- 12 months of Gold Technical Support coverage
- One Major Preventive Maintenance Service call
- One 6 month Preventive Maintenance Service call
- Two Quarterly Preventive Maintenance Service calls
- Huge discounts on any labor during the coverage period
- Valuable discounts on selected parts and & upgrade kits

Comprehensive Service Contract – Our premium Comprehensive Service Contract is offered for the customer with a critical mission where downtime is unacceptable. This service "has you covered" and includes all of these services:

- 12 months of Gold Technical Support coverage
- Quick response to down situations by a preassigned Field Engineer
- Monthly check up and utilization reviews
- One Major Preventive Maintenance Service call
- One 6 month Preventive Maintenance Service call
- Two Quarterly Preventive Maintenance Service calls
- Corrective maintenance services (repairs) during the coverage period
- Valuable discounts on selected parts & upgrade kits

*There are many cost-effective support solutions available from AGS.
Call today for details about how we can help you!*

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- it must be done, ensure that the system is lifted evenly or frame separation may occur.
- ___ 3.2 Maintain a minimum service clearance of 24 inches all around the system. Any deviation from this requirement must be approved by AGS Field Engineering.
 - ___ 3.3 Maintain a minimum service clearance of 12 inches all around each of the ancillary systems (pump, chiller, etc.). Any deviation from this requirement must be approved by AGS Field Engineering.
 - ___ 3.4 Position the system with enough vertical clearance so that large and/or heavy objects can be lifted straight up and away from the system.

4.0 FACILITIES REQUIREMENTS

(Refer to the appropriate Facilities Manuals and/or Drawings for detailed requirements.)

- 4.1 Installation drawing list (see appendix)
 - 4.1a System 900-RIE/CVD Plan View
 - 4.1b System 900-RIE/CVD Facilities Plan
 - 4.1c Service Panel Dimensions
 - 4.1d Recommended Plumbing Installation

COMPLETE THE FOLLOWING AND CHECK OFF:

- 4.2 Electrical services to system disconnect enclosure
- 4.3 Electrical Services to reactor and ancillary equipment
- 4.4 Pneumatic Air (CDA or N2) for valve actuation etc.
- 4.5 High Purity Dry N2 for purging and venting
- 4.6 Helium leak checked Process Gas Lines.
- 4.7 High Purity Process Gases (99.999% or '5 nines' pure minimum)
- 4.8 Facilities Cooling Water or PCW (may be required for some options)
- 4.9 House Exhaust for System Cabinet
- 4.10 Scrubbed Exhaust for Vacuum Pumps
(NOT to be mixed with cabinet exhaust for safety reasons)
- 4.11 Install interconnects for vacuum lines, coolant, and any other optional equipment required for start-up (Do Not connect cryo pump helium lines).
- 4.12 Supplies: Deionized Water, Latex Gloves, Lint Free Wipes, Isopropyl Alcohol, Specified Chiller Coolant, Pump Oils, test wafers, and any other required supplies necessary to start-up system.
- 4.13 Helium Leak Checking Equipment, and any Calibration and test equipment as specified in the system manuals as required for initial start-up.

NOTE: DO NOT TURN ON POWER TO ANY SYSTEM PRIOR TO ARRIVAL OF AN AGS FIELD ENGINEER! SYSTEM REQUIRES A THOROUGH SAFETY INSPECTION PRIOR TO POWERING UP. FAILURE TO ADHERE CAN RESULT IN DAMAGE OR INJURY AND MAY VOID ANY WARRANTY IN EFFECT.

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SYSTEM 900™ INSTALLATION CHECKLIST

1.0 PURPOSE

The purpose of this document is to organize the steps required to install or move a System 900 Advanced Plasma Processor so that the system start up will conform to requirements. Unpacking, positioning, facilities requirements and hookups are covered in this convenient checklist form. This checklist also serves as proof of completion of the installation requirements necessary prior to the AGS Plasma Systems, Inc. Field Engineers arrival for start-up.

2.0 UNPACKING

Upon receiving the system, a careful inspection should be completed to record the shipment condition at the customer location.

- 2.1 Receiving inspection
- 2.2 Do not tilt system or components while moving
- 2.3 Unpack shipment and verify against Packing List
- 2.4 Locate system manual and deliver to end user

3.0 POSITIONING SYSTEM

- 3.1 Roll system into position. Use of a forklift on the system is not recommended; however, if it must be done, ensure that the system is lifted evenly or frame separation may occur.
- 3.2 Maintain a minimum service clearance of 24 inches all around the system. Any deviation from this requirement must be approved by AGS Field Engineering.
- 3.3 Maintain a minimum service clearance of 12 inches all around each of the ancillary systems (pump, chiller, etc.). Any deviation from this requirement must be approved by AGS Field Engineering.
- 3.4 Position the system with enough vertical clearance so that large and/or heavy objects can be lifted straight up and away from the system.

5.0 DEVIATIONS and CONDITIONS

___ 5.1 Contact AGS Field Engineering if any Deviations from the facilities requirements are requested and record the following:

5.1.a Exception to facilities requirements as noted:

5.1.b Name of AGS Field Engineer approving the above exceptions:

___ 5.2 Conditions stated by the AGS Field Engineer regarding the above exceptions to the facilities requirements:

6.0 VERIFICATION and SIGN OFF

(This section must be signed and returned to AGS 10 working days PRIOR TO Start-up.)

___ 6.1 AGS System Type: _____ System Serial No.: _____

___ 6.2 The undersigned verifies that the AGS System stated below has been properly and completely facilitized according to the above checklist and that said system is ready for start-up and commissioning by an AGS Field Engineer.

___ 6.3 Facilities Sign Off Authority:

Name: _____

Title: _____

Office Phone No.: _____

Signed: _____

Date : _____

By signing the above verification, it is acknowledged that the facilities are complete and that the system is ready for start up and commissioning by an AGS Field engineer. Therefore, it is agreed that delays in start up due to non-conformance to the facilities installation requirements may result in reasonable charges for labor, parts, and/or travel.

Facilities Information Matrix

The following information covers the facilities requirements for the System 900-RIE/CVD™ with turbo and cryo pump options:

1. Electrical

Item	Description	Volts AC	Phase	Wire	Type	max	typical	Length
1	Main System Service	208	2	4	WYE	20	10	10 ft.

2. Compressed Gases

Item	Description	Pressure		Flow	Type	Fittings	
		psi	+/-			Required	Filter
1	Compressed Air or Nitrogen	80	5	pulsed	CDA	1/4" SwageLok	<20μ
2	UHP/Dry Nitrogen	40	3	300 lph	UHP	1/4" SwageLok	<5μ
3	Process Gases (1-5)	15	<.2	100 sccm	UHP	1/4" VCR (SST)	<1μ

3. Exhaust **Warning: Check local agency regulations before connecting!**

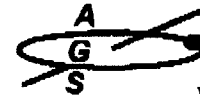
Item	Description	Draw	Vacuum	Duct Size	Exhaust System	Hazard
1	Mechanical Pump	20 CFM	<.05 in Hg	KF 16	Inquire	Possible
2	Gas Cabinet	100 CFM	>1 in Hg	2 in.	Inquire	Possible

4. Cooling water

Item	Description	Flow	Pressure	Temp.	Fitting	Type
1	Equipment Cooling	>1.5 GPM	20-60 psi	20-35°C	3/8" Parker	House
2	TCU/Chiller (optional)	>1 GPM	20-80 psi	<20°C	1/2" FPT	Chilled

5. Physical Dimensions

Item	Description	Width	Depth	Height	Service Clearance	Service Ceiling
1	System Mainframe	25 in	40 in	50 in	24 in	66 in
2	Gas Cabinet Enclosure	26 in	10 in	32 in	36 in	n/a
3	Mechanical Pump, DP15	16 in	24 in	14 in	18 in	36 in
4	TCU/Chiller, Dual (optional)	24 in	34 in	30 in	18 in	48 in



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Process Applications Note

Our systems are designed to provide versatile platforms to meet the widest range of process requirements for research and production possible. Although each customer's application is unique, the basic results for a variety of plasma process applications are shown in the tables below. We are dedicated to assisting you with optimizing your plasma process performance.

ETCH PROCESSES

Dielectrics – Fluorinated Chemistries

Material to be Etched	Substrate	Etch Rate (Å/min)	Selectivity	Uniformity (±%)
Thermal SiO ₂	Silicon	450	10:1	5%
PECVD SiO ₂	Silicon	450	10:1	8%
4% PSG	Silicon	550	12:1	10%
PECVD SiN ₃	Oxide	450	4:1	8%
LPCVD SiN ₃	Oxide	300	2:1	8%
Isotropic	Silicon	250	10:1	7%
Single Xtal	n/a	300	(mask) 2:1	9%
TiW	Oxide	250	3:1	10%
Molybdenum	Oxide	1000	15:1	15%
Polyimide	Aluminum	600	>30:1	10%
Photo-Resist	Oxide	1000	>20:1	7%

Metals – Chlorinated Chemistries

Material to be Etched	Substrate	Etch Rate (Å/min)	Selectivity	Uniformity (±%)
Pure Aluminum	Thermal Oxide	800	12:1	10%
Al/1-2%Si	Thermal Oxide	600	8:1	10%
Al/<2%Cu	Thermal Oxide	500	6:1	10%
Polysilicon	Thermal Oxide	400	15:1	8%
Single Xtal	n/a	500	(mask) 10:1	8%
GaAs Via	n/a	1μ/min	>10:1	6%

Note: Etch rate and selectivity can be optimized for increased throughput.

DEPOSITION PROCESSES

Material to be Deposited	Deposition Rate (Å/min)	Stress	Refractive Index	Uniformity (±%)
SiN ₃	500	Controllable	1.9-2.1	5%
SiO ₂	400	Low, Comp.	1.4-1.5	5%
Low Temp SiO ₂	100	Low, Tens.	1.4-1.5	5%
Oxynitride	100-400	-	1.4-1.5	5%
Carbon	500	-	-	10%

At AGS we act as a partner of the customer and, as such, we look forward to being able to help you analyze and solve your plasma processing challenges now – and in the future.

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Typical Process Recipe's

1. RIE ETCH RECIPE - Oxide
 - a. Rough- 250.0 mTorr
 - b. Gas 1- 95% (CF₄)
 - c. Gas 2- 5% (O₂)
 - d. Throttle Pressure- 60 mTorr
 - e. RF Power- 50.0%
 - f. Timer- 10.0 minutes
2. RIE ETCH RECIPE - Nitride
 - a. Rough- 250.0 millitorr
 - b. Gas 1- 90% (CF₄)
 - c. Gas 2- 8% (O₂)
 - d. Throttle Pressure- 50 mTorr
 - e. RF Power- 50.0%
 - f. Timer- 10.0 minutes
3. RIE ETCH RECIPE - Poly/PSG/Silicon
 - a. Rough- 250.0 mTorr
 - b. Gas 1- 20% (SF₆)
 - c. Gas 2- 50% (O₂)
 - d. Throttle Pressure- 80 mTorr
 - e. RF Power- 10.0%
 - f. Timer- 10.0 minutes
4. RIE ETCH RECIPE - Aluminum
 - a. Rough- 250.0 mTorr
 - b. Gas 3- 80.0% (BCl₃)
 - c. Gas 4- 10.0% (Cl₂)
 - d. Throttle Pressure- 50 mTorr
 - e. RF Power- 40.0%
 - f. Timer- 10.0 minutes
5. CVD DEPOSITION RECIPE - Oxide film
 - a. Rough- 250.0 mTorr
 - b. Gas 1- 100% (N₂O)
 - c. Gas 2- 25% (SiH₄)
 - d. Temp- 300°C
 - e. Throttle Pressure- 300 mTorr
 - f. RF Power- 10.0%
 - g. Timer- 10.0 minutes
6. CVD DEPOSITION RECIPE - Nitride film
 - a. Rough- 250.0 mTorr
 - b. Gas 1- 50% (NH₃)
 - c. Gas 2- 25% (SiH₄)
 - d. Temp- 300°C
 - e. Throttle Pressure- 300 mTorr
 - f. RF Power- 10.0%
 - g. Timer- 10.0 minutes