Emergency Off with Safety Lock-Out

Full Opening Chamber for Easy Accessibility

Chamber Complete with Accessory Parts

Interlocked Door for Quick Access to Vacuum Area

Convenient Sample Preparation Area

Versatile Rack Mount Console

Doors/Panels Easily Removed for Service

Lockable See-Thru Door for Viewing Electronics

Sealed Gas-Pod Option Available for Process Gas Safety

Circuit Breakers Conveniently Located on Front
AGS Plasma Systems, Inc.

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 – CC/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 l/s 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, 100scm/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
• 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

* 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.

V200-PE1, APC-2000, PlasmOps, AutoPurge, MapCouple, QuickPump, AutoRange are trademarks of AGS Plasma.
MONOVAT and VATOK are trademarks of VAT Inc., MS Windows & MS Visual Basic are trademarks of Microsoft, Viton is a trademark of DuPont
AGS Plasma Systems, Inc.

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 900/700 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
- Weekly checkup 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!

RVA: 908023, AGS

...
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.
AGS Plasma Systems, Inc.
229o-G RINGWOOD AVE
SAN JOSE, CA 95131, USA

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 facilitated 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

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Volts AC</th>
<th>Phase</th>
<th>Wire</th>
<th>Type</th>
<th>max</th>
<th>typical</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Main System Service</td>
<td>208</td>
<td>2</td>
<td>4</td>
<td>WYE</td>
<td>20</td>
<td>10</td>
<td>10 ft</td>
</tr>
</tbody>
</table>

#### 2. Compressed Gases

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Pressure</th>
<th>+/-</th>
<th>Flow</th>
<th>Type</th>
<th>Required</th>
<th>Filter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Compressed Air or Nitrogen</td>
<td>80</td>
<td>5</td>
<td>pulsed</td>
<td>CDA</td>
<td>1/4&quot; SwageLok</td>
<td>&lt;20µ</td>
</tr>
<tr>
<td>2</td>
<td>UHP/Dry Nitrogen</td>
<td>40</td>
<td>3</td>
<td>300 lph</td>
<td>UHP</td>
<td>1/4&quot; SwageLok</td>
<td>&lt;5µ</td>
</tr>
<tr>
<td>3</td>
<td>Process Gases (1-5)</td>
<td>15</td>
<td>.2</td>
<td>100 sccm UHP</td>
<td>1/4&quot; VCR (SST)</td>
<td>&lt;1µ</td>
<td></td>
</tr>
</tbody>
</table>

#### 3. Exhaust

**Warning:** Check local agency regulations before connecting!

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Draw</th>
<th>Vacuum</th>
<th>Duct</th>
<th>Exhaust</th>
<th>Hazard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mechanical Pump</td>
<td>20 CFM</td>
<td>&lt;.05 in Hg</td>
<td>KF 16</td>
<td>Inquire</td>
<td>Possible</td>
</tr>
<tr>
<td>2</td>
<td>Gas Cabinet</td>
<td>100 CFM</td>
<td>&gt;1 in Hg</td>
<td>2 in.</td>
<td>Inquire</td>
<td>Possible</td>
</tr>
</tbody>
</table>

#### 4. Cooling Water

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Flow</th>
<th>Pressure</th>
<th>Temp.</th>
<th>Fitting</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Equipment Cooling</td>
<td>&gt;1.5 GPM</td>
<td>20-60 psi</td>
<td>20-35°C</td>
<td>3/8&quot; Parker</td>
<td>House</td>
</tr>
<tr>
<td>2</td>
<td>TCU/Chiller (optional)</td>
<td>&gt;1 GPM</td>
<td>20-80 psi</td>
<td>&lt;20°C</td>
<td>1/2&quot; FPT</td>
<td>Chilled</td>
</tr>
</tbody>
</table>

#### 5. Physical Dimensions

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Width</th>
<th>Depth</th>
<th>Height</th>
<th>Service Clearance</th>
<th>Service Ceiling</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>System Mainframe</td>
<td>25 in</td>
<td>40 in</td>
<td>50 in</td>
<td>24 in</td>
<td>66 in</td>
</tr>
<tr>
<td>2</td>
<td>Gas Cabinet Enclosure</td>
<td>26 in</td>
<td>10 in</td>
<td>32 in</td>
<td>36 in</td>
<td>n/a</td>
</tr>
<tr>
<td>3</td>
<td>Mechanical Pump, DP15</td>
<td>16 in</td>
<td>24 in</td>
<td>14 in</td>
<td>18 in</td>
<td>36 in</td>
</tr>
<tr>
<td>4</td>
<td>TCU/Chiller, Dual (optional)</td>
<td>24 in</td>
<td>34 in</td>
<td>30 in</td>
<td>18 in</td>
<td>48 in</td>
</tr>
</tbody>
</table>
AGS Plasma Systems, Inc.

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**

<table>
<thead>
<tr>
<th>Material to be Etched</th>
<th>Substrate</th>
<th>Etch Rate (A/min)</th>
<th>Selectivity</th>
<th>Uniformity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal SiO$_2$</td>
<td>Silicon</td>
<td>450</td>
<td>10:1</td>
<td>5%</td>
</tr>
<tr>
<td>PECVD SiO$_2$</td>
<td>Silicon</td>
<td>450</td>
<td>10:1</td>
<td>8%</td>
</tr>
<tr>
<td>4%PSG</td>
<td>Silicon</td>
<td>550</td>
<td>12:1</td>
<td>10%</td>
</tr>
<tr>
<td>PECVD SiN$_3$</td>
<td>Oxide</td>
<td>450</td>
<td>4:1</td>
<td>8%</td>
</tr>
<tr>
<td>LPCVD SiN$_3$</td>
<td>Oxide</td>
<td>300</td>
<td>2:1</td>
<td>8%</td>
</tr>
<tr>
<td>Isotropic</td>
<td>Silicon</td>
<td>250</td>
<td>10:1</td>
<td>7%</td>
</tr>
<tr>
<td>Single Xal</td>
<td>n/a</td>
<td>300</td>
<td>(mask) 2:1</td>
<td>9%</td>
</tr>
<tr>
<td>TiW</td>
<td>Oxide</td>
<td>250</td>
<td>3:1</td>
<td>10%</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>Oxide</td>
<td>1000</td>
<td>15:1</td>
<td>15%</td>
</tr>
<tr>
<td>Polyimide</td>
<td>Aluminum</td>
<td>600</td>
<td>&gt;30:1</td>
<td>10%</td>
</tr>
<tr>
<td>Photo-Resist</td>
<td>Oxide</td>
<td>1000</td>
<td>&gt;20:1</td>
<td>7%</td>
</tr>
</tbody>
</table>

**Metals – Chlorinated Chemistries**

<table>
<thead>
<tr>
<th>Material to be Etched</th>
<th>Substrate</th>
<th>Etch Rate (A/min)</th>
<th>Selectivity</th>
<th>Uniformity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pure Aluminum</td>
<td>Thermal Oxide</td>
<td>800</td>
<td>12:1</td>
<td>10%</td>
</tr>
<tr>
<td>Al/1-2%Si</td>
<td>Thermal Oxide</td>
<td>600</td>
<td>8:1</td>
<td>10%</td>
</tr>
<tr>
<td>Al/2%Cu</td>
<td>Thermal Oxide</td>
<td>600</td>
<td>6:1</td>
<td>10%</td>
</tr>
<tr>
<td>Polysilicon</td>
<td>Thermal Oxide</td>
<td>400</td>
<td>15:1</td>
<td>8%</td>
</tr>
<tr>
<td>Single Xal</td>
<td>n/a</td>
<td>500</td>
<td>(mask) 10:1</td>
<td>8%</td>
</tr>
<tr>
<td>GaAs Via</td>
<td>n/a</td>
<td>1µ/min</td>
<td>&gt;10:1</td>
<td>6%</td>
</tr>
</tbody>
</table>

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

DEPOSITION PROCESSES

<table>
<thead>
<tr>
<th>Material to be Deposited</th>
<th>Deposition Rate (A/min)</th>
<th>Stress</th>
<th>Refractive Index</th>
<th>Uniformity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SiN$_3$</td>
<td>500</td>
<td>Controllable 1.9-2.1</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>SiO$_2$</td>
<td>400</td>
<td>Low, Comp. 1.4-1.5</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Low Temp SiO$_2$</td>
<td>100</td>
<td>Low, Tens. 1.4-1.5</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Oxynitride</td>
<td>100-400</td>
<td></td>
<td>1.4-1.5</td>
<td>5%</td>
</tr>
<tr>
<td>Carbon</td>
<td>500</td>
<td></td>
<td></td>
<td>10%</td>
</tr>
</tbody>
</table>

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.
AGS Plasma Systems, Inc.

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

AGS App Note - Recipes

Company Confidential