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Date : October 31.2014

SPECIFICATION

Product : Interback-Type sputtering system
Model : SIV-200

Customer				
ULVAC				
Approved by	*Checked by*	*Checked by*	*Checked by*	*Written by*

Please return one copy of this specification with your signature for approval within two weeks from the arrival date.
In case of no return within 2 weeks, this specification should be treated as accepted

Advanced Electronics Equipment Division
ULVAC, Inc

Revision History

Rev. No.	*Rev. Mark*	Date	*Description*		*Approved by*	*Checked by*	*Checked by*	*Checked by*	*Written by*
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1		Oct.31. 2014		New Manufacture					

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1. General Description

1.1 Purpose

This specification describes an inter-back type sputtering system with its purpose in research and development and small-lot production.

1.2 System Configuration

This system has the following structure.

(1) System main body
   1) The system has a carrier stocker, a load lock chamber and a sputtering chamber.
   2) Operation touch panel is attached at the front side of the system.

1.3 Features

This system has the following functions.

(1) Load lock chamber
   1) Pipes for rough evacuation and N2 vent are provided.
   2) An Ionization vacuum gauge, a Pirani vacuum gauge, and an atmospheric pressure check switch are provided for measurement of vacuum level.

(2) Sputtering chamber
   1) 2-steps exchange mechanism is provided.
   2) As a sputtering source, one set of magnetron type cathode (1 pc on one side) is provided sideways on the side of the sputtering chamber.
   3) T/S distance (distance between target and substrate) is 90mm fixed.
   4) Deposition is executed with the carrier, which is standing transferring, and the substrates are located on the carrier.
   5) A DC power supply with 5.0kW output is provided for the sputtering power supply.
      * The DC Power Supply output is limited to upper bound 2.0kW by the control interlock.
      * ITO target power density is limited to 4W/cm2.
   6) A Diaphragm vacuum gauge, an Ionization vacuum gauge, a Pirani vacuum gauge, and an atmospheric pressure check switch are provided for measurement of vacuum level.
   7) Maintenance of inside of the sputtering chamber is executed by opening/closing the door.

(3) Gas system
   1) Mass flow controllers (MFC) for each process gas of Ar, O_2 are provided respectively.
   2) Additional one gas line is equipped which is sealed for the future.
   3) A main valve is provided for the load lock chamber and the sputtering chamber, and deposition pressure can be changed by controlling the evacuation speed and MFC flow rate.
      * APC function is not attached.

(4) Evacuation system
   1) A cryo pump (8 inch) is provided for the main evacuation system of the sputtering chamber.
   2) A dry pump and a mechanical booster pump are provided for the rough evacuation system of the load lock chamber.
   3) The dry pump and the mechanical booster pump described in 2) are also used for the rough evacuation system of the sputtering chamber. Individual evacuation is not available.
   4) A cryo pump (8 inch) is provided for the main evacuation system of the load lock chamber.

(5) Safety
   1) UL standard
   2) Field-Label

(6) Transfer system and carrier stocker

1) Carrier is transferred by the rollers at the bottom of the chamber and carrier stocker is transferred by the rack and pinion method.
2) Carrier stocker (for 6 carriers) is provided through the isolation valve of the load lock chamber. Continuous deposition is available by using 6 carriers.
3) Substrate holder put/remove area is located on the front side of the stocker.

2. Specifications·Performance

2.1 Substrate size, Number of loading substrates

Number of loading substrates:

3 pcs/carrier for 6 inch wafer

Note) Non-deposition area is necessary. Details will be determined in discussion and on the delivery drawing.

2.2 Vacuum performance

2.2.1 Ultimate pressure

(1) Load lock chamber

Equals to or less than **1.3×10^{-4} Pa**

(The value shall be obtained after 12 hours or longer of continuous vacuum evacuation)

(2) Sputtering chamber

Equals to or less than **1.3×10^{-4} Pa** (The value shall be obtained after 12 hours or longer of continuous vacuum evacuation)

2.2.2 Pumping time

(1) Load lock chamber

Within 10 min. to **6.7×10^{-3} Pa**

（From atmospheric pressure）

2.2.3 Pressure build-up value

(1) Load lock chamber

(2) Sputtering chamber

Equals to or Less than **6.7×10^{-6} Pa·m^3/sec**

* Measuring conditions

◊ The measured values shall be obtained after continuous evacuation for 12 hours or longer.

◊ Above values shall be obtained by the ionization vacuum gauge mounted to the vacuum chamber under the following conditions; (1) Standard electrode is built-in, (2) No substrate is loaded, (3) Vacuum chamber is at the room temperature, and (4) Vacuum chamber is clean.

◊ Above values shall be obtained when no target is loaded.

2.3 Sputtering Performance

2.3.1 Film thickness uniformity

6 inch substrate is confirmed under the following conditions.

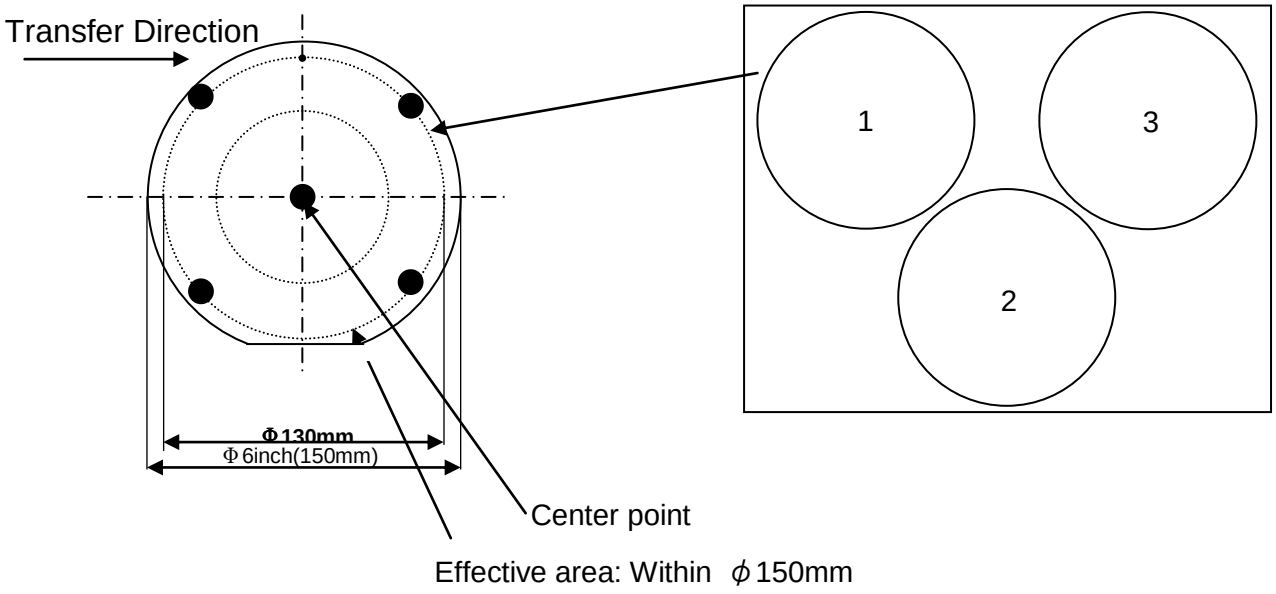
(1) α cathode DC (ITO deposition)

Within 6 inch-dia. substrate	**Within ± 5%**
Within 1 carrier	**Within ± 5%**
Within 3 carriers	**Within ± 5%**

* Measuring conditions will be determined in discussion.

- Substrate shall be supplied by the customer.
- Target shall be supplied by the customer.
- Film thickness **1100Å** shall be deposited for evaluation.
- Deposition is executed by using Ar gas only.
- Pressure and applying power shall be determined by ULVAC with consideration of past record.
- **In house test：Dektak or Ellipsimeter shall be used for the measurement.**
  At customer site test ：Ellipsometer post anneal.
- A correcting plate for film thickness uniformity may be used.
- Measuring points are as follows. They will be determined in discussion.
- The values out of specification due to measurement error of the Dektak will be discussed separately.

＜Measurement point of Film thickness uniformity＞



- Calculating formula for film thickness uniformity is as follows.

(a) Within 6 inch-dia. substrate

± {(T max. – T min.)/(T max. + T min.)} × 100 %
T max. : Maximum film thickness of 5 points in a substrate
T min. : Minimum film thickness of 5 points in a substrate

(b) Within 1 carrier

± {(T max. – T min.)/(T max. + T min.)} × 100 %
T max. : Maximum film thickness of 15 points(5 points × 3 wafers)
T min. : Minimum film thickness of 15 points. (5 points × 3 wafers)

(c) Within 3 carriers

± {(T max. – T min.)/(T max. + T min.)} × 100 %
T max. : Maximum film thickness of 45 points(5points × 3 wafers × 3 carriers)
T min. : Minimum film thickness of 45 points. (5points × 3 wafers × 3 carriers)

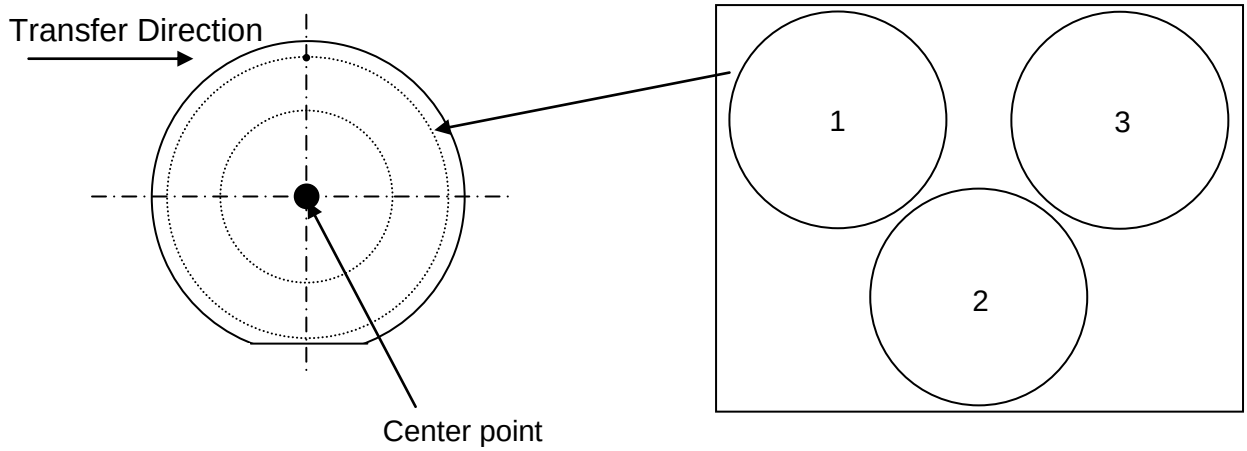
2.3.2 Sheet resistance check

(1) α cathode DC (ITO deposition)
Within 1 carrier, Equals or Less than **30Ω/□** (after annealing is processed)

* Measuring conditions

- Substrate shall be supplied by the customer.
- Target shall be supplied by the customer.
- Sheet resistance shall be evaluated after 1100 Å deposition and annealing are executed.
- Deposition is executed by using Ar and O2 gas(detail will be determined by ULVAC).
- Pressure, applying power, and annealing conditions shall be determined by ULVAC with consideration of past record.
- A correcting plate for film thickness uniformity may be used.
- The value shall be measured at one center point of each substrate.

＜Measurement point of Sheet resistance＞



2.3.3 Pressure variable range

0.4 - 1.2 Pa (When Ar gas is introduced)

2.3.4 Mechanical Particle

Mechanical Particle :40pcs(φ150mm Si wafer) for the particle size greater than 1.0μm

＊Test condition＊

- **Particle are measured on silicon wafers transferred into the process chamber.**
- **Once in the chamber, gases are flowed into the chamber and plasma is not turned on.**
- **The wafers are then transferred back out of the carrier stocker.**
- **Adders will be determined based on control wafers which will be placed in same area of the cleanroom as the Equipment during the testing period.**
- **Deposition shield, Career, Substrate holder uses the new article which is not used for Sputtering performance test.**
- **A chamber is cleaned before a particle test.**

2.3.5 Transmittance check

(1) Luminescence wavelength 450nm

Within substrate 98% or more

* Measuring conditions
  - We use the sapphire substrate of a double-sided polishing. Substrate shall be supplied by the customer.
  - Target shall be supplied by the customer.
  - Transmittance shall be evaluated after 1100Å deposition and annealing are executed.
  - Deposition is executed by using Ar gas and O2 gas(detail will be determined by ULVAC).
  - **Pressure, applying power, and annealing conditions shall be determined by ULVAC with consideration of past record.**
  - A correcting plate for film thickness uniformity may be used.

(2) Luminescence wavelength **525,625nm**

Within substrate **95% or more**

* Measuring conditions
  - We use the sapphire substrate of a double-sided polishing. Substrate shall be supplied by the customer.
  - Target shall be supplied by the customer.
  - Deposition is executed by using Ar gas and O2 gas(detail will be determined by ULVAC).
  - **Film thickness, Pressure, applying power, and annealing conditions shall be determined by ULVAC with consideration of past record.**
  - A correcting plate for film thickness uniformity may be used.

2.3.6 Contact resistance

(1) GaN,GaP To be discussed based on demo results.

2.4 Transfer speed

2.4.1 Variable transfer speed of the sputtering chamber

Carrier transfer speed during deposition 10 – 1500 mm/min

2.5 Running test

Make sure that the trouble does not occur with 100 carrier continuously transferred. (No discharge)

2.6 Throughput

2.6.1 Throughput

Less than 15min / 1Tray ITO:1100Å

(above number is according to following process conditions. Due to slow vent, slow pumping and each process, above number may not be achieved.)

Note) Above time is applied to continuous operation. A few carriers in the early operation are not counted.

2.7 Data acquired during system test

Following data shall be obtained. In house test : ○ At site : ●

2.7.1 Vacuum performance

(1) Ultimate pressure ○●
Pressure value from the start-up of high vacuum evacuation to the ultimate pressure specification value

(2) Pumping time ○●
Pressure value from the process chamber atmospheric pressure to the specification pressure after the pumping time

(3) Pressure build-up value ○●
Pressure build-up value for 15 min. from the main valve close

(4) P-Q value ○●
Pressure value to the gas flow rate

2.7.2 Deposition performance

(1) Film thickness uniformity ○●
Film thickness uniformity data of each cathode

(2) Sheet resistance check ○●
Sheet resistance check data of each cathode

(3) Power rate ○●
Deposition rate data to the output power of the power supply for each cathode
(Measured at a center of the substrate for each 3 output power)

(4) Discharge check data ○●
Discharge check data for 3 min. at upper and lower limits of discharge pressure

(5) **Mechanical Particle ●**
40pcs(φ150mm Si wafer) for the particle size greater than 1.0μm

(6) Running test ●
100 carriers continuously transferred. (No discharge)

(7) Throughput ○●
Less than 15 min (ITO:1100Å)

(8) Transfer speed ○●
Carrier transfer speed during deposition 10 – 1500 mm/min.

(9) Transmittance check ●

(10) Contact resistance on GaN,GaP ●

2.7.3 System control performance

(1) Manual operation ○●
On the screen, confirm that each unit is operable.

(2) Automatic operation ○●
Confirm that each auto mode is operable.

(3) Interlock (FAT: Partially confirmed / SAT: Partially confirmed)
Confirm that the interlock works appropriately.
(4) Alarm check (FAT: Partially confirmed / SAT: Partially confirmed)
Confirm that each alarm outputs and a buzzer sounds.

*** For check method of above data, refer to Acceptance Test Criteria submitted after a finalization of purchase order.**

2.8 Control specification

[Contents of control]

This system is controlled by the computer and PLC, and the touch panel screen is used as an interface with an operator. By switching this touch panel screen, (1) Graphic screen, (2) Mode select screen, (3) Recipe setting screen, (4) Monitor screen and (5) Alarm screen are displayed, and batch operations are available. The system has the logging function, which enables process data and maintenance data to be recorded. (All breakers excluding the main breaker are installed in the power supply panel.) After the customer completes installation, the PLC program will be switched to the ROM operation.

(1) Graphic screen
The system diagram is displayed, and open/close status of each valve can be confirmed. During the manual operation, units can be operated on this screen.
(2) Mode select screen
During the automatic operation, operation such as process start can be executed.
(3) Recipe setting screen
Recipes such as deposition recipe, etc. can be saved respectively. In addition, process recipes that have a combination of those recipes can be saved.
Up to 10 steps such as discharge time, gas flow rate, and power supply output can be set.
(4) Monitor screen
The actual value for each set value is displayed. During the automatic operation, set values can be changed during the operation.
(5) Alarm screen
When an alarm is output, the alarm content is displayed.

[Operation mode]

a.	Pump preparation	Cryo pump start-up
b.	High vacuum evacuation	Vacuum evacuation of all chambers
c.	Process	Process operation
d.	System vent	Vent operation of all chambers
e.	L/UL vent	Vent operation of load lock chamber
f.	Regeneration	Regeneration of the cryo pump

[Process operation]

In the process mode, one carrier is loaded into the spattering chamber, and substrates are deposited in accordance with the set recipe. Ten layers in one carrier can be automatically deposited.

* In one pass, deposition transfer speed is fixed.

* Different recipes for 5 carries can be made.
* Conditions for process operation
  a. Operation mode is AUTO. High vacuum evacuation is completed.
  b. 6 carriers are set to the carrier stocker.
  c. Doors are closed.
  d. Alarms are cleared.
* Substrates are required to be set to the carrier manually.
  Substrate presence sensor is not provided. Therefore processing of a substrate shall be judged by the operator.
* The number of processing carriers set at the process start cannot be changed during the process operation.
* Substrates cannot be changed during continuous deposition of 6 carriers.

3. List of components

3.1 Load lock chamber

3.1.1 Vacuum chamber

(1)	Load lock chamber (Al made)		1 set
(2)	Accessories		1 set
	1) Manual door open/close mechanism (The chamber has a door only on one side.)		
	2) Carrier presence sensor		
	3) Door open/close sensor		
	4) O-ring		
	5) Atmospheric-vacuum isolation valve		

3.1.2 Transfer system

(1)	Carrier transfer mechanism		1 set

3.1.3 Measuring system

(1)	Pirani vacuum gauge	(ULVAC SPU WP-16)	1 set
(2)	Pirani vacuum gauge	(ULVAC SPU WP-16)For Cryo pump	1 set
(3)	Atmospheric pressure check switch		2sets
(4)	Ionization vacuum gauge	(ULVAC SH-2 M-34)	1 set

3.1.4 Vacuum evacuation system

(1)	Dry pump	(EDWARS iXL1000N+eTIM)	1 set
(2)	Cryo pump	(ULVAC U10HSP)	1 set
(3)	Roughing valve		1 set
(4)	Vent valve		1 set
(5)	Main valve	(OPEN/CLOSE only)	1 set
(6)	Vacuum pipes		1 set

3.2 Sputtering chamber

3.2.1 Vacuum chamber

(1)	Sputtering chamber	(Al made)	1 set
(2)	Accessories		1 set
	1) Manual door open/close mechanism		
	2) Carrier presence sensor		
	3) Door open/close sensor		
	4) O-ring		
	5) Vacuum-vacuum isolation valve		

3.2.2 Transfer system

(1)	Carrier transfer mechanism		1 set
(2)	Carrier transfer mechanism2-steps exchange mechanism		1 set

3.2.3 Cathode system

(1) α cathode for ITO (There is no Y-axis swing.) 1 set
Target bonding method
T/S distance is 90mm.
Note: Target shall be prepared by the customer and provided after bonding to the backing plate provided by ULVAC.
ITO (Filling rate 99.5%) 1 piece
Target size 300*382* t5/10[mm]
Cathode maintenance is conducted by open/close of the door. Cathode pulling down mechanism is not provided.

(2) Backing plate (With ITO) 1 piece
(3) Earth shield (SUS304 made with blast treatment) 1 set
(4) Chimney (SUS304 made with blast treatment) 1 set
(5) Gas inlet pipe 1 pc

3.2.4 Power supply system

(1) DC Power supply for sputtering 1 set
* Depending on the TAP status of the power supply, electric discharge status, and target materials, maximum Power cannot be applied.
* The DC Power Supply output is limited to upper bound 2.0kW by the control interlock.

3.2.5 Internal jig system

(1) Carrier 6 sets
(2) Substrate holder (for 4 inch dummy), (with blast treatment) 6 pieces
(3) Deposition shield (with blast treatment) 1 set

3.2.6 Vacuum evacuation system

(1) Cryo pump (ULVAC U10HSP) 1 set
(2) Main valve (OPEN / CLOSE / HALF OPEN only) 1 set
(3) Vacuum pipes 1 set

3.2.7 Measuring system

(1) Pirani vacuum gauge (ULVAC SPU WP-16) 1 set
(2) Pirani vacuum gauge (ULVAC SPU WP-16) for Cryo pump 1 set
(3) Atmospheric pressure check switch 2 sets
(4) Ionization vacuum gauge (ULVAC SH-2 M-34) 1 set
(5) Diaphragm gauge (MKS) 1 set

3.2.8 Gas inlet system

(1) MFC
Ar :200 sccm 1 set
O_2 :5 sccm 1 set
(2) Joint: Swagelock joint or equivalent 1 set
(3) Pipe: SUS316 pipe 1 set

3.3 Carrier stocker

3.3.1	Carrier waiting POSITION	6 sets
3.3.2	Carrier slide system	1 set
3.3.5	Carrier transfer mechanism	1 set

3.4 Operation control system

(1) Operation control panel 1 set
(2) Additional power supply cabinet 1 set
: Control system GPCS-2700 (computer and touch panel)
Evacuation system: Auto/Manual
Deposition system: Auto/Manual
Transfer system: Auto/Manual
* 1 second logger is not provided.
* The specification of the signal tower is conducted in ULVAC specification.
* Host communication is not included in this specification.
(3) Stepdown Trans 1 set

3.5 Compressed air system

(1) Filter regulator unit 1 set
(2) Solenoid valve unit 1 set
(3) Pipe 1 set
(4) Speed controller 1 set

3.6 Cooling water system

(1) Water supply/drain header 1 set
(2) Cooling water pipes 1 set
(3) Pressure switch 1 set
(4) Flow meter 1 set

3.7 Frame system

(1) Framework (angle structure made by SS) 1 set
(2) Panel 1 set

3.8 Spare parts

(1)	Backing plate	without ITO	4 piece
(2)	Earth shield		3 piece
(3)	Chimney	with blast treatment	3 piece
(4)	Substrate holder (for 6 inch)	with blast treatment	6 pieces
(5)	Deposition shield	with blast treatment	3 sets

4. Safety

Following countermeasures are provided for safety.
(Part of countermeasures are described here for safety measures and component protections)

4.1 Safety Measures (Abstract)

(1)	Emergency stop	Emergency stop buttons are provided on the front side of the system. Pressing this button stops all electrical systems.
(2)	High voltage section	DC power supply, and electrically-charged section with voltage of 24V or higher are covered by panels.
(3)	Power inlet sections	These parts are covered by panels and cannot be touched directly.
(4)	Hot sections	These parts are covered by panels and cannot be touched directly.
(5)	Movable sections	These parts are covered by panels and cannot be touched directly.
(6)	Earth leakage measure	Earth leakage breaker is used. In case of power leakage, all electrical systems stop.
(7)	Control system	Control system is designed as to be operated with 24VDC or lower.

4.2 Component Protection (Interlock) (Abstract)

(1)	Cryo pump	It cannot be activated when the amount of the cooling water is lower than the specified amount.
(2)	Power failure, Water shortage	In case of power failure or water shortage, the pumps stop and the valves close. (Door valves keep the conditions right before the stopping operation.) Automatic recovery is not available. The system must be restarted manually.
(3)	Compressed air	When compressed air pressure is insufficient, the system cannot be started-up.
(4)	Cover	The power supply cannot be turned on when a cover at a high voltage section is removed.
(5)	Cathode	The power cannot be started up when the cooling water is lower than the specified amount.
(6)	Sputtering power supply	It can be turned on only when the sputtering chamber is vacuum and the gas is flowing.
(7)	Process gas	It can be flown only when the sputtering chamber is in vacuum and when the main valve is open.

4.3 Signal Tower Performance Indication

A three-color (red, yellow, and green) LED tower (signal tower) that indicates the system condition is provided to this system. If any change to the signal tower is required in accordance with the customer's standard, please contact ULVAC at an early stage.

5. Utilities

5.1 Floor Space

(1) Floor Space Approx. W6000 x D3200 x H2100 mm
(The maintenance area is contained)

5.2 Utility

Type	Application	Amount/Pressure	Connection	Condition
Electricity	Motive energy	3-phase 200V±5% 50Hz Approx. 21.4KVA		
Cooling water	Cooling the system	Supply pressure 0.25 - 0.3 MPa Back pressure 0.05 MPa or lower :22l/min	Supply:RC1× 1 set	Gauge pressure Specific resistance 5kΩ/cm or higher 20 - 25°C
			Drain: RC1・1/4 × 1 set	
			Open drain: RC1/2 × 1 set	For cathode
Pressure air	Compressed air driving	0.6 - 0.7MPa Certain amount Normal use 0.5MPa	Rc3/8	Gauge pressure Regulator is attached to the system
N_2 gas	System vent	0.05MPa Approx. 30 m3/hr	RC1	Gauge pressure No regulator No filter
	Purge	0.1～0.5MPa Approx:4m3/hr	Rc1/2	Gauge pressure No regulator No filter
Process gas	Ar,O2	0.05 MPa Ar: 200sccm, 5N more O2: 5sccm	1/4 VCR	Gauge pressure No regulator
Exhaust	Rough evacuation	DRP MAX Volume 359m^3/Hr Back pressure:-10mmAq	NW40	General exhaust

5.3 Grounding

(a) A-type grounding work (Type 1 earth: Earth with grounding resistance of 10 ohm or lower)
According to "Laws for Electrical Engineering and Electrical Facility Management," this system is classified as high-voltage equipment. For safety, preparation of Type-A grounding for high-voltage equipment is required.

(b) D-type grounding work (Type 3 earth: Earth with grounding resistance of 100 ohm or lower)

* The above values are only quotation values. The final values will be described on the delivery drawing submitted by ULVAC after formal purchase order.

6. General Specification

6.1 Regulation

This system is compliant to the following regulations.

(1) Japanese Industrial Standards (JIS)
(2) The Japan Electrical Manufactures' Association (JEM)
(3) The Institute of Electrical Engineers of Japan (JEC)
(4) ULVAC In-house standard.
(5) Imported parts may comply with the standard of the country of origin.
If the system needs to comply with the customer's standard, submit the conditions in writing before signing the contract.
In this case, the quotation amount may be changed.

6.2 Submitting Document

(1)	Delivery Specification	Normal paper	3 copies
(2)	Distribution diagrams and layout drawings	Normal paper	3 copies
(3)	Maintenance drawing of main parts	CD-R	
(4)	Operation manual	CD-R	
(5)	Test report	Normal paper	3 copies

For the delivery specification and delivery system drawing, sign the document and return 1 copy out of 3.
Please return the delivery system drawing within one week from the date of the delivery of the drawing. When the delivery system drawing is not returned within a week, delivery of the system might be delayed.

6.3 Painting Color

(1) Main painting color: Japan Paint Manufacturers Association DIC546 1/2 Semi-gloss and smooth surface, Ivory
(2) Vacuum pumps, vacuum valves, and purchased components are the standard colors of the maker.
If any particular color is required at the customer side, please specify the color before signing the contract.
At this time, even with the color sample submitted, please understand that some deviation may result in colors.

6.4 Utility Requirement

(1) If the installation area has possibility of getting extremely cold or hot, please provide such information before signing the contract.
ULVAC will examine the countermeasures; however, some components cannot be used under a certain condition. In this case, the quotation amount may be changed.

7. Scope of Quotation

7.1 Scope of Quotation

This quotation includes Item 2 (Specification and Performance), design, fabrication, assembly, and test of Item 3 (List of Components), witness test at ULVAC.

7.2 Items excluded from the quotation

(1) Foundation and building works
(2) Electrical wiring work at the primary side and wiring materials (Customer's facility - Operation panel, Grounding work)
(3) Cooling water piping work at the primary side and pipes (Customer's facility - This system)
(4) Compressed air piping work at the primary side and pipes (Customer's facility - This system)
(5) Gas piping work at the primary side and pipes (Customer's facility - This system)
(6) Exhaust duct at the pump exhaust side and pipes
(7) Clean air inlet and exhaust duct work
(8) Facilities and works necessary for gas exhaust process (when necessary) (Leak test at the connecting section is not included)
(9) In case vacuum pipes become long when the pump is installed in the separate room or under the grating.
(10) Power, gas, compressed air, and consumables necessary during installation, assembly, test of acceptance criteria, and witness test at the customer's site
(11) Targets and substrates necessary for witness test and test of acceptance criteria at the customer site and at ULVAC
(12) Work, parts, and spare parts not described in Item 3 (list of components)
(13) Cost required for disposal of this system
(14) Re-cleaning cost of deposition shield after the test at ULVAC and at the customer's site

8. Acceptance Conditions

This system is to be finally accepted when the following items are confirmed during the witness test at the customer's site.

(1) Confirmation of Item 2 (Specification and Performance) (For details of check items, refer to Acceptance Test Criteria submitted at the time of contract.)
(2) Confirmation of components described in Item 3 (list of components)

9. Warranty Period

ULVAC warrants satisfactory operation of the system under normal and adequate maintenance for the period of 12months after completion of SAT (Site Acceptance Test) or 15 months from date of FOB Japan, whichever terminates earlier. However, consumables such as O-ring, oil, and insulator and deposition parts such as view glass, carrier, deposition shield, and transfer roller are excluded from this warranty.

10. Precautions

(1) Grounding

According to "Laws for Electrical Engineering and Electrical Facility Management," this system is classified as high-voltage equipment. For the safety, be sure to prepare the Type-A grounding for high frequency equipment.

(2) Disposal

Disposal cost of a system delivered by ULVAC shall be burden upon the customer's responsibility. The "system" described here include all attachments, attached documents, and media other than the system body itself.

(3) INTELLECTUAL PROPERTIES FOR THE APPARATUS

ULVAC represents that any intellectual property rights relating to the Apparatus sold by ULVAC will be either original to ULVAC, in the public domain, or obtained by ULVAC with a written consent of its owner to use, and that the Apparatus will not infringe any third party's intellectual property rights to the best of its knowledge. Should any third party claim that the Apparatus sold by ULVAC infringes its apparatus patent, ULVAC will exert its best efforts in order that your company may continue to use the Apparatus by such means as acquiring a license from said third party or remodeling of the Apparatus to avoid the infringement. ULVAC shall defend, indemnify and hold harmless your company from and against any costs (including reasonable attorney's fees incurred), expenses, losses, damages, liabilities relating to any claim that the Apparatus infringes any intellectual property right of any third party, provided that, any infringement caused by design made pursuing your company's request is excluded. Such costs and expenses to be borne by ULVAC as a result of the infringement shall not exceed the amount paid for the Apparatus by your company.

Provided, however, that your company shall give notice to ULVAC immediately after receiving such claims from a third party and give assistance to ULVAC. With respect to any third party claims based on process patent and/or your products manufactured by using the Apparatus, no liability lies with ULVAC.