☐ Customer's Copy

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Nov. 06, 2023

SPECIFICATION

Customer : Company V

Product : Dry Etching System

Model : uGmni-200E

Mfg No. : MA21-0111-0 Rev.02

Customer's signature We have accepted this specification. Date **Jan** / **6** / **2024**		
ULVAC, Inc.		
Approved by	Checked by	Written by
27568 2023.11.07 間嶋	27890 '23. 11. 06 小川(慶)	39191 '23.11.06 長田(智)

Due date of the specification return: Please return one copy with signature of the person in charge. If no return is obtained by the date above, we will comprehend that this specification is accepted.

Advanced Electronics Equipment Division

ULVAC, Inc.

Format No. : Q6660Y0109-13E
Document No.: QA21-0090-0-D-021/04

History of Revisions

Rev. No.	Symbol	Date	Description	Approved by	Checked by				Written by
01		Dec.20.2021	Newly issued	Mashima				Suzuki	Osada
02	Rev.02	Jun.17.2022	Delivery Specification is issued. Change Manufacturing No. from QA21-0090-0 to MA21-0111-0. 2.1.2-④ add 13slot cassette 2.1.3-⑩ add 13slot cassette, add transportable wafer thickness 3.1.1 revise a part of test method 3.1.2 revise a part of test method 3.1.5 revise flow rate of test method 3.1.6 add test item 3.3.2 add test item 3.4.2 delete a part of explanation 3.5.1 revise item name 4.4 revise items for Customer's Scope of Supply 5.1.2-①,②,④ revise weight value of some component 5.4 correct some utility value 6.1 revise standard of Safety 10.1 revise to "Removal or Disuse of the Product" 10.2,10.4 revise section name	Mashima		Kamimura	Hirota	Mashima	Osada
03	Rev.03	May.16.2023	1.3 add comment for L3 related unit. 2.1.5, 4.1.5, 4.2.4 add comment for L3 related units 2.3 Exclude training 2.4 Revise SECS/GEM specification. 3.1 Exclude the TEST at customer plant. 3.3.2 correct RF calibration to "not conducted" at ULVAC plant 4.4 delate wafers to be used in SAT(at Customer plant) 5. add comment 7.1 revise scope of quotation 8. revise acceptance condition	Kamimura			Hirota	Yamamoto	Osada

Format No. : Q6660Y0109-13E
Document No.: QA21-0090-0-D-021/04

04	Rev.04	Nov.06,2023	1.3, 2.1.5, 4.1.5, 4.2.4 remove the note about upgrade to NE-7800 using L3	27568 2023.11.07 間嶋					39191 '23.11.06 長田(智)

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9. WARRANTY

10. REMARKS

1. PURPOSE

1.1 Purpose

This is an ISM (Inductively Super Magnetron) dry etching system.
The main application is for semiconductor production and experiments.

1.2 Size of Substrate

①. Wafer size
- ☐ 4 inch wafer (OF JEITA)
- ☐ 6 inch wafer (OF JEITA)
- ☑ 8 inch wafer (Notch JEITA)

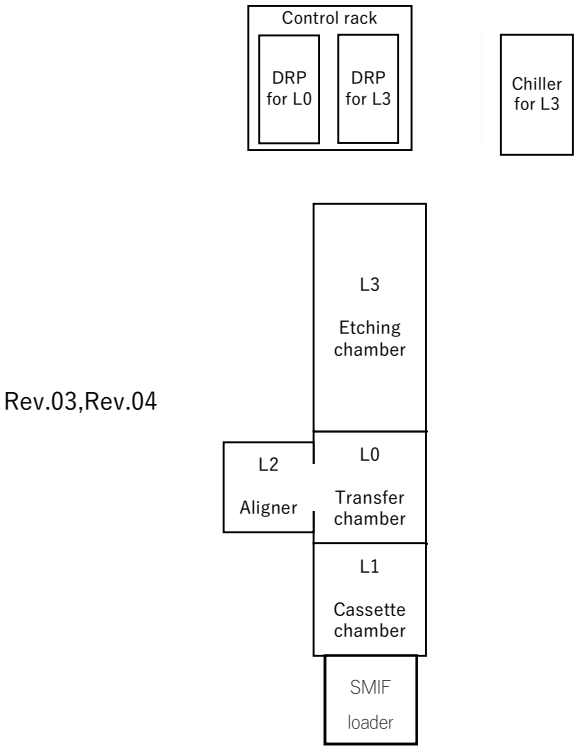
1.3 System Overview

This system has the following structure.

Module		Spec.	Pumping	Stage temp. control	Other system
L0	Transfer chamber	Rectangular core	DRP		
L1	Cassette chamber	25 Slot Cassette	DRP Shared with L0		SMIF loader
L2	Aligner	Wafer drop type			
L3	Etching chamber	STD	TMP+DRP	Chiller He assisted	Control Rack
L4					

[Schematic diagram]

(Other system)
- Chiller for electrode cooling (for L3)
- DRP (for L0)
- DRP (for L3)
- Control / Power supply rack



Rev.03,Rev.04

2. SPECIFICATION

2.1 System Description

2.1.1 L0 module

①. This module is equipped with a transfer module (Transfer chamber) equipped with a vacuum transfer system. The transfer chamber is a rectangular made of Al alloy, and it is possible to mount up to two process modules.

②. A transfer system is mounted in the center of the transfer chamber, and the wafer can be transferred between modules in a vacuum. The maximum payload of the transfer system is 2000g (including trays and end effectors).

③. Equipped with N2 gas piping and vent valve for chamber vent. The gas piping is made of SUS and is equivalent to UJR fittings (made by Fujikin). The vent valve is a smooth vent valve with a slow vent function.

④. Equipped with a Pirani vacuum gauge and an atmospheric check switch for checking the pressure inside the chamber.

⑤. The maximum transferable wafer size is Φ200 mm (8 inch wafer), and the corresponding wafer size can be selected from the following specifications.

- ☐ 4 inch wafer (OF JEITA)
- ☐ 6 inch wafer (OF JEITA)
- ☑ 8 inch wafer (Notch JEITA)

⑥. The rough valve is equipped with a flow rate two-step control valve with a slow rough function.

⑦. Equipped with a dry pump for rough exhaust. The vacuum piping that connects the main body and the dry pump is attached only within the range that can be installed within the range of W 2000 mm x D 4000 mm including the main body and ancillary equipment (dry pump, control rack, chiller).

⑧. The front of the main body is covered with a panel, which supports partitions (Please contact us for installation).

⑨. A gas connection port is provided on the right side of the device. In this specification, the following gas connection ports are prepared.

- ☑ N2 for vent
- ☐ Ar for process
- ☐ O2 for process
- ☐ N2 for process
- ☑ He for substrate cooling

⑩. It is possible to attach a grounding rod for static elimination of the high-voltage charging part as an option.

- ☐ Without grounding rod
- ☑ With grounding rod (Option)

⑪. As an option, an exhaust duct for process chamber maintenance (corrosive gas compatible specifications) can be installed.

- ☐ Without Maintenance duct
- ☑ With Maintenance duct (Option)

2.1.2 SMIF loader

①. The system equips SMIF loader that is set in front of the cassette chamber.

②. Operators set SMIF pod including wafer cassette manually onto the stage of SMIF loader.

③. SMIF loader open the SMIF pod then transfer wafer cassette into cassette chamber by transfer system automatically.

④. It can be used dedicated cassette.

- ☑ 8inch 25slot or 13slot cassette compatible with SMIF pod

Rev.02

2.1.3 L1 module

①. This module is equipped with a cassette module (cassette chamber). The cassette chamber is made of stainless steel.
②. The transfer chamber and cassette chamber are separated by an isolation valve.
The system equips vacuum cassette chamber. Operators set cassette manually into cassette station.
③. Manually open and close the front door of the cassette chamber to handle the cassette.
④. The cassette stage can be moved up and down by the elevating mechanism to select any slot.
⑤. The wafer and cassette are detected by the wafer detection sensor and the cassette detection switch.
⑥. Equipped with N2 gas piping and vent valve for chamber vent. The gas piping is made of stainless steel and UJR fittings (made by Fujikin). The vent valve is a smooth vent valve with a slow vent function.
⑦. The rough valve is equipped with a flow rate two-step control valve with a slow rough function.
⑧. Use a dry pump for rough exhaust. The dry pump is shared with the transfer chamber. The vacuum piping that connects the main body and the dry pump is attached only to the same floor.
⑨. Equipped with a Pirani vacuum gauge and an atmospheric pressure switch for checking the pressure inside the chamber.
⑩. The wafer cassette can be selected from the following specifications.
☐ Metal cassette for ϕ100 mm (4 inch wafer)
☐ Metal cassette for ϕ150 mm (6 inch wafer)
☐ Metal cassette for ϕ200 mm (8 inch wafer)
☑ Other (8inch 25slot or 13slot cassette compatible with SMIF pod) Rev.02
*Wafers(including MEMS coupon) 400-600um will be in 25 slot cassette,
*Wafers(including MEMS coupon) 600-800um will be in 13 slot cassette
⑪. A dummy cassette can be installed as an option.
☑ Without dummy cassette
☐ With dummy cassette (option)

2.1.4 L2 module

①. This module is equipped with an alignment module (aligner). The alignment chamber is made of Al alloy. The alignment module does not come with an exhaust system (vacuum pump, pressure gauge). Also, there is no mechanism to separate the aligner from the transfer chamber.
②. The aligner drops into the wafer guide for centering and detects orientation flats or notches.
③. Equipped with a wafer lifting mechanism for transferring the wafer to and from the vacuum transfer system.
④. Equipped with a window for a checking the inside of the chamber.

2.1.5 L3 module Rev.03, Rev.04

①. The process chamber is equipped with a module for the etching process using an ISM plasma source.
②. The transfer chamber and the etching chamber are separated by isolation valve.
③. The top plate has a structure that allows it to rise and turn, making it easy to access and maintain the inside of the chamber.
④. The upper electrode part and the lower electrode part are covered with a shield box.
⑤. L3 module is equipped with a wafer lift mechanism for transferring the wafer to and from the vacuum transfer system.
⑥. L3 module is equipped with gas piping and gas valve for process gas supply and chamber vent. The gas piping is made of stainless steel and UJR fittings (made by Fujikin). The vent valve is a smooth vent valve with a slow vent function.
⑦. Gas introduction equipment such as gas valves and mass flow controllers (MFCs) are housed in gas boxes. The gas box has a connection port for exhausting the housing.
⑧. It is equipped with a gas regulator and a pressure controller with a mass flow meter as a He gas supply device to the wafer stage.

⑨. Rough valve is equipped with a flow rate two-step control valve equipped with a slow rough function.
⑩. L3 module is equipped with a bake heater for heating the chamber.
⑪. The structure makes it easy to replace the shield plate. The shield plate is equipped with a bake heater for heating.
⑫. The side of process chamber is equipped with a viewing window for checking the discharge. Equipped with a discharge confirmation sensor.
⑬. The process chamber equipped with a diaphragm gauge, Pirani vacuum gauge, cold cathode gauge and atmospheric pressure switch for checking the pressure inside the chamber.
⑭. The shield plate has an opening for transporting the wafer. A shutter can be attached to the opening. A shutter heater can be attached to the shutter as an option.
☐ Without shutter heater
☑ With shutter heater (Option)
⑮. The exhaust system is equipped with a turbo molecular pump (TMP) and a pendulum pressure control valve (APC). APC and diaphragm gauge allow pressure adjustment during the process. The TMP, APC and fore valve are equipped with a heater.
⑯. An end point detector can be installed as an option.
☑ Without end point detector
☐ Plasma process monitor / C10346 (Option)
☐ Real Time Interferometric Process Monitor (Manual stage) (Option)
⑰. As an option, it is possible to install an atmosphere introduction valve for maintenance after using corrosive gas.
☑ Without Atmospheric introduction valve
☐ With Atmospheric introduction valve (Option)
⑱. The system is equipped with a wafer temperature control function that includes a chiller and a He gas introduction mechanism, and can be controlled according to the process.
The temperature setting range of the chiller can be selected from the following specifications.
☑ cooling chiller (-20°C～+40°C)
☐ cooling chiller (+20°C～+90°C)
☐ Heating chiller (+70°C～+200°C)
*The set temperature is the temperature control range of the circulating fluid, not the wafer temperature itself.
*Before operating the chiller, make sure that the circulating fluid is filled in the specified amount.
*For circulating fluid, check the instruction manual of the chiller before making a selection.
⑲. The gas system consists of a gas box system and can be equipped with up to 8 gas lines, and stop valves are equipped each gas lines.
⑳. The gas system is equipped with a mass flow controller (MFC) for adjusting the process gas flow rate. See Section 4-1 for MFC full scale and compatible gas types.
㉑. The wafer holding mechanism can be selected from the following specifications.
☐ Mechanical chuck
☑ ESC (Electrostatic chuck)
㉒. An antenna is placed on the upper electrode. The RF power supply installed in the antenna section is 1000W / 13.56MHz.
* Actual applicable power varies depending on the process conditions.
㉓. A substrate bias mechanism is placed on the lower electrode. The RF power supply installed in the substrate bias section has a different frequency from the RF power supply for the antenna. The maximum output of the RF power supply can be selected from the following specifications.
☐ Maximum output 1000W (12.5MHz)
☑ Maximum output 600W (12.5MHz)
☐ Maximum output 300W (12.5MHz)
☐ Maximum output 1000W (400kHz)
㉔. It is equipped with a dry pump for rough exhaust and as an auxiliary pump for turbo molecular pumps. The vacuum piping that connects the main body and the dry pump is attached only to the same floor.

2.2 Exterior color

①. Painting color of the main part: NCS-S-1005-R80B
②. Purchase components such as vacuum pump and vacuum valve are the standard color of the maker.

2.3 Training

Note: This revised specification does not include the following training(2.3.1~2.3.3). Rev.03

2.3.1 GPCS operation system (Standard required days: 0.5 day)
ULVAC describes how to operate GPCS (name of the controller used for system control) with reference to the operation manual.
For details of the training, refer to the training menu submitted separately.

* Training beyond the standard required days above is outside the scope of the quotation. If necessary, contact ULVAC in advance. ULVAC will submit a separate quotation. (Paid work)

2.3.2 Maintenance (Standard required days: 0.5 day)
ULVAC describes periodical maintenance works related to system operation performed by the customer, such as replacement of the film-deposited parts with reference to the maintenance manual. For details of the training, refer to the training menu submitted separately.

* This training does not include transfer system teaching and parts replacement other than the above.
* Training beyond the standard required days above is outside the scope of the quotation. If necessary, contact ULVAC in advance. ULVAC will submit a separate quotation. (Paid work)

2.3.3 Safety training
In order to use the device safely, we will explain based on the user safety training items specified by us.
For details of the training, please refer to the training menu submitted separately.

* Training for more than the above standard required days is out of the estimated range. If necessary, please let us know your request in advance. We will submit a separate quotation. (Paid work)

2.4 Optional Functions

2.4.1 Communication interface
①. SECS/GEM Rev.03
This specification includes SECS/GEM following the Standard On-line Equipment Communication Specification(MA21-0111-0-J-151/05) discussed with LGD.

3. PERFORMANCES

3.1 Vacuum performances

Rev.03

Measurements are made when no work is loaded, and the chamber is clean at room temperature.

3.1.1 Ultimate pressure

[Presence/Absence of test and how to confirm the test result]

✔: Test is conducted/－: Test is not conducted

ULVAC plant			Customer plant		
Test	Data submission	Witness test	Test	Data submission	Witness test
✔	✔	✔	－	－	－
Measuring equipment, Required equipment, etc. ・Cold cathode gauge ・Pirani gauge					

[Guaranteed value]

①. L0 / L2 module Transfer chamber 10 Pa or lower
②. L1 module Cassette chamber 10 Pa or lower
③. L3 module Etching chamber 1.0×10^{-3}Pa or lower

[Measurement conditions/Testing method]

Chamber temperature must be 20-30 degrees C.
Chamber cleaning must be done prior to pumping down the chamber.
The process chamber is heated to 50 degrees C for more than 5 hours and is pumped for more than 12 hours continuously.
No wafer and no cassette loaded in the chamber.

Rev.02

3.1.2 Pressure build-up

[Presence/Absence of test and how to confirm the test result]

✔: Test is conducted/－: Test is not conducted

ULVAC plant			Customer plant		
Test	Data submission	Witness test	Test	Data submission	Witness test
✔	✔	－	－	－	－
Measuring equipment, Required equipment, etc. ・Cold cathode gauge ・Pirani gauge					

[Guaranteed value]

①. L0 / L2 module Transfer chamber 1.0×10^{-3}Pa・m^3/sec or lower
②. L1 module Cassette chamber 1.0×10^{-3}Pa・m^3/sec or lower
③. L3 module Etching chamber 5.0×10^{-5}Pa・m^3/sec or lower

[Measurement conditions/Testing method]

Chamber temperature must be 20-30 degrees C.
No wafer and no cassette loaded in the chamber.

Rev.02

After ultimate pressure is confirmed, the build-up is measured by the vacuum gauge attached to the system after the valve is closed and 10 min elapsed.

3.1.3 Pumping time

[Presence/Absence of test and how to confirm the test result]

✔: Test is conducted/－: Test is not conducted

ULVAC plant			Customer plant		
Test	Data submission	Witness test	Test	Data submission	Witness test
✔	✔	－	－	－	－
Measuring equipment, Required equipment, etc. ・Cold cathode gauge ・Pirani gauge					

[Guaranteed value]

①. L0 / L2 module Transfer chamber　　Within 10 minutes from ATM to 10 Pa or lower
②. L1 module Cassette chamber　　Within 10 minutes from ATM to 10 Pa or lower
③. L3 module Etching chamber　　Within 10 minutes from ATM to 2.7×10^{-3} Pa or lower

[Measurement conditions/Testing method]

Vent to atmospheric pressure with dry N2, leave at atmospheric pressure for three minutes then pump down the chamber with the auto pump-down function. The state while keeping at atmospheric pressure is described below;

The Transfer chamber and Etching chamber cannot be opened to atmosphere after venting.
The Cassette chamber is opened the door.

Chamber temperature of 20-30 degrees C, after cleaning.
The cold cathode gauge and Pirani gauge are used to measure pressure.
The pump down time includes slow roughing.
No wafer and no cassette is loaded in the chamber.

Rev.02

3.1.4 Gas flow characteristics

[Presence/Absence of test and how to confirm the test result]

✔: Test is conducted/－: Test is not conducted

ULVAC plant			Customer plant		
Test	Data submission	Witness test	Test	Data submission	Witness test
✔	✔	－	－	－	－
Measuring equipment, Required equipment, etc. ・Diaphragm gauge					

[Guaranteed value]

①. L3 module Etching chamber　　Reference Only

[Measurement conditions/Testing method]

Divides MFC maximum flow rate into five and records the chamber pressure to each flow rate

3.1.5 Auto pressure control(APC) Characteristic

[Presence/Absence of test and how to confirm the test result]

✔: Test is conducted/－: Test is not conducted

ULVAC plant			Customer plant		
Test	Data submission	Witness test	Test	Data submission	Witness test
✔	✔	－	－	－	－
Measuring equipment, Required equipment, etc. ・Diaphragm gauge					

[Guaranteed value]

①. L3 module Etching chamber　　Reference Only

[Measurement conditions/Testing method]

Flows 20sccm of Ar into the process chamber and records APC opening level for each pressure setting.　Rev.02

3.1.6 PFC pressure - He flow Characteristic　Rev.02

[Presence/Absence of test and how to confirm the test result]

✔: Test is conducted/－: Test is not conducted

ULVAC plant			Customer plant		
Test	Data submission	Witness test	Test	Data submission	Witness test
✔	✔	－	－	－	－
Measuring equipment, Required equipment, etc. ・PFC unit					

[Guaranteed value]

①. L3 module Etching chamber　　1.0sccm or lower @PFC1000Pa

[Measurement conditions/Testing method]

Wafer : ϕ200mm SiO2 wafer

Records the He flow at each PFC pressure

3.2 Helium leak check

3.2.1 He leak check

[Presence/Absence of test and how to confirm the test result]

✔: Test is conducted/－: Test is not conducted

ULVAC plant			Customer plant		
Test	Data submission	Witness test	Test	Data submission	Witness test
✔	✔	－	－	－	－
Measuring equipment, Required equipment, etc. ・He leak detector　Supplied by the customer					

[Guaranteed value]

①. He leak rate　　5.0×10^{-8}Pa・m^3/sec or lower

[Measurement conditions/Testing method]

Check each seal for leaks in the Etching chamber, Transfer chamber, and Cassette chamber.

3.3 Process performance

3.3.1 Discharge pressure range

[Presence/Absence of test and how to confirm the test result]

✔: Test is conducted/－: Test is not conducted

ULVAC plant			Customer plant		
Test	Data submission	Witness test	Test	Data submission	Witness test
✔	✔	－	－	－	－
Measuring equipment, Required equipment, etc. ・Si wafer 1pc　Supplied by the customer					

[Guaranteed value]
①. L3 module Etching chamber 0.07～6.7 Pa

[Measurement conditions/Testing method]
The operating pressure range is a range in which discharge can be set up in stable condition at a flow rate of Ar gas that can be fed within the range of pumping and pressure control range

3.3.2 RF calibration

Rev.02, Rev.03

[Presence/Absence of test and how to confirm the test result]
✔: Test is conducted/－: Test is not conducted

ULVAC plant			Customer plant		
Test	Data submission	Witness test	Test	Data submission	Witness test
–	–	–	–	–	–
Measuring equipment, Required equipment, etc. ・Power sensor, RF cable, Dummy load Supplied by the customer					

[Guaranteed value]
①. L3 module Etching chamber Reference Only

[Measurement conditions/Testing method]
Disconnect RF cable at the M.Box side.
Connect power sensor to the RF cable from RF generator and connect dummy load by other RF cable from power sensor.
Record power monitor value and calibration parameter at each RF power before and after calibration.

3.3.3 SiO2 Etching uniformity within wafer
[Presence/Absence of test and how to confirm the test result]
✔: Test is conducted/－: Test is not conducted

ULVAC plant			Customer plant		
Test	Data submission	Witness test	Test	Data submission	Witness test
–	–	–	–	–	–
Measuring equipment, Required equipment, etc. ・8 inch SiO2(1000nm)/Si wafer 1 pc Supplied by the customer ・NANOSPEC equivalent ※Prepare the measuring instrument at customer.					

[Guaranteed value]
①. L3 module Etching chamber ±5% or lower

[Measurement conditions/Testing method]
Stage ; Electrostatic chuck
Substrate ; 8 inch SiO2/Si wafer
Process condition ; using ULVAC recommendation condition
Measuring instrument ; NANOSPEC equivalent
Measuring point ; 5 points within wafer described below
*Etched thickness is measured 5 mm inside the periphery at the orientation flat and notch.

The following formula is used to calculate the etching uniformity.
・Within wafer
Uniformity=(A.max-A.min) / (A.max+A.min) X 100 (%)

A.max; maximum value of etched thickness within a wafer.
A.min; minimum value of etched thickness within a wafer.

3.3.4 SiO2 Etching uniformity wafer to wafer

[Presence/Absence of test and how to confirm the test result]

✔: Test is conducted/－: Test is not conducted

ULVAC plant			Customer plant		
Test	Data submission	Witness test	Test	Data submission	Witness test
－	－	－	－	－	－
Measuring equipment, Required equipment, etc. ・8 inch SiO2(1000nm)/Si wafer 3 pc Supplied by the customer ・NANOSPEC equivalent ※Prepare the measuring instrument at customer.					

[Guaranteed value]

①. L3 module Etching chamber ±5% or lower (Continuous 3 wafer processing)

[Measurement conditions/Testing method]

Stage ; Electrostatic chuck
Substrate ; 8 inch SiO2/Si wafer
Process condition ; using ULVAC recommendation condition
Measuring instrument ; NANOSPEC equivalent
Measuring point ; 5 points within wafer
*Etched thickness is measured 5 mm inside the periphery at the orientation flat and notch.

The following formula is used to calculate the etching uniformity.

・Wafer to wafer

Uniformity=(B.max-B.min) / (B.max+B.min) X 100 (%)
B.max; maximum value of average value of etched thickness within 3 wafers..
B.min; minimum value of average value of etched thickness within 3 wafers.

3.4 Etching performance for L3 module

3.4.1 Chuck temperature uniformity within wafer

[Presence/Absence of test and how to confirm the test result]

✔: Test is conducted/－: Test is not conducted

ULVAC plant			Customer plant		
Test	Data submission	Witness test	Test	Data submission	Witness test
✔	✔	－	－	－	－
Measuring equipment, Required equipment, etc. ・8 inch TC wafer 1 pc Prepared by ULVAC					

Performance of below items are checked on customer site.

[Guaranteed value]

①. Temperature uniformity < +/- 3 degrees C

[Measurement conditions/Testing method]

Stage ; Electrostatic chuck
Substrate ; 8 inch TC wafer
Process condition ; under vacuum, no plasma

Measuring instrument ; TC
Measuring point ; 5 points within wafer
*TC measuring point are 10 mm inside the periphery at the orientation flat and notch.

The following formula is used to calculate the chuck temperature uniformity.
・within wafer
Uniformity=(D.max-D.min) / 2 degrees C
D.max; maximum value of temperature within a wafer.
D.min; minimum value of temperature within a wafer.
D.mean; mean value of temperature within a wafer.

3.4.2 Mechanical particle test

[Presence/Absence of test and how to confirm the test result]
✔: Test is conducted/－: Test is not conducted

ULVAC plant			Customer plant		
Test	Data submission	Witness test	Test	Data submission	Witness test
－	－	－	－	－	－
Measuring equipment, Required equipment, etc. ・8 inch blanket Si wafer 1 pc Supplied by the customer ・Tencol equivalent ※Prepare the measuring instrument at customer.					

Mechanical particle test of below items are checked on customer site.

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[Guaranteed value]
①. Particle adders <20 particle adders size > 0.3um

[Measurement conditions/Testing method]
Substrate ; 8 inch blanket Si wafer
Substrate conditions : Initial particle number <10 particle size >0.3um
Transfer conditions ; pumpdown, transfer into chamber, clamping, flow gasses, transfer out
Measuring instrument ; Tencol equivalent
Measuring area ; EE 5mm inside the periphery at the orientation flat and notch.

3.4.3 Photo resist Etching Performance within wafer

[Presence/Absence of test and how to confirm the test result]
✔: Test is conducted/－: Test is not conducted

ULVAC plant			Customer plant		
Test	Data submission	Witness test	Test	Data submission	Witness test
－	－	－	－	－	－
Measuring equipment, Required equipment, etc. ・8 inch blanket photo resist wafer 1 pc Supplied by the customer ・NANOSPEC equivalent ※Prepare the measuring instrument at customer.					

Etching performance of below items are checked on customer site.
Details of the specifications will be decided after the demo result are obtained .

[Guaranteed value]
①. Etching Rate > 100nm/min
②. Etch uniformity ≦ +/-5%

[Measurement conditions/Testing method]
Stage ; Electrostatic chuck
Substrate ; 8 inch blanket photo resist wafer
Process condition ; using ULVAC recommendation condition
Measuring instrument ; NANOSPEC equivalent
Measuring point ; 17 points within wafer
*Etched thickness is measured 5 mm inside the periphery at the orientation flat and notch.

The following formula is used to calculate the etching uniformity.
・within wafer
Uniformity=(C.max-C.min) / (C.mean X 2) X 100 (%)
C.max; maximum value of etched thickness within a wafer.
C.min; minimum value of etched thickness within a wafer.
C.mean; mean value of etched thickness within a wafer.

3.4.4 Wafer handling test
[Presence/Absence of test and how to confirm the test result]
✔: Test is conducted/－: Test is not conducted

ULVAC plant			Customer plant		
Test	Data submission	Witness test	Test	Data submission	Witness test
✔	✔	－	－	－	－
Measuring equipment, Required equipment, etc. ・8 inch blanket Si wafer 100 pcs Supplied by the customer					

Wafer handling test of below items are checked on customer site.
Details of the specifications will be decided after the demo result are obtained .

[Guaranteed value]
①. Total 1000 wafers run No faults

[Measurement conditions/Testing method]
Substrate ; 8 inch blanket Si wafer
Transfer conditions ; transfer in, N2 flow, pump down, return
*Total 1000 wafers test with in-house and on-site.

3.5 Component action

3.5.1 Automatic/Interlock operation Rev.02
[Presence/Absence of test and how to confirm the test result]
✔: Test is conducted/－: Test is not conducted

ULVAC plant			Customer plant		
Test	Data submission	Witness test	Test	Data submission	Witness test
✔	✔	－	－	－	－
Measuring equipment, Required equipment, etc. ・SiO2 wafer 1pc Supplied by the customer					

[Guaranteed value]
①. Perform automatic operation and check that it operates normally

[Measurement conditions/Testing method]
Confirm that the interlock works according to the interlock list.

<Precautions>
When there is no particular instruction in performance check at the time of contract, the tests will be conducted in accordance with ULVAC standard.
Please note that the cost and delivery date may change if you instruct the performance check after the contract.
The performance check is conducted to confirm that each unit works properly and the specified basic performance is satisfied.
Therefore, the tests based on the customer's usage conditions (condition settings) are excluded.
Please note that if the substrates, process gas, and testing equipment required to acquire the acceptance test data cannot be prepared, the acquisition of data for the test items may be excluded from the acceptance conditions.

4. CONPONENTS DESCRIPTION

4.1 Components

4.1.1 L0 module

①. Transfer chamber

a)	Transfer chamber	1set
b)	Transfer system	1set
c)	Wafer sensor	1set
d)	Rough valve	1set
e)	Vent valve	1set
f)	Atmospheric pressure check switch	1set
g)	Pirani vacuum gauge	1set
h)	Dry pump	1set
i)	Vacuum pipe	1set

4.1.2 SMIF loader

①. SMIF loader

a)	SMIF pod stage	1set
b)	Cassette present sensor	1set
c)	SMIF pod cover lifting mechanism	1set
d)	SMIF pod with compatible 8inch wafer cassette (supplied by customer)	1set
e)	Robot arm for picking up and placing wafer cassette	1set
f)	Static-dissipative plastic windows	1set

4.1.3 L1 module

①. Cassette chamber

a)	Cassette chamber	1set
b)	Auto door	
c)	Cassette elevating mechanism	1set
d)	Wafer cassette for 8 inch wafer compatible with SMIF pod (supplied by customer)	1set
e)	Isolation valve	1set
f)	Rough valve	1set
g)	Vent valve	1set
h)	Atmospheric pressure switch	1set
i)	Pirani vacuum gauge	1set
j)	Dry pump	Shared with L0 module
k)	Vacuum pipe	1set

4.1.4 L2 module

①. Aligner

a)	Alignment chamber	1set
b)	Alignment mechanism	1set
c)	Wafer sensor	1set

4.1.5 L3 module Rev.03, Rev.04

①. Process chamber

a)	Etching chamber	1set
b)	Chamber opening and closing mechanism	1set
c)	Deposition shield (Made of aluminum, anodic oxidation treatment)	1set
d)	Deposition shield heater (Max 200°C)	1set
e)	Deposition shield glass	1set
f)	Deposition shield shutter (Made of aluminum, anodic oxidation treatment)	1set

☐ Without heating mechanism
☑ With heating mechanism (MAX200°C)

g) Plasma monitor for RF discharge confirmation 1set
h) Atmospheric pressure switch 1set
i) Pirani vacuum gauge 1set
j) Diaphragm gauge 1set
k) Cold cathode gauge 1set
l) Automatic Pressure Control (APC) valve 1set
m) Endpoint monitor 1set
☑ Without End point detector
☐ Plasma process monitor/C10346 (Option)
☐ Real Time Interferometric Process Monitor (Manual stage)(Option)
n) Isolation valve 1set
o) Rough valve 1set
p) Vent valve 1set

②. Upper electrode
a) RF power supply (1kW 13.56MHz) 1set
b) Automatic matching box (13.56MHz) 1set
c) Antenna coil 1set
d) Upper electrode Shield box 1set
e) Star electrode 1set
f) Capacitor for star electrode 1set
g) Star electrode switching mechanism 1set

③. Lower electrode
a) RF power supply 1set
☐ Maximum output 1000W (12.5MHz)
☑ Maximum output 600W (12.5MHz)
☐ Maximum output 300W (12.5MHz)
☐ Maximum output 1000W (400kHz)
b) Automatic matching box 1set
c) Lower electrode shield box 1set
d) Vpp monitor 1set
☑ Max 5kV sensor (Standard)
☐ Max 1kV sensor
e) Wafer holding system 1set
☐ Mechanical chuck
☑ Electrostatic chuck
f) Wafer hoist mechanism 1set

④. Gas system
a) Mass flow controller 4sets
b) Process gas inlet valve 4sets
c) Process gas pipe 1set

No.	Calibration gas	Max flow N_2 Gas conversion	Bypass line	Pipe heater	Max flow Actual gas
1	N_2	100			Ar：140.9
2	N_2	100			O2：98.2
3	N_2	100			N2：100
4	N_2	200			CF4：84.6

5	-	-	-	-	-
6	-	-	-	-	-
7	-	-	-	-	-
8	-	-	-	-	-

⑤. Temperature control system

a) Chiller 1set
- ☑ —20～+40°C
- ☐ +20～+90°C
- ☐ +70～+200°C

b) Circulating liquid 1set
- ☑ Galden (HT-135)(−20～+40°C)
- ☐ Galden (HT-270)(+70～+200°C)
- ☐ Other

c) Pressure flow controller 1set

d) He inlet pipe 1set

e) Regulator for He gas 1set

⑥. Exhaust system

a) Turbo molecular pump (TMP) (Heating type) 1set

b) Dry pump 1set

c) TMP fore valve (Heating type) 1set

d) Vacuum pipe 1set
- ☑ Without heating mechanism
- ☐ Customer supply

4.1.6 Others

①. Control system

a) PLC 1set

b) Touch panel monitor 1set

c) PC 1set

d) Electrical components 1set

e) Control panel (Built in Mani body) 1set

②. Compressed air

a) Filter regulator 1set

b) Compressed air piping 1set

③. Panel, Flame

a) Main flame 1set

b) Panel 1set

c) Signal tower 1set

4.2 Spare parts

4.2.1 L0 module

①. Pick up 1pc

4.2.2 L1 module

No items

4.2.3 L2 module

No items

4.2.4 L3 module Rev.03, Rev.04

①. Deposition shield glass	2pcs
②. Deposition shield (1)	2pcs
③. Deposition shield (2)	2pcs
④. Special nut	16pcs
⑤. Shutter	2pcs
⑥. 8inch electrode plate	2pcs

* Details are described in the spare parts list submitted after the design is completed.

4.3 Optional Parts

No items

4.4 Customer's Scope of Supply Rev.02, Rev.03

①. 8 inch SiO2(1000nm)/Si Wafer (Including spare) (for FAT)	25 pcs
②. 8 inch Si Wafer (Including spare) (for FAT)	25 pcs
③. 8 inch PhotoResist(1um)/Si Wafer (for etching test on demo system)	25 pcs
This item to be supplied by the start of production of the system.	
④. 8inch SMIF pod Entegris part # M200-ET2067RF2P (specified by customer)	2 pcs
⑤. 8inch 25slot cassette Entegris part # C126-1776-97C02 (specified by customer)	2 pcs
⑥. 8inch 13slot cassette Entegris part # C126-1780-97C02 (specified by customer)	2 pcs
Above items to be supplied by the start of production of the system (SMIF loader and main system)	

Please prepare the items supplied by the customer by the date specified by ULVAC. If they are delayed, which may affect the system delivery date.
(For the due date, refer to the separate list of the items supplied by the customer.)

5. UTILITY SPECIFICATION

Rev.03

Note.: This chapter is only reference because this system will be not installed at customer's plant.

5.1 Footprint (reference value)

5.1.1 Installation space

①. Main body	: W 1917mm × D 2002mm × H 2251mm
②. Control rack	: W 600mm × D 1000mm × H 2202mm
③. Dry pump for L3 module	: W 370mm × D 770mm × H 453mm (EV-M20N)
④. Dry pump for L0 module	: W 230mm × D 450mm × H 274mm (EV-S20P)
⑤. Chiller for L3 module	: W 380mm × D 870mm × H 950mm (HRZ-010)

* Maintenance area is not included.
* The values listed above are reference values. The final values can be confirmed on the final drawing separately provided after design is completed after order placement.

5.1.2 Weight

①. System	Approx. 1300kg	Rev.02
②. Control rack	Approx. 230kg	Rev.02
③. Dry pump	Approx. 170kg (EV-M20N)	
	Approx. 60kg (EV-S20P)	

④. Chiller Approx. 200kg (HRZ010) Rev.02

* The values listed above are reference values. The final values can be confirmed on the final drawing separately provided after design is completed after order placement.

<Precautions> Dispersion plate
Dispersion plates, etc for load distribution are not included in this system and auxiliary equipment. Please contact ULVAC if you need dispersion plates due to the environment in which the system is installed.

5.2 Usage Environment

This system will work properly in the following environment.

Incoming AC supply	Voltage state voltage 0.9 times to 1.1 times of nominal voltage Frequency: 0.99 times to 1.01 times of nominal frequency continuously or 0.98 times to 1.02 times short time
Ambient air temperature	Temperatures between +20℃ and +35℃
Humidity	humidity does not exceed 50% at a maximum temperature of + 35℃ (with no dew condensation)
Altitude	1000m or less above sea level
Contaminants	Pollution Degree 2 or better
Liquids	System shall NOT be used under the circumstance that water will drip on the system
Radiation	Place not affected by radiation
Vibration	Place where there are no objects that vibrate around.
Transportation and storage A short time(24Hr)	Storage temperatures within a range of +5℃ to +40℃. +40℃
Overvoltage category	Category II

5.3 Safety Interlock

Gemini-200E prepares following three (3) interlocks.
Level A : The same function as EMO, No alarm happens
Level B : All process gas stop, Process stops, all units stop, The system alarm happens.
Level C : Process stops, Evacuation by TMP and dry pumps continue, The system alarm happens

Connect the signals as follows, please.

The alarm from Gas treatment system (Critical situation) should be connected to Level B

The warning from Gas treatment system (Not critical situation) and Gas leakage signal from gas detector should be connected to Level C

5.4 Utility list

Type	Usage	Usage amount/ Usage pressure	Connection	Condition	
Electricity	Motive power	3φ 200V±10V(3W+G) 60Hz Approx. 26KVA	M8	Type A Grounding : M8	Rev.02
Cooling water	DRP for L0(L1) module	Supply: 0.2 to 0.4MPaG Back pressure: 0.05MPaG or lower Differential Pressure: 0.2MPa or higher Flow rate: 1.5 to 3.0 L/min	Water supply: Rc1/4"	Gauge pressure Cooling water temperature: 20 to 30°C No regulator is attached to the system	
			Water drain: Rc1/4"		
	DRP for L3 module	Supply: 0.2 to 0.3MPaG Back pressure: 0.05MPaG or lower Differential Pressure: 0.2MPa or higher Flow rate: 3.0 to 8.0 L/min	Water supply: Rc3/8"	Gauge pressure Cooling water temperature: 20 to 30°C No regulator is attached to the system	
			Water drain: Rc3/8"		
	Chiller For L3 module	Supply: 0.35 to 0.70MPaG Back pressure: 0.05MPaG or lower Differential Pressure: 0.3MPa or higher Flow rate: 15 L/min	Water supply: Rc1/2"	Gauge pressure Cooling water temperature: 10 to 25°C No regulator is attached to the system	Rev.02
			Water drain: Rc1/2"		
Compressed air	Pneumatic drive	0.6 to 0.9MPaG, some amounts Maximum compressed air usage: 38.9Nm3/Hr	Φ8mm Push in joint	Gauge pressure Regulator is attached to the system	
Dry air	Lower shield box (Condensation prevention)	0.02 to 0.03MPaG 15 to 20L/min Dew point : -40°C or lower	Φ8mm Push in joint	Gauge pressure No regulator is attached to the system	
N2 gas	System vent	0.2 to 0.4MPaG	1/4" UJR (male)	Gauge pressure No regulator is attached	
	DRP for L0(L1) module	0.15 to 0.70MPaG Flow rate : 15 L/min	1/4" Swagelok	Gauge pressure Regulator is attached	
	DRP for L3 module	0.15 to 0.70MPaG Flow rate : 45 L/min	1/4" Swagelok	Gauge pressure Regulator is attached	
He gas	Wafer Temperature control	0.1 to 0.4MPaG	1/4" UJR (male)	Gauge pressure Regulator is attached*1	Rev.02
Process gas	Process gas for L3 module	0.05 to 0.10MPaG	1/4" UJR (female)	Gauge pressure No regulator is attached	

Type	Usage	Usage amount/ Usage pressure	Connection	Condition	
Exhaust	Pump exhaust L0(L1) DRP	1.0m^3/min or higher	KF25	Connect to the acid exhaust duct.	Rev.02
	Pump exhaust L3 DRP	1.0 m^3/min or higher	KF40	Connect to the detoxification processing exhaust duct.	
	Pump heat exhaust L0(L1) DRP	1.0 m^3/min or higher	Φ50mm pipe end	Connect to the heat exhaust duct.	Rev.02
	Pump heat exhaust L3 DRP	1.0 m^3/min or higher	Φ50mm pipe end	Connect to the heat exhaust duct.	

	Gas box exhaust for L3 module	1.0 m^3/min or higher	Φ60.5mm pipe end	Hazardous gas treatment equipment to be connected
	Maintenance exhaust	1.0 m^3/min or higher	Φ63.5mm pipe end	Connect to the acid exhaust line.
	Chiller heat exhaust L3	2.0 m^3/min or higher	Φ114.3mm pipe end	Connect to the heat exhaust duct.
	Air (CDA) exhaust	back pressure less than atmosphere	Φ8mm Push in joint	Connect to the general exhaust duct.

Rev.02

The values listed above are reference values. The final values can be confirmed on the final drawing separately provided after design is completed after order placement.

When using chlorine gas, connect the duct to the acid exhaust.

Maintenance duct is required when using chlorine-based gas. Do not install a gas detector at the connection destination of the maintenance duct.

A nylon tube is used for He piping. The acceptance standard value for the amount of leakage from the He pipe due to the permeation of the thin flex tube is set at 6.67 x 10-3 MPa / h.

Power supply and gas supply are on the top of the machine. For details, refer to "Device external view".

If there is a risk that the equipment installation location will be extremely low, high, or humid, please indicate so before making a contract. We will consider countermeasures, but if there are some devices that cannot be used depending on the conditions, the estimated price may differ.

For equipment that requires cooling water, prepare water quality that meets the water quality standards of the "cooling water system" of the Water Quality Guidelines for Refrigerating and Air-Conditioning Equipment (JRA-GL-02-1994: Japan Refrigerating and Air-Conditioning Industry Association).
(Must meet the following water quality standards)

(Based on JRA-GL-02-1994) * Circulating water standard

LIST		Cooling Water
Baseline Item	pH(25 deg C)	6.5 to 8.2
	Electrical Conductivity (μS/cm) Resistivity (kΩ・cm)	10 to 800 1.25 to 100
	Chloride ion (mg/l)	200 or less
	Sulfate ion (mg/l)	200 or less
	M alkali level (mg/l)	100 or less
	Total hardness (mg/l)	200 or less
	Calcium hardness (mg/l)	150 or less
	Ionized silica (mg/l)	50 or less
Reference Item	Fe (mg/l)	1.0 or less
	Cu (mg/l)	0.3 or less
	Sulfide ion (mg/l)	Undetectable
	Ammonium ion (mg/l)	1.0 or less
	Chlorine residual (mg/l)	0.3 or less
	Free carbonic acid (mg/l)	4.0 or less
	Stability index	6.0 to 7.0

5.5 Earthing

①. Type-A grounding work (No. 1 type earth: Earth with grounding resistance of 10Ω or lower) is required.
According to "Laws for Electrical Engineering and Electrical Facility Management," this system is classified as high-voltage equipment, Type-A grounding work must be conducted for safety.
②. Type-D grounding work (No. 3 type earth: Earth with grounding resistance of 100Ω or lower) is required.

5.6 Installation environment

①. If the installation area has possibility of getting extremely cold or hot, please provide such information before signing the contract.
②. ULVAC will examine the countermeasures; however, some components cannot be used under a certain condition. In this case, quotation amount may be changed.
③. Please contact ULVAC regarding the connecting sections of the partitions.
④. When organic material is used, it may scatter around the system during maintenance.
⑤. Countermeasures to this issue is not included in this quotation and shall be taken by the customer.

6. SAFETY

6.1 Standards

Rev.02

This system complies with the following regulations.

① S-mark third party authentication

② KCs autonomous (Robot)

This system incorporates the contents of bellow check sheet agreed with the factory where the system is installed.

① "장비안전평가 Check Sheet_r6.0_v0.1_v0.1_20220107ULVAC 回答.xlsx"

* Please contact ULVAC in advance if you need to comply with the customer's safety standards. Otherwise, ULVAC will make a separate quotation and charge a fee for the items not informed in advance.

6.2 Safety measures (excerpts of major parts only)

6.2.1 Emergency stop

An emergency stop button is provided on this system and the control panel at intervals of approx. 3 meters. When this emergency button is pressed, all electrical systems stop.

6.2.2 High voltage section

The energized section exceeding 24V is covered with a panel, etc. so that it cannot be easily touched.

6.2.3 High-temperature section

The high-temperature section exceeding 60°C is covered with a panel, etc. so that it cannot be easily touched.

6.2.4 Movable section

The movable section is covered with a panel, etc. so that it cannot be easily touched.

6.2.5 Electrical leakage measures

All electrical systems are stopped by an earth leakage breaker in case of an electrical leakage.

6.2.6 Other control system

Control system is designed as to be operated with 24 VDC or lower.
(All breakers excluding the main breaker are installed in the power supply panel.)

6.3 Unit protection (excerpts of major parts only)

6.3.1 Unit that requires cooling water

The unit cannot be activated when amount of cooling water is lower than the specified flow rate.
(ex. dry pump, turbo molecular pump, cryo compressor, etc.)

6.3.2 Action in case of power failure or water outage

In case of power failure or water outage, the pumps stop and the valves close.
(The door valves remain in a condition right before the power failure or water outage occurred.)
This system does not recover automatically, and manual startup is necessary.

6.3.3 Compressed air

When compressed air pressure is insufficient, the system cannot start.

6.3.4 Power supply

Each power supply can be safely turned ON under the determined conditions only.
For example, the sputtering power supply can be turned ON only when the sputtering chamber is in a vacuum and the process gas is flowing.

For other power supplies, refer to the interlock list separately provided.

6.3.5 Gas

Each gas can be safely used under the determined conditions only.
For example, process gas of the sputtering chamber can be flown only when the sputtering chamber is in a vacuum and the main valve is open.

6.3.6 When the inside of the chamber is hot or cold

The chamber cannot open when the chamber temperature is higher than the specified temperature.

6.3.7 Parameters set on the system

At the start of the system, the parameters are set based on the parameter list submitted separately, but this is not always optimized. Set the optimum parameter values when using the system.

6.4 Signal tower

This system has a three-color light (signal tower) to indicate system status.
The height of signal tower is at least 1.8 meters from ground. (customer's request)
Details of signal lighting follow the customer's specifications. Please provide lighting specifications for ULVAC in advance.
If you do not provide the lighting specifications by the start of the design, ULVAC will use our standard specifications.
If you request lighting specification change after the start of the fabrication, ULVAC will make a separate quotation and charge a fee.

7. SCOPE OF QUOTATION

7.1 Scope of quotation Rev.03

This quotation includes Item 2 (Specifications), Item 3 (Performances), Item 4 (List of Components) and design, fabrication, assembly, test, witness test at ULVAC, terms of trade FCA (to designated warehouse in Japan).
Not includes installation, assembly and test-run (vacuum performance check, transfer check and Auto operation check) at the customer's site.

7.2 Exclusions of quotation

①. Foundation works and building works
②. Electrical wiring work at the primary side and wiring materials (Customer's facility to operation panel, Grounding work)
③. Cooling water piping work at the primary side and pipes (Customer's facility to this system)
④. Compressed air piping work at the primary side and pipes (Customer's facility to this system)
⑤. Gas piping work at the primary side and pipes (Customer's facility to this system)
⑥. Exhaust duct work at the pump exhaust side and pipes
⑦. Clean air inlet work 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 required for installation, assembly, test-run and witness test at the customer's site
⑪. Targets and substrates necessary for witness test and test-run at the customer' site and at the ULVAC's site
⑫. Works, parts, and spare parts not described in Item 4 (List of Components)

⑬. Cost for crane operation during carry-in (This quotation does not include crane operation, but carrying for 30m.)
⑭. Cost for complying with customer's safety standards when they are provided after the quotation is submitted
⑮. Cost for disposal of this system
⑯. Costs for load dispersion plates and floor reinforcement work
⑰. Cost for partition installation
⑱. Second and subsequent training (for the contents other than those described in Item 2)
⑲. Failure of the item supplied by the customer and failure caused by the item supplied by the customer
⑳. Other items not described in this specification

7.3 AVAILABLE DOCUMENT

①. Delivery specification *1	Normal paper 2 pc
②. System diagram and layout drawing (Final system drawing) *1	Normal paper 2 pc
③. Main parts maintenance drawing, Parts list	PDF file (electric data)
④. Operation manual	PDF file (electric data)
⑤. Test report	PDF file (electric data)
⑥. Difference list *2	

*1 For the delivery specification and final system drawing, sign the document and return 1 piece out of 2 pieces. Please return the final system drawing within one week after the drawing is delivered. When the drawing is not returned within one week, delivery of the system might be delayed.

*2 The difference list shows the differences in the units between the existing system and the same model of the system.
Basically, the system has the same units as the existing system, however they may be changed due to production discontinuation or other unavoidable reasons.
In this case, the changed units are listed on the difference list.

8. ACCEPTANCE CONDITION Rev.03

This system is to be finally accepted when the followings are confirmed.
①. Confirmation of the performances described in Item 3 (section3)
②. Confirmation the system have been delivered to the designated warehouse in Japan.

9. WARRANTY

ULVAC, Inc. (hereinafter "ULVAC") shall provide the following warranty to the Buyer with regard to the quality of the equipment manufactured and sold by ULVAC (hereinafter the "Equipment") and ULVAC shall make no other warranty.

9.1 Warranty

①. The ULVAC warrants that the Equipment conforms to the specification described herein (hereinafter the "Specification"), provided that the Buyer shall use the Equipment in accordance with the conditions specified in handling or maintenance manuals, and other manuals, data or documents, including Customer Support News, which may be provided by ULVAC from time to time before or after the installation of the Equipment (hereinafter collectively the "Manuals") and subject to the User's Liability provided for in Clause 2. For the avoidance of any doubt, the Equipment herein does not mean any individual part composing the Equipment nor the Consumable Parts as defined below, but means the whole of the Equipment.

②. As such warranty, ULVAC shall, at its own expense, repair the Equipment and/or compensate the Buyer for its loss or damage resulting from the Defect in case it does not conform to the Specification (such non-conformity of the Equipment, hereinafter the "Defect"), during one (1) year from the date of the acceptance (i.e. the date on which ULVAC and the Buyer confirmed that the Equipment satisfied the acceptance criteria described in ULVAC's Acceptance Document) unless otherwise agreed by the Buyer and ULVAC in writing. Such repair shall aim to eliminate the Defect and make the Equipment conform to the Specification If the system does not have the performances described in this specification during warranty period, ULVAC will repair the system without charge.
③. Consumables are not included in this warranty.

9.2 User's Liability

The Buyer shall cause its operators of the Equipment to carefully read the Manuals and take operation training provided by ULVAC. The Buyer shall strictly observe such items as may be designated as "danger", "warning", or "with care" in particular. Also, the Buyer shall comply with any applicable laws, regulations or standards established by the national or local governments, or other public authorities in relation to the safety and health, environmental sanitation, or the like.
In no event shall ULVAC be liable for any Defect if such Defect results from the Buyer's failure to comply with this Clause 2.

9.3 Exclusion

Notwithstanding Clause 1 above, ULVAC shall not provide any warranty for such Defect as shall be attributable to any of the following cases:
①. Any parts, modules or components provided by any party other than ULVAC or the third party designated by ULVAC.
②. Any force majeure event including fire, earthquake, and other natural disasters.
③. Unusual physical or electrical stress, noise, erroneous operation, accidental events, and/or other events or matters which are directly or indirectly beyond the control of ULVAC.
④. Any modification or alteration of the Equipment (including modification of software) made without prior written consent of ULVAC.
⑤. Any repair or reconditioning by any party other than ULVAC or the third party designated by ULVAC.
⑥. Any operation, adjustment, or maintenance which is not in accordance with the Manuals or not described in the Manuals, or any other operation, adjustment, or maintenance deviating from ULVAC's recommendation, designation or instruction.
⑦. Any use of any material, gas or other process substance which is not recommended or instructed to use by ULVAC.
⑧. Any matters which cannot be recognized on the basis of scientific or technical knowledge of the time of delivery.
⑨. Any equipment or parts which ULVAC does not warrant, or which the Buyer procured.
⑩. Any equipment for pre- or post-process of the Equipment, or any utilities which ULVAC does not provide.
⑪. Any relocation without prior written consent of ULVAC.
⑫. Any erroneous or improper operation, maintenance or other works by the operator of the Equipment.
⑬. Any modification, change, or alteration of the Manuals made by any party other than ULVAC.
⑭. Any failure or omission by the Buyer of periodic replacement of any parts which are separately designated by ULVAC as periodic replacement parts in writing.

9.4 Limitation of liability

①. Notwithstanding anything to the contrary provided herein, the aggregate liability of ULVAC to the buyer arising out of or in connection with the defect of the equipment shall not exceed the price of the equipment.

②. In no event shall ULVAC be liable for any indirect or secondary loss, damage or expenses, future losses which may arise out of or in connection with the defect of the equipment, including, but not limited to, any defective product manufactured by the equipment or degrease of productivity of the equipment.
③. Any cost or expenses for consumable parts, periodical replacement parts , and any parts for maintenance and any cost or expenses for labor or transportation for replacement which may be incurred during and after the Warranty Period shall be borne by the Buyer.

9.5 Disclaimer on intellectual property right

①. ULVAC represents, to the best of its knowledge, that the Equipment will not infringe any intellectual property right of any third party. In case any third party claims that the Equipment itself infringes that party's patent, ULVAC will, at its own discretion, obtain a license, modify the Equipment, or otherwise make best efforts for the Buyer to be able to continue using the Equipment. Subject to Clause 5. 2) below, ULVAC shall indemnify, protect and hold harmless the Buyer from any damages and expenses arising from the infringement of a third party's patent by the Equipment, except in the case such infringement is caused by the Buyer's designation, instruction or requirement. Provided, however, that (a) ULVAC shall have the sole right to appoint attorney(s) at its own responsibility and expense, and (b) any costs or expenses for investigation by the Buyer, attorney's fee incurred by the Buyer, Buyer's labor costs or personnel expenses, or any compensation for damages or settlement payment the Buyer paid to the third party without prior consent of ULVAC shall not be reimbursed by ULVAC.
②. The Buyer shall promptly notify ULVAC in writing of any third party's claim of infringement against the Buyer, and shall assist ULVAC to deal with such claim.
③. The aggregate costs and expenses to be borne by ULVAC subject to Clause 5. 1) above shall not exceed the total price of the Equipment.
④. Notwithstanding Clause 5.1) through 5.3) above, ULVAC shall not be liable for any infringement of intellectual property rights in relation to the usage or utilization of the Equipment, or product manufactured by the Buyer or patents of manufacturing method.
⑤. ULVAC shall assume no liability or responsibility with respect to any infringement of intellectual property of a third party by the Equipment other than those which are specifically provided for herein.

10. REMARKS

10.1 Relocation or Disuse of the Product

Rev.02

Dismantling, disabling or scrapping of the product are excluded from this specification.
In this case, please contact us or your nearest ULVAC Customer Service Center.
And, the product in the meaning of this passage includes its appurtenances, annexed documents and / or media, etc. attached to, as well as the product in itself.

10.2 Regarding Product Export

Rev.02

If you export this system from Japan, please contact ULVAC and take necessary procedures in accordance with foreign exchange and foreign trade law.

10.3 Other items not described in this specification

For the items not described in this specification, the contents shall be decided after separate discussion between the two parties. The decisions made there shall be signed by both parties and stored with this specification. The units used in this system listed in this specification are subject to change due to improvements in the system and model changes of the units used.

10.4 Regarding Radio Equipment

Rev.02

If RF power supply is used in the system, usage of this system is controlled by “Radio Law”, and application and permission to/from Bureau of Telecommunications are necessary.

10.5 Contamination

This system does not guarantee the contamination values such as metallic contamination.