SINCE 1889

Yamato

CE

SPRAY DRYER
ADL312SC

- Version 1 -

- Thank you for purchasing " Spray Dryer, ADL312SC" of Yamato Scientific Co., Ltd.
- To use this unit properly, read this "Instruction Manual" thoroughly before using this unit. Keep this instruction manual around this unit for referring at anytime.

⚠WARNING!:

Carefully read and thoroughly understand the important warning items described in this manual before using this unit.

Yamato Scientific Co.,Ltd.

Contents

1. Safety precautions

Explanation of pictograms

About pictograms

A variety of pictograms are indicated in this operating instruction and on products for safe operation. Possible results from improper operation ignoring them are as follows.
Be sure to fully understand the descriptions below before proceeding to the text.

Warning Indicates a situation which may result in death or serious injury (Note 1.)

Caution Indicates a situation which may result in minor injury (Note 2) and property damages (Note 3.)

（Note 1）Serious injury means a wound, an electrical shock, a bone fracture or intoxication that may leave after effects or require hospitalization or outpatient visits for a long time.

（Note 2）Minor injury means a wound or an electrical shock that does not require hospitalization or outpatient visits for a long time.

（Note 3）Property damage means damage to facilities, devices and buildings or other properties.

Meanings of pictograms

This pictogram indicates a matter that encourages the user to adhere to warning (“caution” included).
Specific description of warning is indicated near this pictogram.

This pictogram indicates prohibitions
Specific prohibition is indicated near this pictogram.

This pictogram indicates matters that the user must perform
Specific instruction is indicated near this pictogram.

1. Safety precautions

List of symbols

Warning

General warnings

Danger!: High voltage

Danger!: High temperature

Danger!: Moving part

Danger!: Hazard of explosion

Caution

General cautions

Electrical shock!

Burning!

Caution for no liquid heating!

Caution for water leak!

For water only

Poisonous material

Prohibitions

General bans

Fire ban

Do not disassemble

Do not touch

Compulsions

General compulsions

Connect ground wire

Install levelly

Pull out the power plug

Regular inspection

1. Safety precautions

Warning・Cautions

⚠ Warning

Do not use this unit in an area where there is flammable or explosive gas

Never use this unit in an area where there is flammable or explosive gas. This unit is not explosion-proof. An arc may be generated when the power switch is turned on or off, and fire/explosion may result. (Refer to page 58 “15. List of Dangerous Substances”.)

Always ground this unit

Always ground this unit on the power equipment side in order to avoid electrical shock due to a power surge.

Apply the source of rated power or more

Be sure to apply the source of rated power or more. Applying non-rated voltage or non-rated power supply may cause the fire or electric shock.

Prohibition of use for error

If a smoke or abnormal smell may be occurred, turn off the power switch of the main unit immediately, and turn off the original power source, and finally contact to either the dealer you purchased this unit or our sales office. Leaving the failure may cause the fire or electric shock. Since the repairing of this unit is dangerous for non-specified service person, never repair the unit by the customer himself.

Do not use the power cord if it is bundled or tangled

Do not use the power cord if it is bundled or tangled. If it is used in this manner, it can overheat and fire may be caused.

Do not damage power cord

Do not damage power cord by bending, pulling, or twisting forcedly. It may cause the fire or electric shock. Besides, operating the unit with the something put on the cord may cause overheat, and result in fire.

Never use an explosive or a flammable material with this unit.

Never use an explosive material, a flammable material or a material containing them. An explosion or an electrical shock may result. See section “15. List of Dangerous Substances” on page 58. **Connect ADL312SC with the optional GAS series product to form an enclosed and low-oxygen circulation system, which is able to use the organic solvent sprays without the risk of explosion. When using the organic solvents, pay special attention to their explosion conditions, especially the mixture of multiple organic solvents. Please read the GAS series product instruction manual for operations.**

Never try to touch a hot part.

Some parts of the unit are hot during and immediately after operation. Take special care for possible burning.

Never try to disassemble or alter the unit.

Never try to disassemble or alter the unit. A malfunction, a fire or an electrical shock may result.

1. Safety precautions

Warning・Cautions

⚠ Caution

During a thunder storm

During a thunderstorm, turn off the power key immediately, then turn off the circuit breaker and the main power. If this procedure is not followed, fire or electrical shock may be caused.

If the electric failure shall be occurred

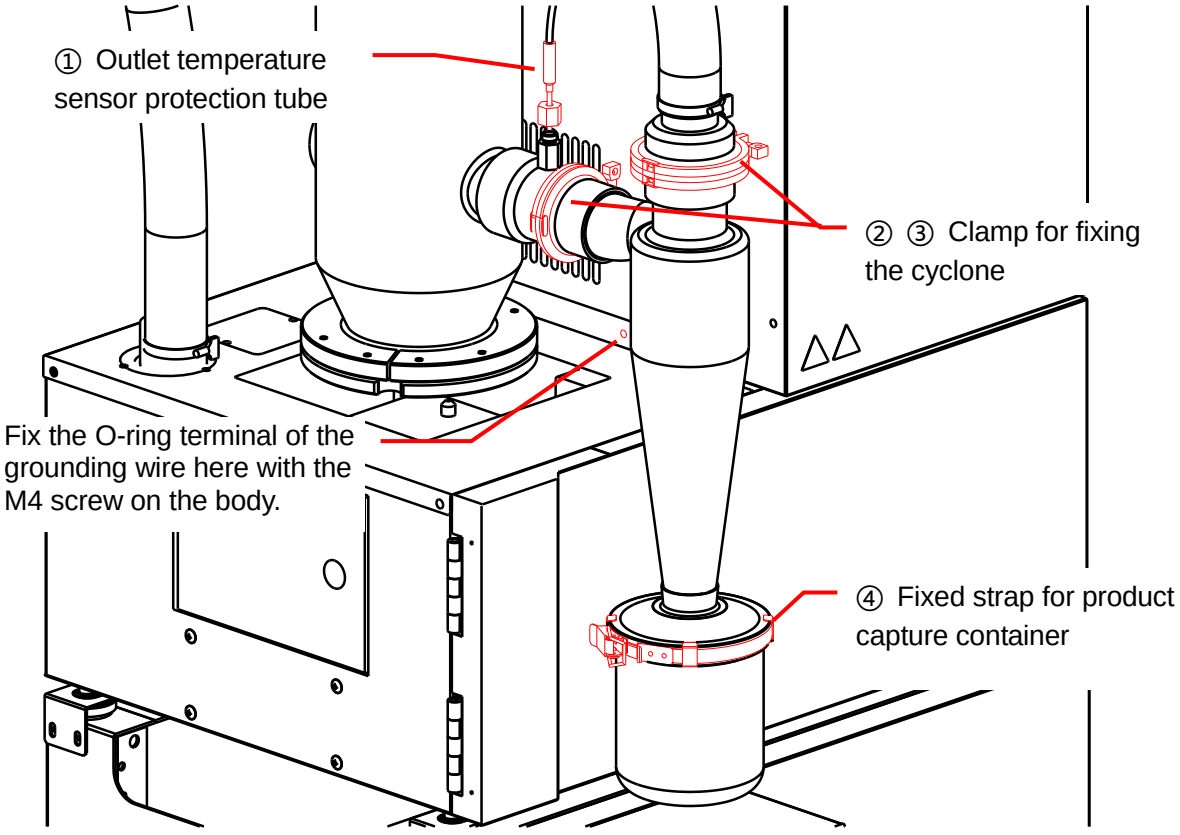
When power is shut off during operation (while the blower is operating or the liquid is being sent) due to turning the ELB to "OFF" or a power failure, all operation modes will reset to the initial states after recovery. When the temperature inside the chamber is higher, keep operating the blower until it cools down to 45℃ or below after recovery from a power failure.

Do not perform unattended operation

Do not perform unattended operation.
After running out of the samples, it will cause idling and nozzle blocking, the outlet temperature will rise, the sample hose will be disconnected from the nozzle and the remaining sample will flow out, which may result in unexpected accident.

About countermeasures against static electricity

The cyclone may be charged with static electricity depending on the samples, operating environment or conditions. Implement countermeasures against static electricity such as installing the accessorial earth clips on the clamp (4 positions) at the connection of the cyclone, or installing an antistatic brush (optional) to the body of the cyclone.



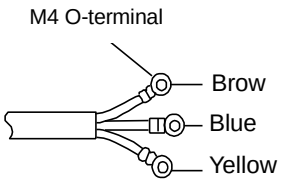
2. Before using this unit

Precautions when installing the unit

⚠ Warning

1. Always ground this unit

- The power supply is single-phase 200-230V～ 50/60Hz. Please entrust the professional personnel of the nearest electrical construction shop or agent to connect the power supply.
- The protection impedance of the machine is 0.5Ω or less. Carry on the grounding construction according to the technical requirements of the electrical equipment at the location of the customer. If the technical requirements are not clear, the construction and acceptance of grounding works according to the grounding resistance of less than 4Ω.
- Be sure to connect the earth wire (the green cable of power cord) to the grounding conductor or ground terminal to prevent accidents caused by electric leakage.
- Do not connect the earth wire to gas or water pipes. If not, the fire disaster may be caused.
- Do not connect the earth wire to the grounding of telephone wire or lightning conductor. If not, the fire disaster may be caused.



Core Wire Color	In-house Wiring
Brown	Voltage Side
Blue	Voltage Side
Yellow green	Ground Side

- Before connecting the power cord, turn off the protection switch on the power supply device.
- This device does not have accessorial plug, please select the plug and terminal that match the power supply capacity according to the connected power supply device.
- Please note the color of each core.

2. Please use a dedicated power supply

Use a power supply that matches the power supply capacity.

Electrical capacity: single phase 200-230V～ 50/60Hz 17-20A (Protection circuit breaker operating current is 25A)

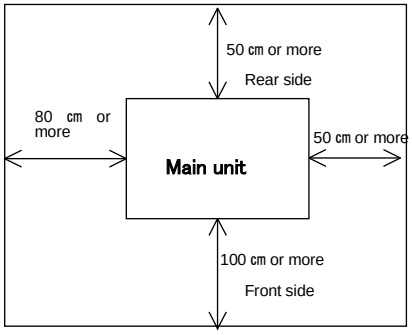
If the power supply is ON, but the equipment does not start, check whether the main power supply voltage is lower or share a power cord with other machines. Please use the power cord separately from other machines. In consideration of the safety of the machine power connection, please entrust the seller, agent or electrical construction shop to carry on.

3. Choose a proper place for installation

Do not install this unit in a place where:

- Rough or dirty surface.
- Flammable gas or corrosive gas is generated.
- Ambient temperature bellow 5℃ or above 35°C.
- Ambient temperature fluctuates violently.
- There is direct sunlight.
- There is excessive humidity and dust.
- There is a constant vibration.
- Place where the water is easy-to-be splashed.

Install this unit on a stable place with the space as shown below.



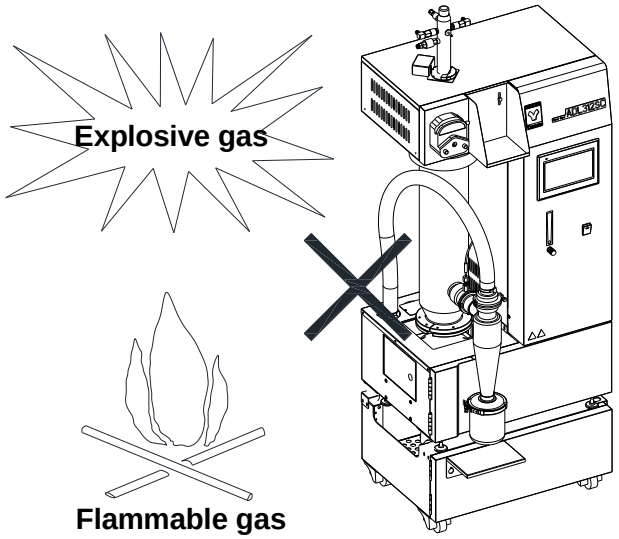
Precautions when installing the unit

Warning

4. Do not use this unit in an area where there is flammable or explosive gas

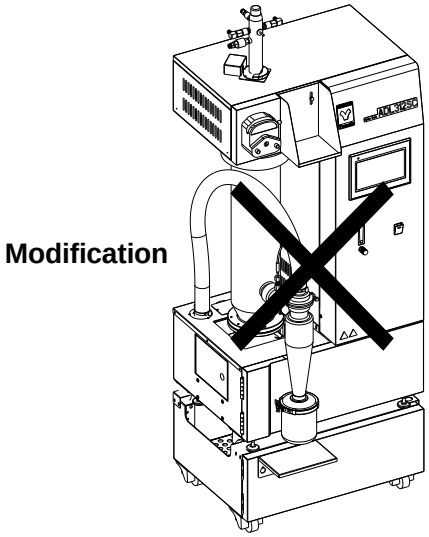
Never use this unit in an area where there is flammable or explosive gas. This unit is not explosion-proof. An arc may be generated when the power switch is turned ON or OFF, and fire/explosion may result.

Refer to page 58 “15. List of Dangerous Substances”.



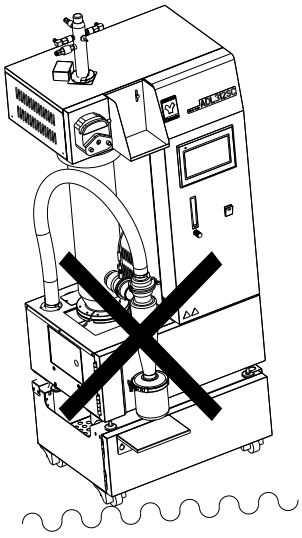
5. Do not modify

Modification of this unit is strictly prohibited. This could cause a failure.



6. Do not topple or tilt this unit

Set this unit to the flattest place. Setting this unit on rough or slope place could cause the vibration or noise, or cause the unexpected trouble or malfunction.



7. Place the unit

Due to sudden earthquake, impact, etc., the product may collapse or move, and then be damaged.

It is best to avoid places where there are many people and take safety precautions.

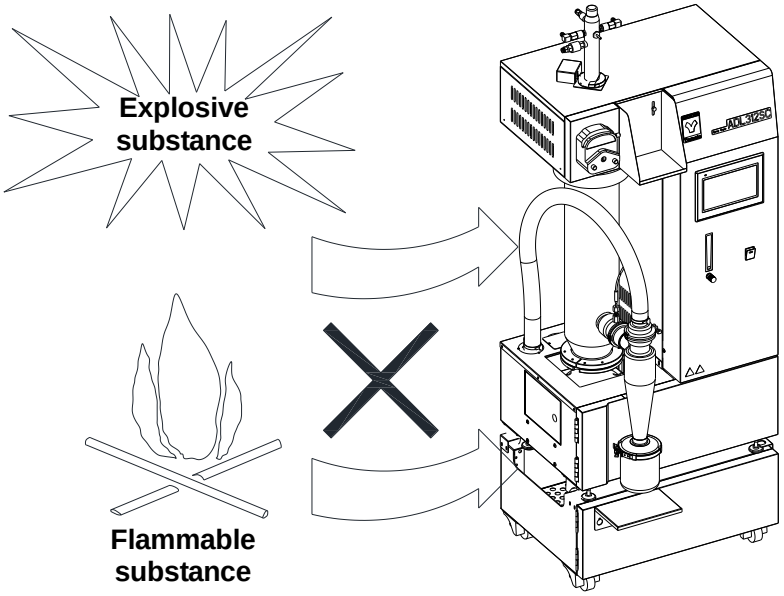
2. Before using this unit

Precautions when installing the unit

⚠ Warning

8. Do not use explosive or flammable substances

Never use explosive substances, flammable substances and substances that include explosive or flammable ingredients in this unit. Explosion or fire may occur. **ADL312SC supports organic solvents by connecting it to the optional GAS series product. Carefully read the operation manual of GAS series product and take special care for handling of organic solvents.** Refer to page 58 “15. List of Dangerous Substances”.



9. Absolutely prohibit the use of toxic or biohazardous substances

This product and GAS are not developed for biosafety purpose, do not have the ability to treat toxic or biohazardous substances, and the use of toxic or biohazardous substances is absolutely prohibited, for example: polychlorinated biphenyls, cyanide, virus or bacteria.

10. Absolutely prohibit the use of substances containing unknown ingredients

The thermal decomposition of ingredients with unknown properties may cause explosion, fire, poisoning or other accidents.

11. Handling of power code

Do not entangle the power cord. This will cause overheating and possibly a fire.

Do not bend or twist the power cord, or apply excessive tension to it. This may cause a fire and electrical shock.

Do not lay the power cord under a desk or chair, and do not allow it to be pinched in order to prevent it from being damaged and to avoid a fire or electrical shock.

Keep the power cord away from any heating equipment such as a room heater. The cord's insulation may melt and cause a fire or electrical shock.

If the power cord becomes damaged (wiring exposed, breakage, etc.), immediately turn off the power at the rear of this unit and shut off the main supply power. Then contact your nearest dealer for replacement of the power cord. Leaving it may cause a fire or electrical shock.

Connect the power plug to the receptacle which is supplied appropriate power and voltage.

2. Before using this unit

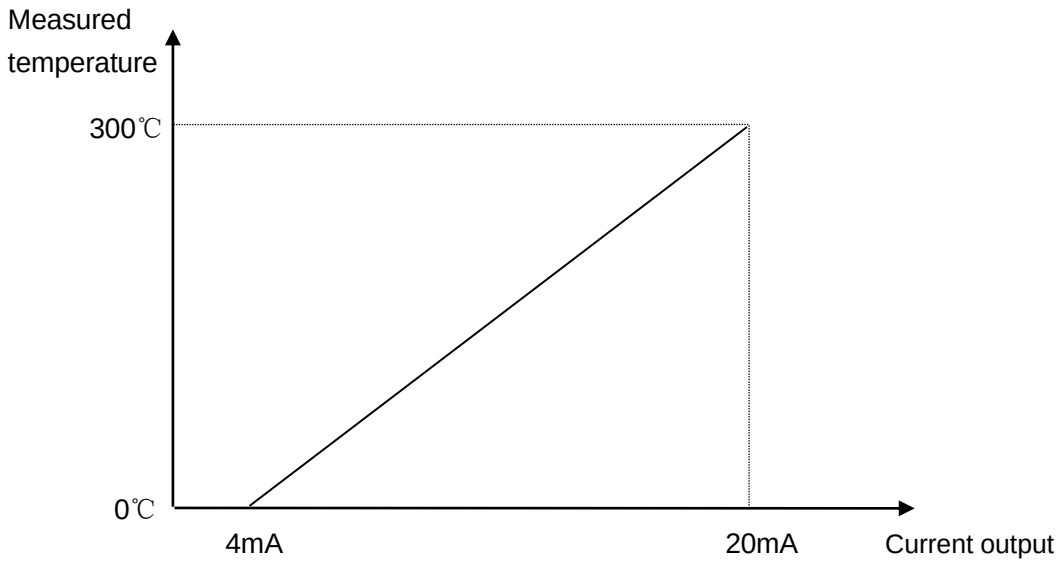
Service receptacle capacity

Apply the 200-230V～ 1A or less service receptacle for this unit.
Connecting the service receptacle with its capacity over 1A blowouts the fuse, and the power source to the service receptacle is shut down.
For resetting, replace the fuse in the fuse holder on the right side of the back of the unit.
If the rated current exceeds 1A, please use another power supply.

Temperature output terminal

The temperature output signals of the Outlet (outlet temperature) and the Inlet (inlet temperature), aiming at the measured temperature 0-300℃, the current output is 4-20mA.

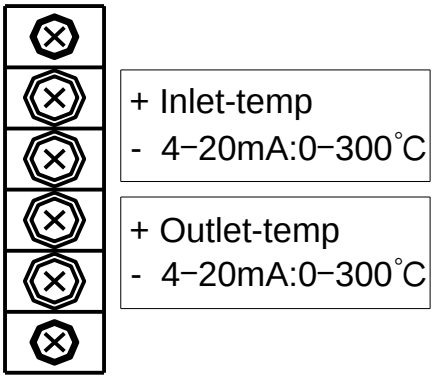
[Current output 4-20mA： Measured temperature 0-300℃]



Conversion formula: Current output I (mA) ＝ Measured temperature T (℃) ÷ 18.75 + 4

Measured temperature T (℃)＝ 18.75 × [Current output I (mA)－ 4]

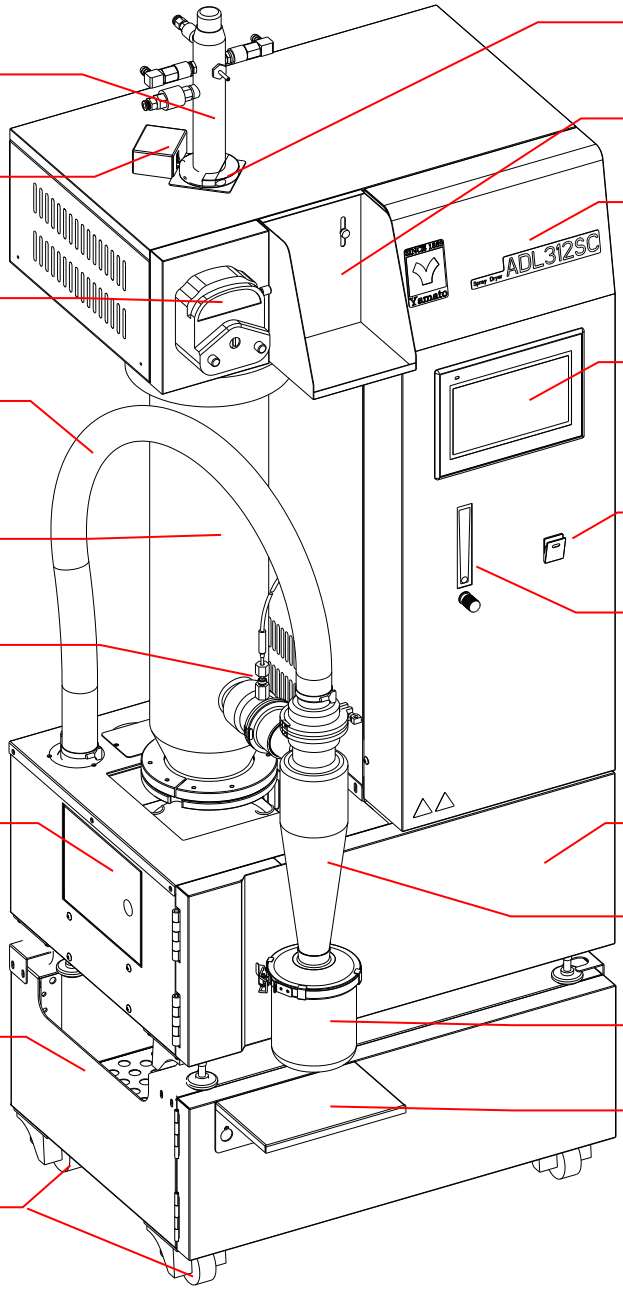
When you connecting to the voltage input of the recorder, connect a fixed resistor (shunt resistor) of 300Ω or lower to the voltage input of the recorder.



3.Names of parts and their function

Main unit + GF301C set

Front side



Spray nozzle

Nozzle detection sensor BOX

Sample liquid-sending pump

Suction hose

Drying chamber

Outlet temperature sensor

Lifter UP/DOWN handle (inside the door)

Stand

Casters (4 positions)

Nozzle locating pin

Sample table

Company name and model label

Operation touch screen

Power switch

Flowmeter of CDA for spray

Blower (inside the door)

Cyclone

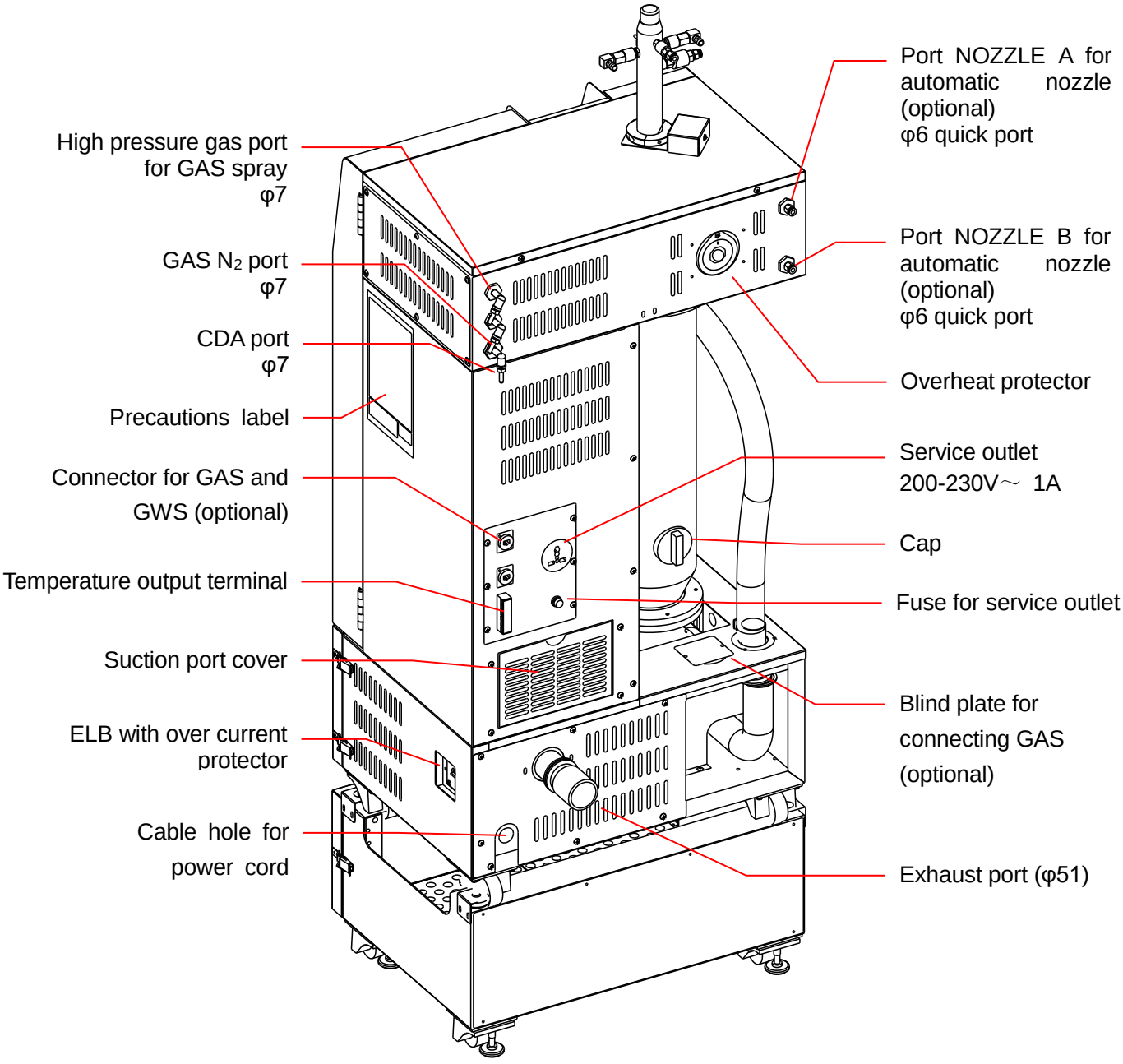
Product collecting container

Tray for product collecting container

3.Names of parts and their function

Main unit + GF301C set

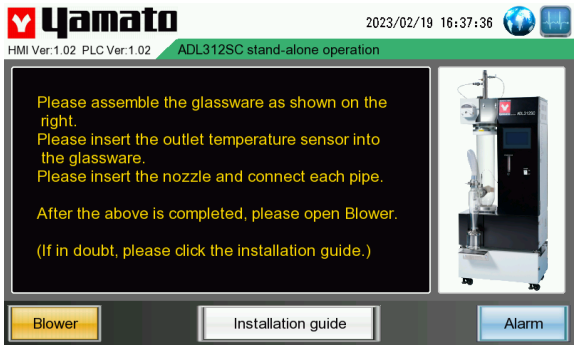
Back side



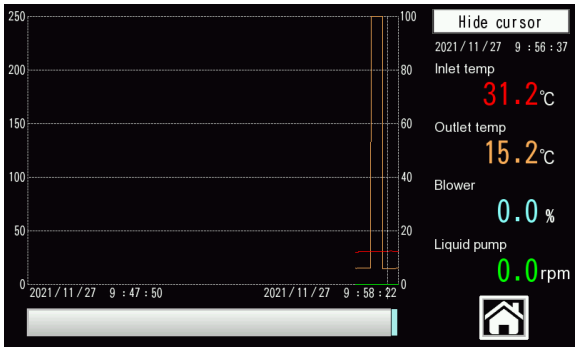
3.Names of parts and their functions

Operation interface overview

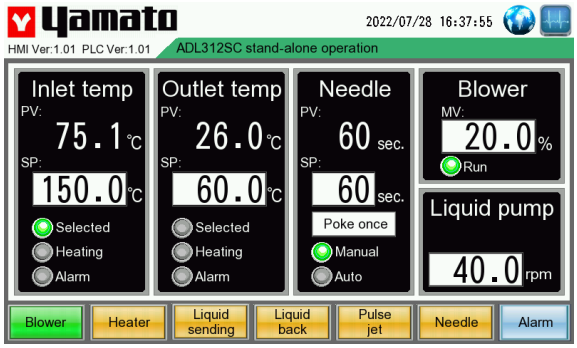
Initial interface



Operation curve interface

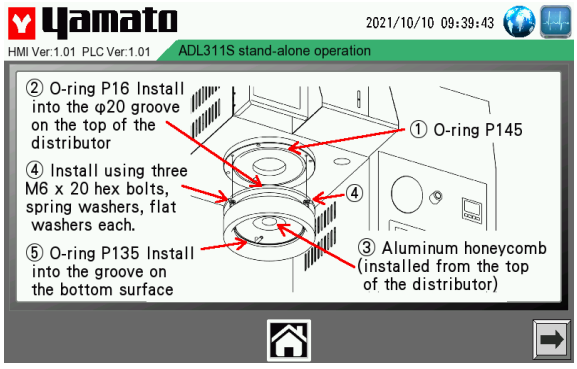


Operation interface

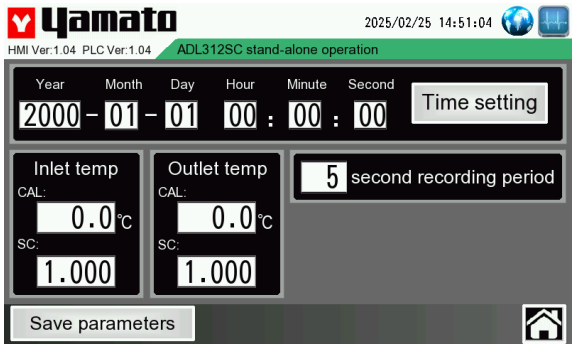


Language selection pop-up interface

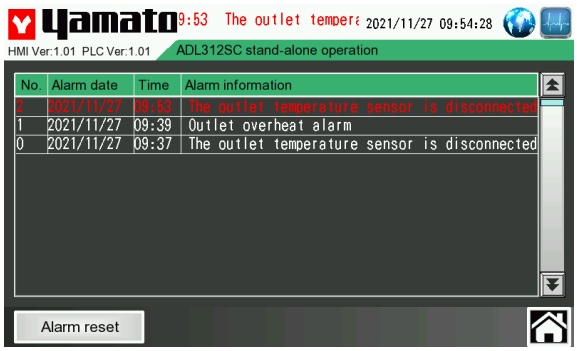
Installation guide interface



System parameters interface



Alarm interface



3.Names of parts and their functions

Description of switch and indicator lamp in the interface

In the operation interface on the touch screen, the action state of each switch button can be confirmed by checking if the indicator lamp is on. The appearance of the switch button is characterized by a button frame inside which is an effective area for operation.

Type 1: Manual operation button

This kind of button is not only a functional switch but also an indicator lamp for the current state of the function. It has only two states of ON/OFF. The operator will switch the state once every time he operates, and the indicator will switch accordingly.

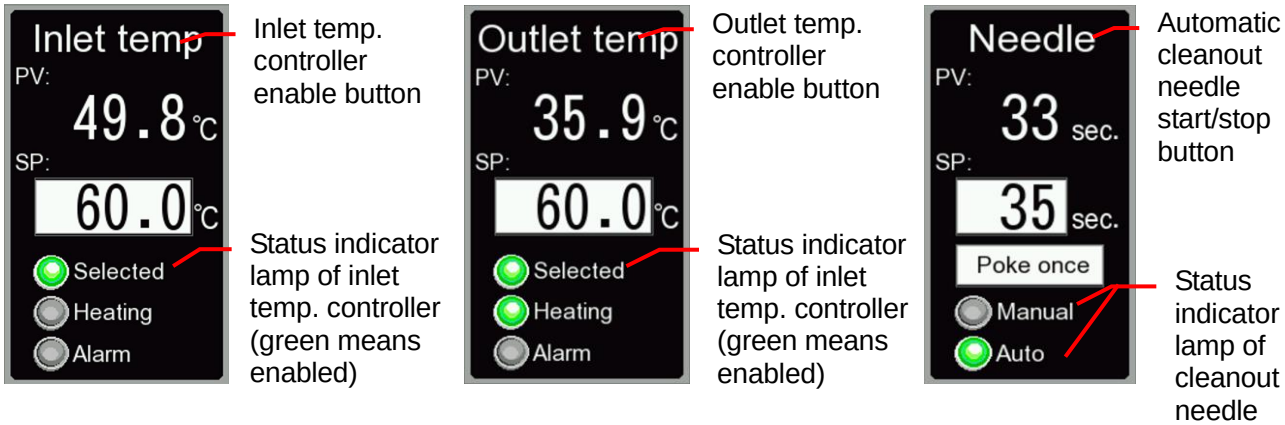
This kind of button has no power-off memory function, and it will be in OFF state after power outage recovery. Its corresponding function can only be activated by the operator.

	Initial state: OFF The temperature controller and heater are not working, and the indicator lamp is in standby state (yellow).
	Click once: the state switches from OFF to ON The temperature controller and heater are working, and the indicator lamp is in operating state (green).
	Click again: the state switches from ON to OFF The temperature controller and heater are not working, and the indicator lamp is in standby state (yellow). The subsequent operations repeat the above actions.

Type 2: Function select button and function enable indicator lamp

This kind of button is only the switch of function, and the usage status of the function is shown by a separate indicator lamp.

This kind of button has power-off memory function, after power outage recovery, will keep the state before power outage. It is characterized by the ability to maintain the last setting of operating parameters.



Type 3: Status indicator lamp

An indicator lamp indicating the current status of each functional unit. This indicator lamp is internal automatic function and has no corresponding switch.

If the indicator lamp is gray or invisible, it indicates that the function is not running. If the indicator lamp is green or visible, it indicates that the function is running. If the indicator lamp is red, it indicates that the function is in the alarm status.

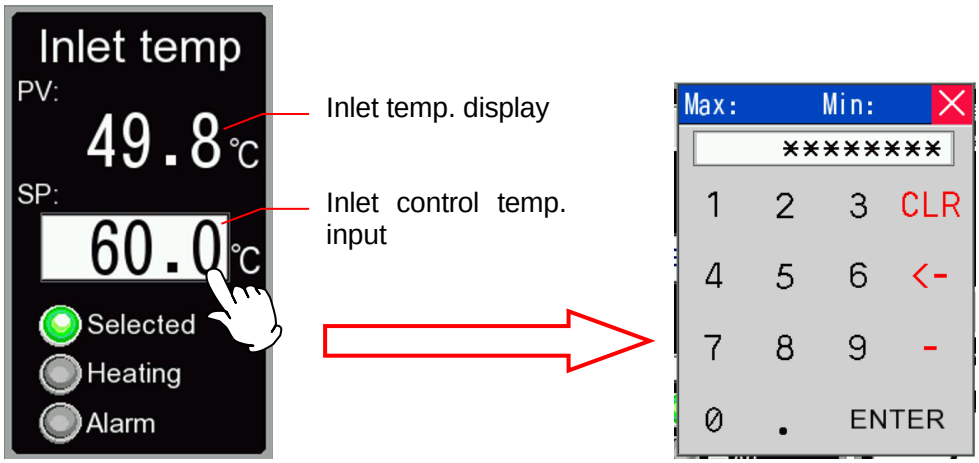
3.Names of parts and their functions

Value display and input description in the interface

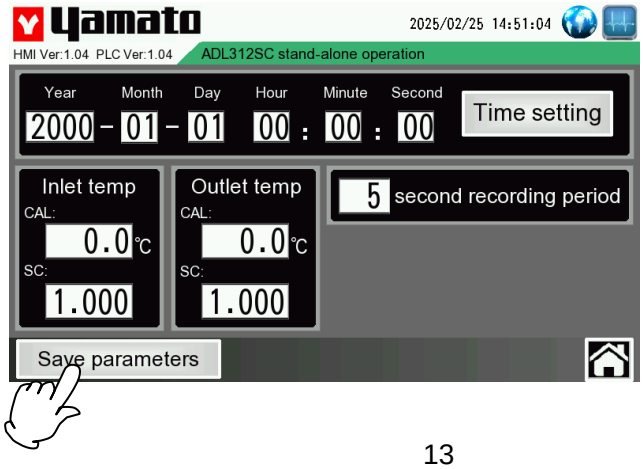
In the operation interface of touch screen, the values can be divided into two types: only display but no input; display and input.

Type 1: Value display
There is no input box for the value display. Its background and the bottom color are the same, and the display value is white.
The value display will display the data in real time. When an alarm occurs, some specific numerical values will change their colors to prompt the operator.
For example, if the temperature exceeds the upper limit allowed by the equipment, the value will change to red; and the danger level of oxygen concentration is displayed in green, yellow and red colors.

Type 2: Value input
There is input box for the value input. Its input box is white, and the display value is black.
Click the white input box to pop up the value input popup. Input the required value and press ENTER button to complete the input.
The value input will display the operator's previous input data in real time. Except for the values used in system setting, the inputs of other values are power-off memory type. The operator only needs to operate once in the initial setting, then no operation is required later as long as the value is not changed. (If it is not used for more than 14 days, data may be lost due to PLC internal power supply exhaustion, and may need to be reset.) ※ In order to keep data for a long time, a button battery can be installed on PLC to provide continuous power for PLC. Please refer to P.40 “About the use of PLC batteries”.



※ Special note: when the data setting in the system parameter interface is completed, click the Save Parameter button in the lower left, the parameters will be saved only after the button turns green. If the modified data is not saved or the equipment is powered off, the data will be restored to the previous data before modification.
Set the system information correctly at the first startup.



4. Operating procedures

PUSH mode installation

The using mode of this unit is divided into standard mode and PUSH mode.
For the differences between the two modes, see P.52 “12. System diagram”. The biggest differences in their uses are as below:

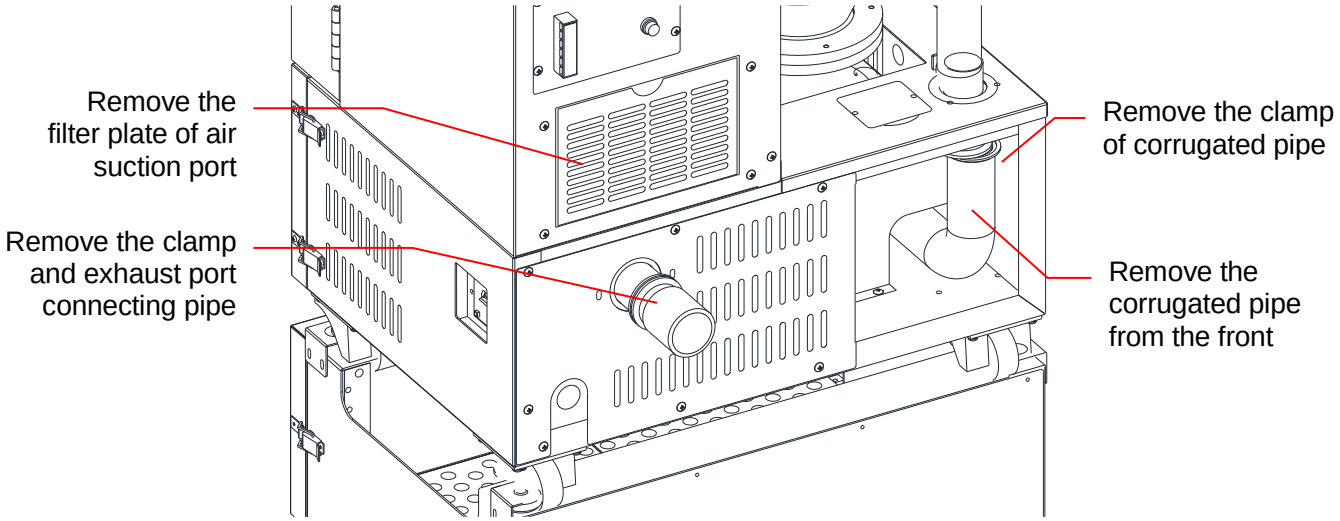
In standard mode, the air in all pipes and glassware is under negative pressure, and the generated hot exhaust gas will pass through the blower.
In PUSH mode, the air in all pipes and glassware is under positive pressure, and the generated hot exhaust gas will not pass through the blower.

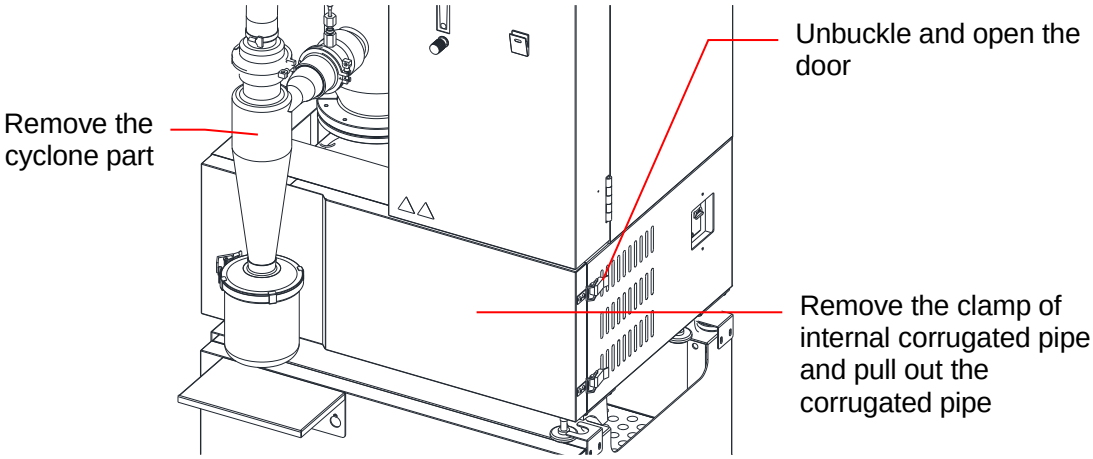
The factory setting of this unit is standard mode, if need to use PUSH mode, please perform the following operations to switch it to PUSH mode during installation.

※ It is not recommended for customer to switch back and forth between the two modes, which may lead to mixed samples.

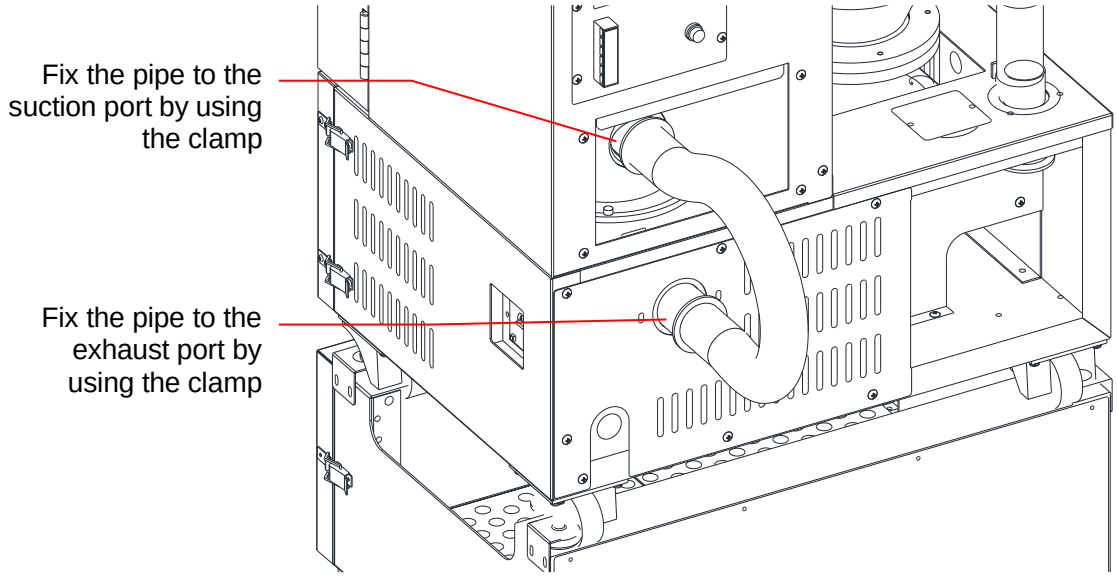
※ After the standard mode is used, if you must switch to PUSH mode, clean the removed pipes and blower filter first, and then check whether there is any foreign matter attached to the blower. If there are foreign matters in the fan blades or air duct of blower, replace the blower components. Otherwise, the attachments of all pipes and fan blades will be blown into the drying chamber and contaminate the samples.

(1) Please remove the filter plate, exhaust port connecting pipe and corrugated pipe according to the following figure.

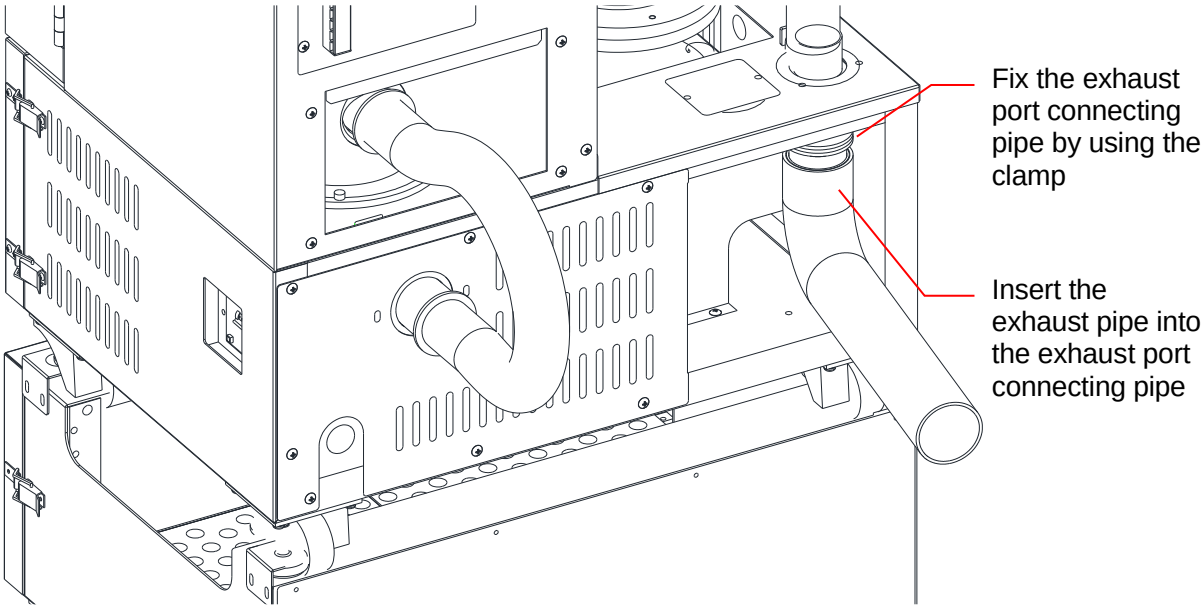




(2) Reassemble the corrugated pipe according to the following figure.



(3) Please reassemble the exhaust port connecting pipe and exhaust pipe according to the following figure.

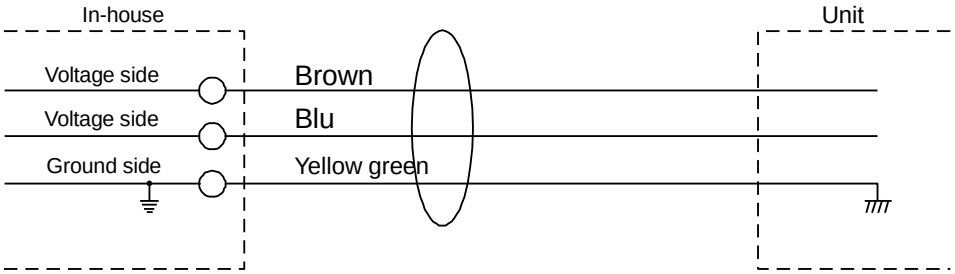


4. Operating procedures

Preparations

(1) Connection of power cord

The power cord of this unit is earthed 3-core including the earth wire, and the yellow green wire must be earthed.



(2) Connection of the exhaust pipe

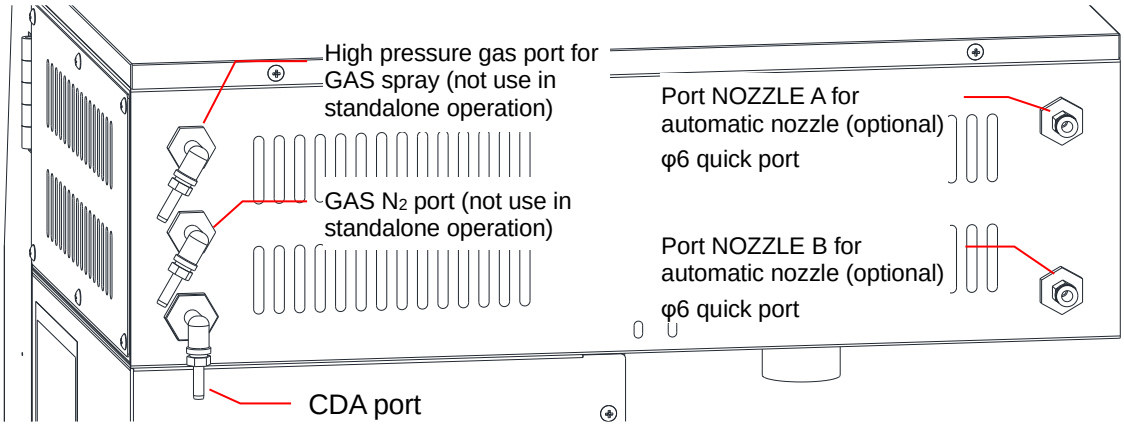
If concerned about the hot air and fine powder discharged from the blower, please connect the exhaust pipe, attached to the exhaust port, to the air pipe and exhaust the gas outdoors.

In consideration of safety and environmental protection, please choose GWS411C cleaning unit to clean and filter the exhaust gas before discharging it outdoors.

If organic solvents or flammable and explosive substances are used, please choose GAS organic solvent recovery unit to carry on closed condensation recovery.

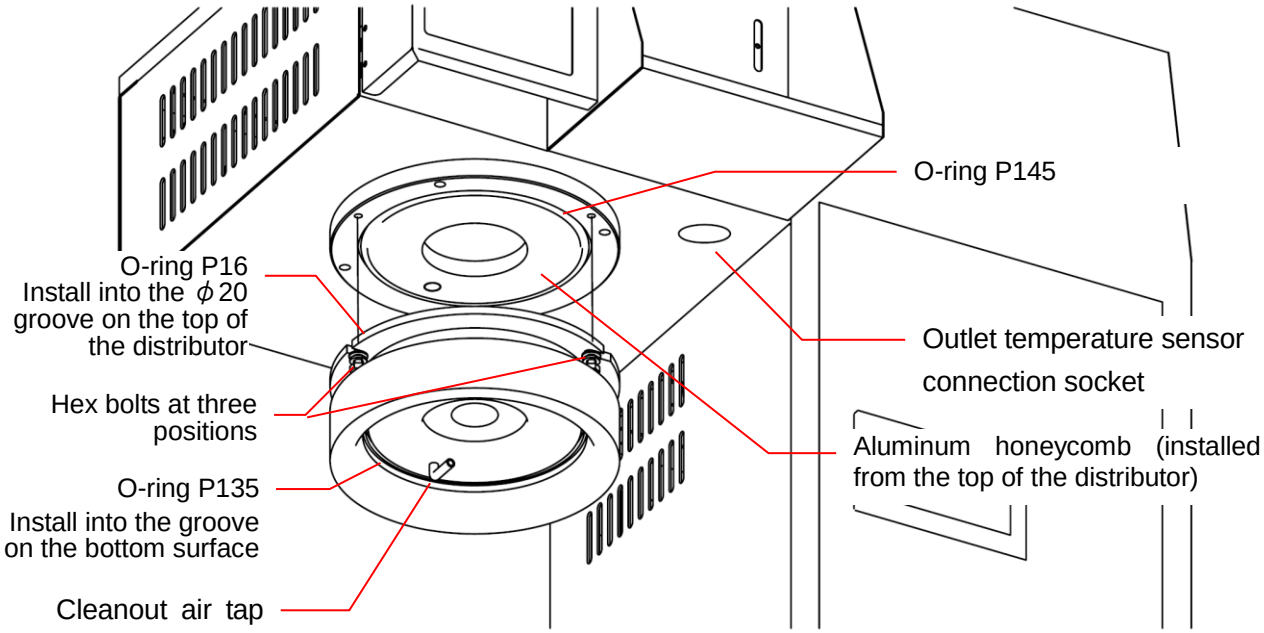
(3) The attached pressure-proof hose is used to connect the port (φ7) on the back of the upper frame with the pressurized air devices such as compressor. Please tighten by using the hose clamp. When using compressor, etc. to provide the pressure air source, use a pressure reducing valve to keep the pressure constant.

※ Please adjust the output pressure of the reducing valve to 0.3-0.6MPa and keep it constant. Using pressure greater than 0.6MPa will damage the pipe. If the pressure is less than 0.3MPa, the automatic nozzle cannot be opened. The non-constant pressure will cause the spraying to form uneven droplets.

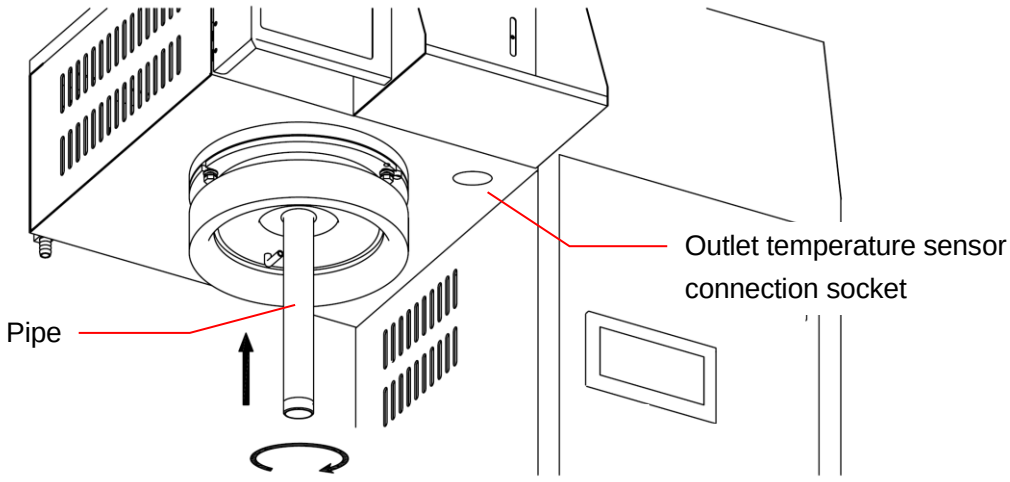


(4) Unpack the glass components and make sure that there is no broken glass or missing items.

(5) Install the distributor and aluminum honeycomb assembly onto the top of the unit.
Install the O-ring P16 into the ϕ20 groove on the top of the distributor.
(install using three M6 x 20 hex bolts, spring washers, flat washers each)



(6) Insert the pipe in the center of the distributor and tighten it clockwise.

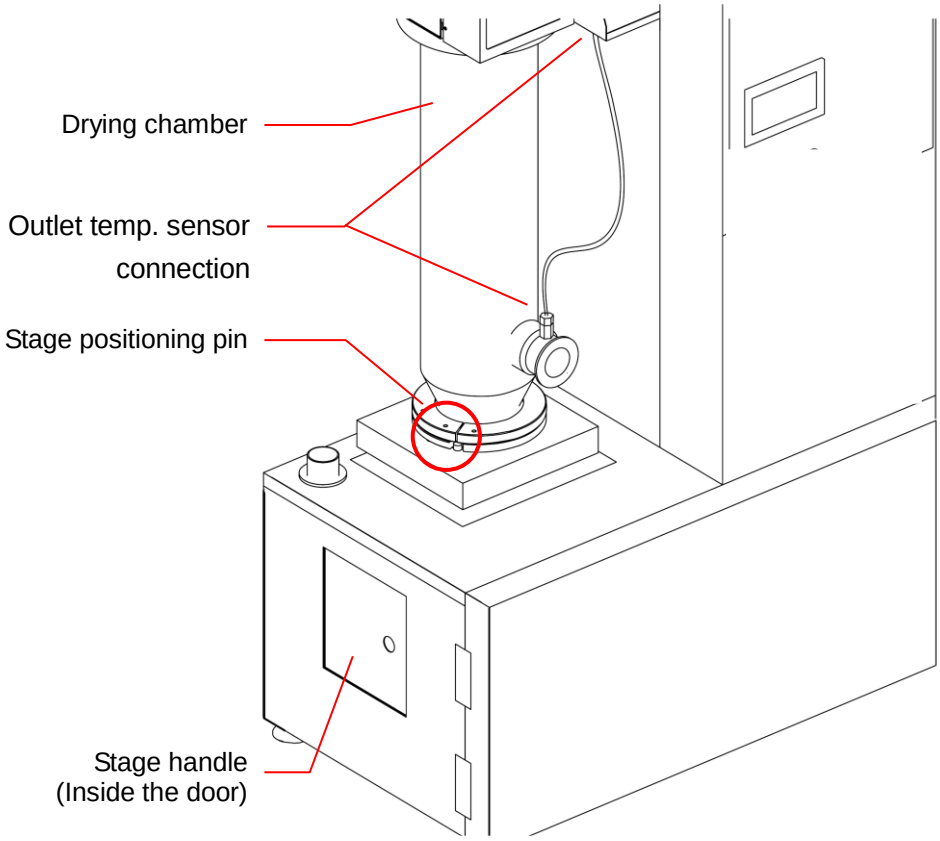


(7) Align the groove with the stage positioning pin and then install the drying chamber.

Open the left side door and turn the handle while holding the drying chamber by hand to lift the stage.

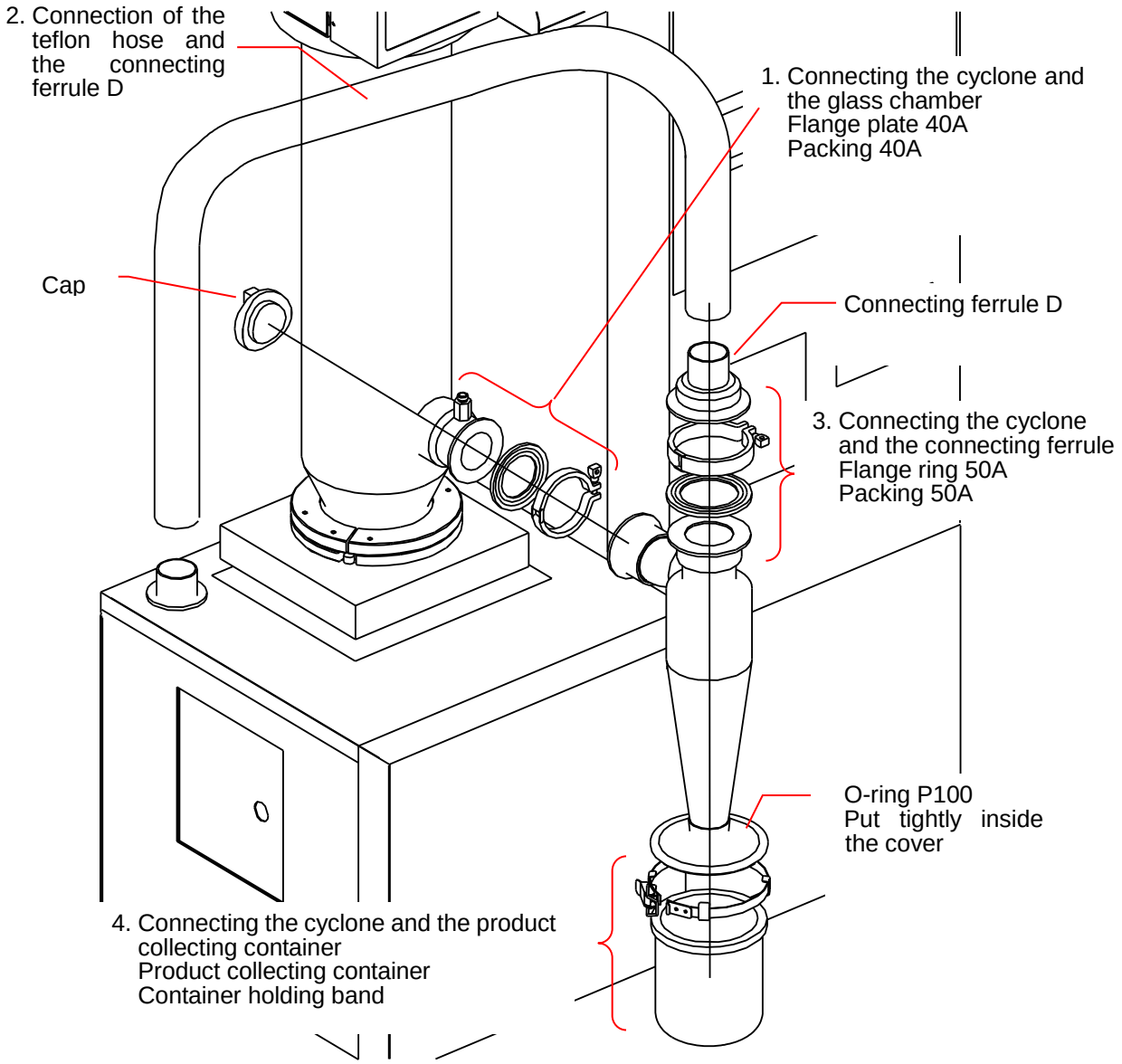
If the drying chamber reaches the top of the main unit and gets stuck, turn the handle by about half a rotation from that position, and then adjust the position of drying chamber, repeat the previous steps.

The stage should be raised until the flat surface of the top of the drying chamber is completely pressed against the O-ring of the distributor.

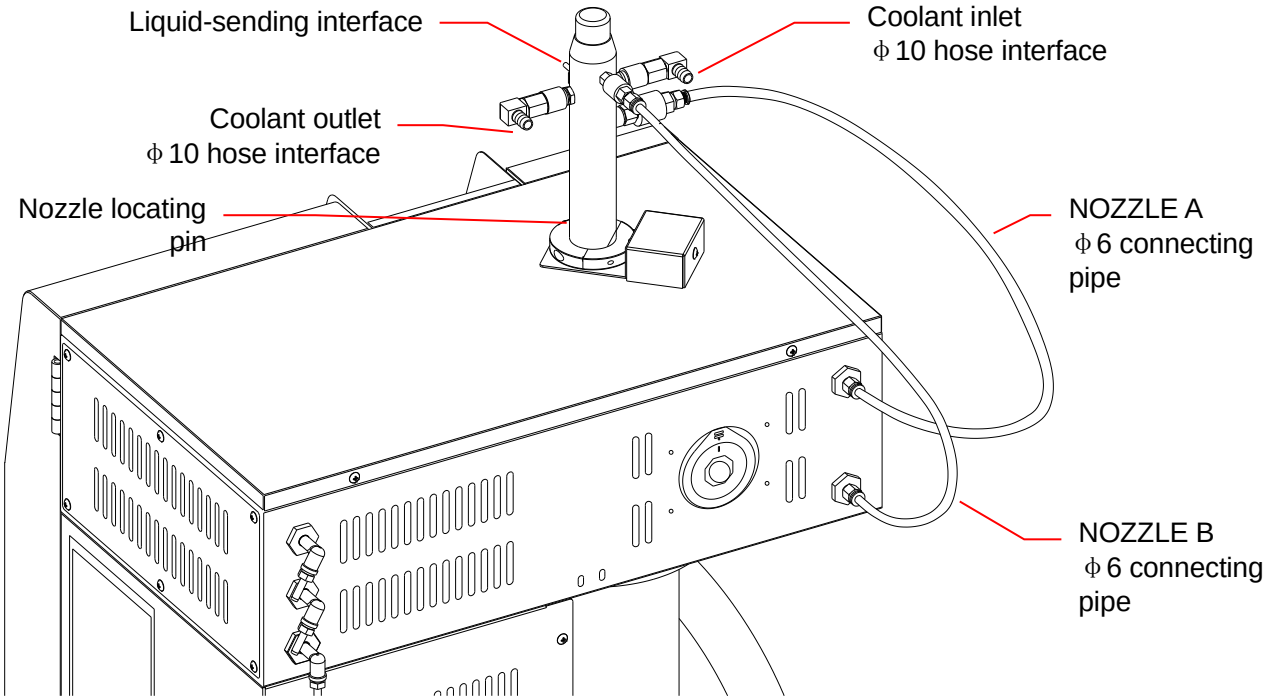


(8) Install the outlet temperature sensor on the pipe of the glass container connection port, and then insert the plug into the connection seat at the main unit and fix it.

(9) Connect the cyclone following the step numbers below.



(10) Insert the automatic needle spray nozzle vertically into the mounting hole on the top as shown in the figure below, please align with the nozzle locating pin when inserting. Then according to the labels on the nozzle, the attached connecting pipes are used to connect the corresponding air pipe ports at the back of the unit body.

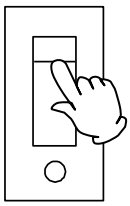


(11) When the characteristics of the samples change greatly due to the influence of temperature, or the samples are easy to be evaporated, lead to the blockage of the pipe inside the nozzle, it is recommended to use the cooling function of the spray nozzle.

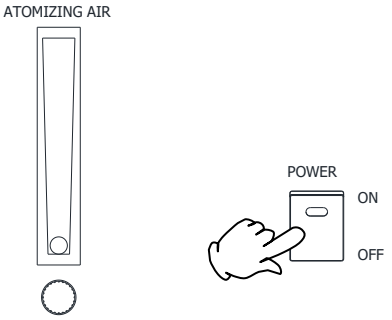
Please connect the coolant inlet and coolant outlet of the automatic needle spray nozzle with the cooling water circulator (such as CF312C) which is sold separately to circulate the coolant through the inside of the nozzle.

The whole outer wall of the automatic needle spray nozzle will be filled with flowing coolant, and the liquid and air pipes inserted into the drying chamber through the center of the nozzle will be completely wrapped, ensuring that the temperature of the samples before entering the drying chamber is basically unchanged.

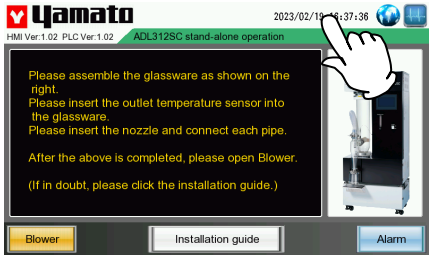
(12) Set the system parameters before using the system for the first time or when it has not been used for a long time.



① Turn ON the ELB on the right side of the main unit.

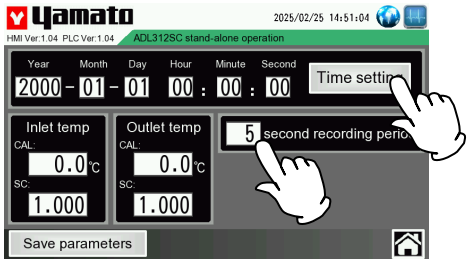


② Turn ON the Power switch on the operation panel of the main unit, touch screen display.



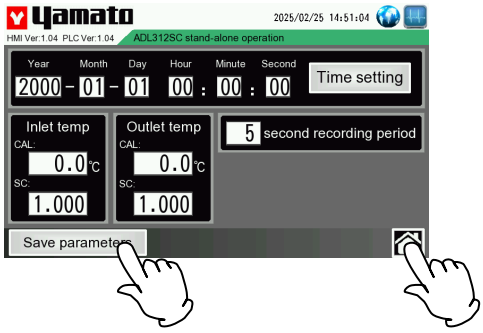
③ Press the time display area for more than 5 secs to jump to the system parameter screen.

※ If the equipment is transported, stored or not used for a long time, leading to the exhaustion of PLC internal power supply, the previous time setting will become unreliable (will also stop updating). Reset the system time of the equipment based on the local time. Otherwise the running curve will show the wrong point in time.



※ Please adjust the recording time interval of the running curve according to the needs of the test. The interval time from 1 to 60 secs can be set, **and the factory parameter is 5 secs.**

※ It is not necessary to set the inlet temp. and outlet temp. correction at the first use. If the sensor has deviation after a long-time use, **please refer to P. 31 "Calibration of temperature sensor".**



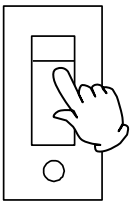
④ Click the Save Parameters button until it turns green. Finally click the Return button to return to the initial screen.

4. Operating procedures

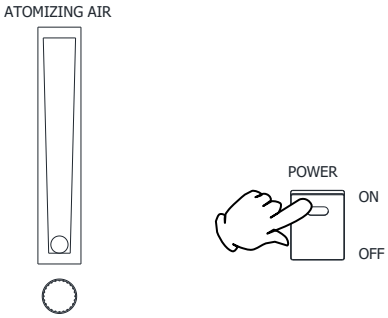
Operating method

The following will use the standard sample setting method as an example for reference.
Sodium chloride water solution, 100g, solid concentration 5wt %

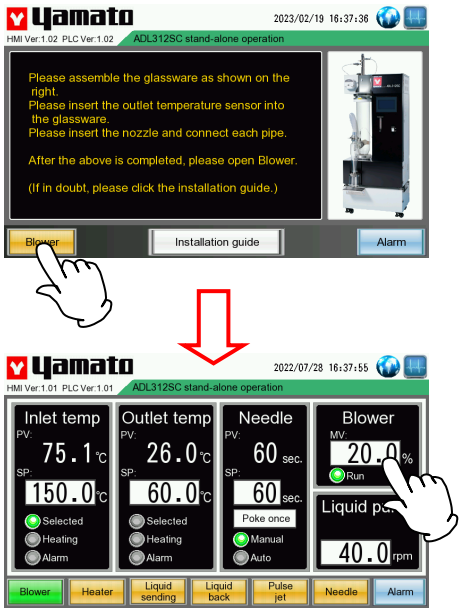
(1) Mini spray accessories are installed in the order described above (P. 16 to P. 19).



(2) Turn ON the ELB on the right side of the main unit.



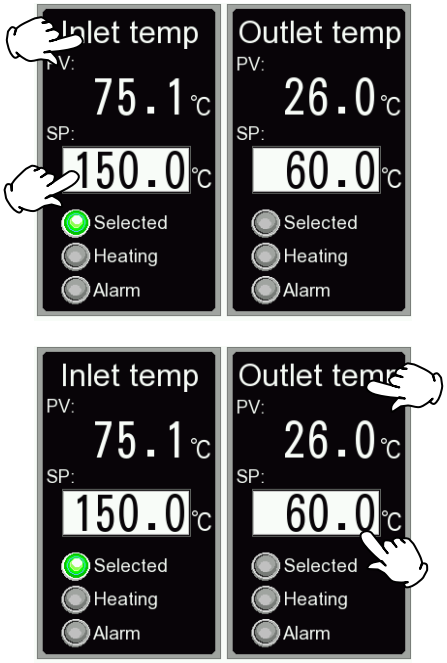
(3) Turn ON the Power switch on the operation panel of the main unit, touch screen display.



(4) Please switch the blower ON to jump to the running screen for blower output power setting.

e.g.: blower output power 50.0% (the air volume is about 0.4m^3/min)
(Please refer to P.29 "The corresponding table of blower output power and average dry air amount")

※ Click the Earth button at the upper right of the touch screen to enter the selection screen of language switching, and you can select the display language (Chinese, Japanese, English). After selecting, click the × button at the upper right of the screen to close the screen.



(5) There are inlet temp. controller and outlet temp. controller respectively on the operation screen, which are used for display and temp. setting.

By clicking the icon of inlet temp. or outlet temp., you can select the inlet temp. or outlet temp. at will. After selecting, the inlet control or outlet control indicator lamp in the inlet temp. or outlet temp. controller will light up.

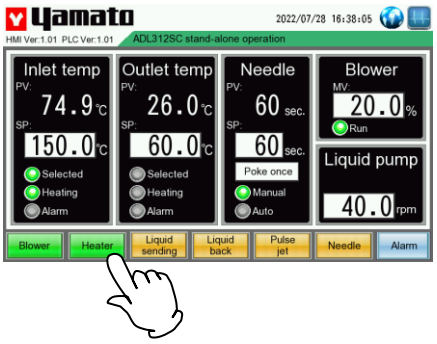
PV value displays the real-time temp. of the temp. sensor, SP value is black characters on white background, click to set the operating temp.

※The setting range of each temp. controller is different.

Inlet temp. setting range: 0 - 240℃

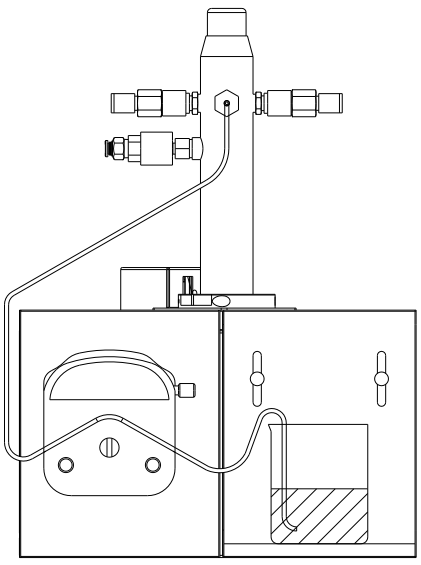
Outlet temp. setting range: 0 - 100℃

e.g.: select the inlet control, set the inlet temp. as 150℃.

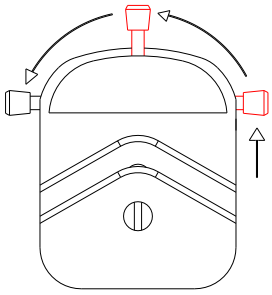


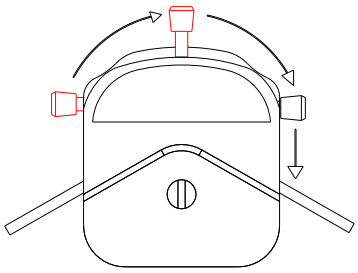
(6) Turn ON the Heater switch.

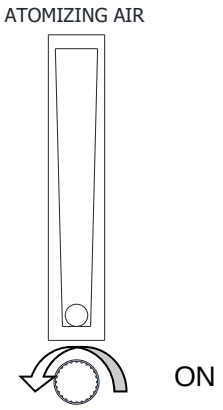
※ After heating, the function switch between inlet temp. control and outlet temp. control will become invalid to prevent the mistake contact in the experiment. If need to switch the control function, firstly turn OFF the Heater switch, switch to inlet temp. control or outlet temp. control, and then turn ON the Heater switch.



(7) Set the liquid-sending hose as shown on the left, turn the pull rod of the liquid-sending pump CCW to open the pump head, put the liquid-sending hose in it, and then turn the pull rod CW to make the liquid-sending hose stuck. Insert the other end of the liquid-sending hose into the liquid-sending interface of the spray nozzle. Please use the distilled water as the sample.



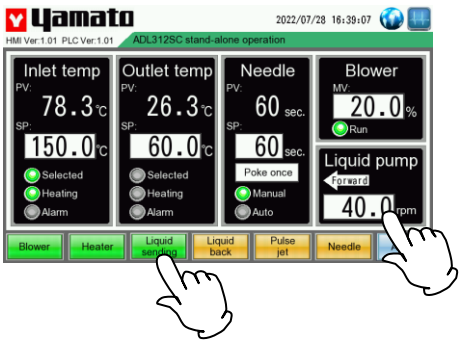




(8) After the inlet and outlet temp. reach the desired temp., set the spray flow and liquid-sending speed, and turn ON the liquid-sending switch to transport the distilled water.

e.g.: When the outlet temp. reaches about 80℃, the spray flow is set as 10L/min and the liquid-sending speed is set as 40rpm (about 10mL/min). (Please refer to P.29 "The corresponding table as below is for blower output power and average dry air amount. ") Adjust the liquid-sending speed to make the outlet temp. be slightly lower than 75℃.

(9) In order to stabilize the outlet temp. and inlet temp. at the desired temp., please adjust the dry air volume, spray flow and liquid-sending speed again.



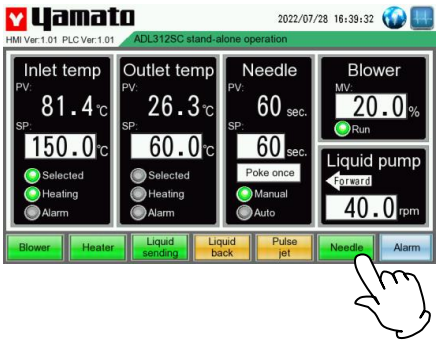
e.g.: Adjust the liquid-sending speed to make the outlet temp. be slightly lower than 75℃.

— Hint —

- When the inlet temp. is constant, the influences of each setting on the outlet temp. are as follows.
  Sample liquid-sending volume → small: outlet temp. → high
  Dry air volume → large: outlet temp. → high
  Sample concentration (external factor) → high: outlet temp. → high
- If increase the spray flow, the spray droplets will become micronized.
- The volume of spray flow is in direct proportion to the diameter of nozzle orifice.
- When the samples are replaced from the distilled water to the actually used samples, the outlet temp. will become slightly higher due to the non-evaporative part (solid part).

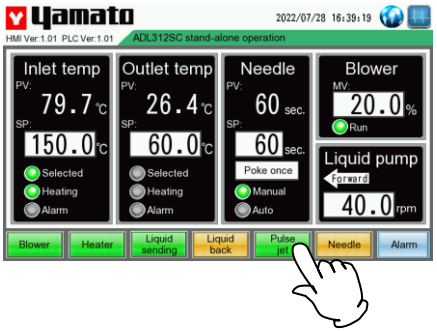
(10) When the outlet temp. is stable, replace the samples with the actually used samples. At this point, the outlet temp. will change more or less, if necessary, please adjust the liquid-sending speed again.

e.g.: Replace the samples with 100g sodium chloride 5% solution



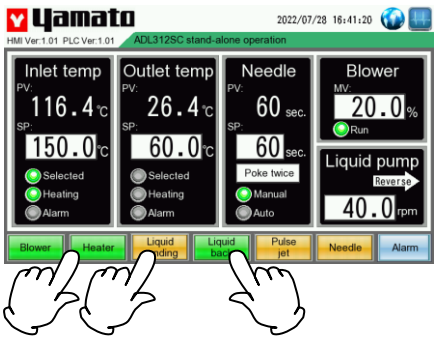
(11) During normal spraying, when the sample cannot be sprayed, the orifice of the spray nozzle may be blocked. Operate the needle button to squeeze out the blockage, or set the automatic needle to prevent the orifice of the spray nozzle from being blocked. Please refer to P.27 “Use of automatic needle spray nozzle”.

When the blockage at the orifice of the spray nozzle cannot be cleaned out by needle, please click the Liquid Sending button to stop the liquid sending, and then long press the Liquid back button to make the sample in the liquid-sending hose return to the sample container.
According to P.26 “— End process —”, stop the unit.
According to P.36 “About cleaning after use”, thoroughly clean the spray nozzle. After drying and assembling, continue to test.



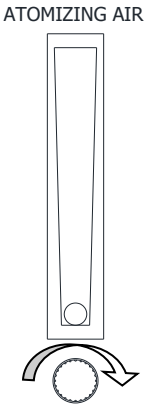
(12) During normal spraying, if the conical misty samples sprayed from the nozzle becomes irregular, it may be due to the attachment of samples near the orifice of the spray nozzle. Please click the Pulse jet button on the operating interface, the air tap near the nozzle for pulse jet will open, and the high pressure gas will blow away the attachment near the nozzle.

If it still cannot be cleaned out, please click the Liquid Sending button to stop the liquid sending, and then long press the Liquid back button to make the sample in the liquid-sending hose return to the sample container. Turn the Heater button OFF, wait until the inlet temperature is lower than 60 ° C and the outlet temperature is lower than 50 ° C, take out the nozzle and scrape off the attachment near the nozzle with a knife.



※ The Liquid back button is a manual/auto button. Press the button, the liquid-sending pump reverses, and release the button, the pump stops reversing. Long press the button for 5 secs, the pump will automatically reverse, even if release the button, it will not stop. At this time, click the Liquid back button again to stop the reverse.

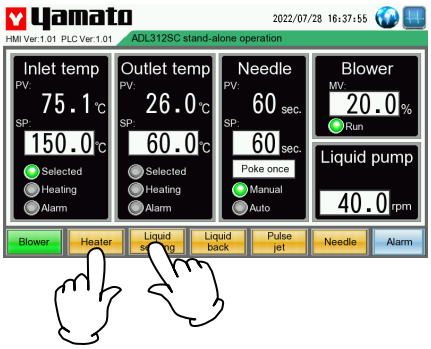
※ Liquid Sending and Liquid back cannot operate at the same time. When the liquid-sending pump is sending liquid, the operation of Liquid back button is invalid. Similarly, when the liquid-sending pump is making liquid back, the operation of Liquid Sending button is also invalid.



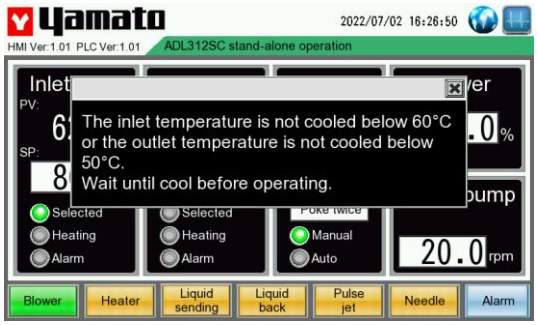
— End process —

(13) When the sample liquid sending is finished, replace the samples with the distilled water again to clean the nozzle. Clean for about 5mins, turn OFF the liquid-sending switch, and then adjust the spray flow to 0.

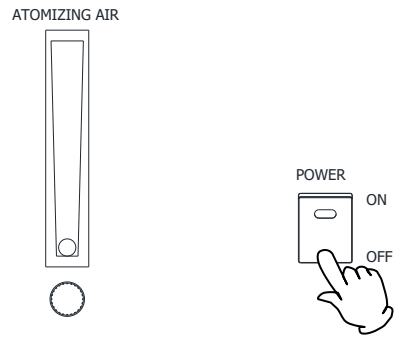
e.g.: After about 15mins, when the process of 100g sending liquid is finished, please replace the samples with the distilled water.



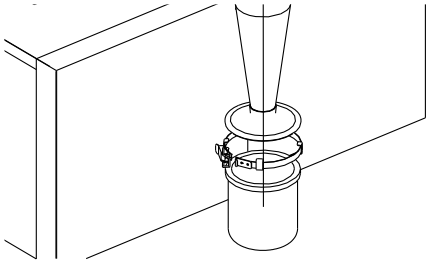
(14) Turn the Heater button OFF, when the inlet temp. is lower than 60℃ and the outlet temp. is lower than 50℃, please turn the Blower button OFF. Otherwise, you will be prompted:



※ When the outlet temp. is above 50℃, do not stop the operation of the blower by forcibly cutting off the power. Otherwise, the malfunction may occur.



(15) Turn OFF the power switch.



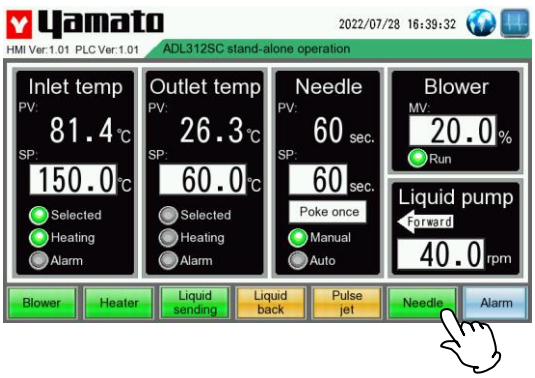
(16) Remove the container fixing clamp and take out the product collecting container. At this point, please note that the back of the cyclone cover also has powder attached.

e.g.: Amount of collected powder is about 3-3.5g.

(17) Wash the containers according to P.36 “About cleaning after use”.

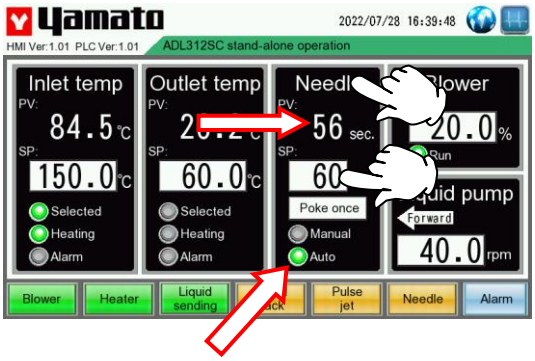
※ When use a sample such as sodium chloride that corrodes metals, break down the spray nozzle and wash thoroughly.

Use of automatic needle spray nozzle



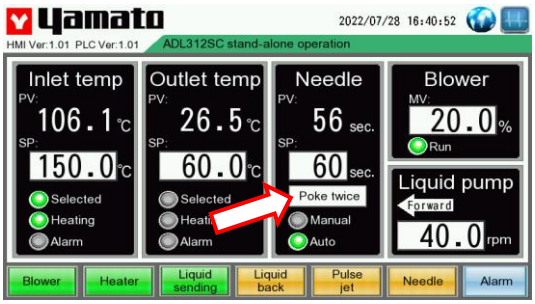
During normal spraying, if the sample cannot be sprayed, possibly because the orifice of the spray nozzle is blocked.

When using the automatic needle spray nozzle, press the Needle button on the operation screen, the automatic needle will continue to move at the frequency of poking once per second until the Needle button is released.



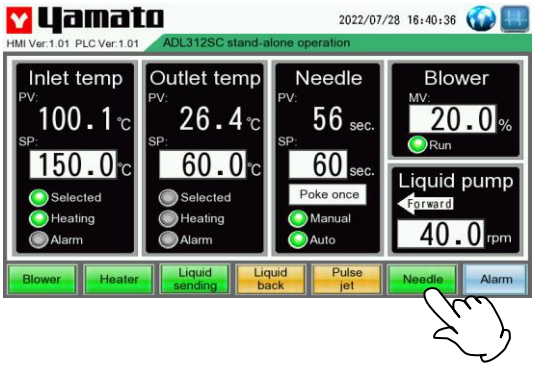
When it is estimated that the blocking will occur in the test, click the icon of needle controller to turn on the automatic needle function while switching from the distilled water to the samples. The manual mode indicator lamp of the needle controller goes off and the automatic mode indicator lamp lights on. When the automatic needle function is not used, just need to click the icon of needle controller to turn off the function.

When the automatic needle function is enabled, the countdown of the needle timer starts. When the timing (PV value) is 0, the needle activates. Later the timer resets and starts the next timing.
The time of the timer can be set by clicking the SP value of the needle controller.



When the timing is reached, the action times of automatic needle can be set by clicking the action times setting button. Its setting method is to click once, then the needle action times increases by 1, successively increasing to the maximum value of 3, and then click again to return to the value of 1, and cycle again.

※ The maximum action times of automatic needle can be set for three times. The test data show that if it acts for three times, the blockage still cannot be cleared, then there is no effect to act for more times. At this time, you can consider reducing the interval time of the timer, and you can activate the needle when the blockage has not accumulated to be unable to clear it, so as to prevent blockage.



When using the automatic needle function, if the blockage is found between the two actions of automatic needle, the manual needle button can also be clicked, and its action mode is the same as manual needle. The action of manual needle does not affect the timing and action of automatic needle. Manual and automatic modes can be carried out in parallel without cross influence.

If want to interrupt the sample processing, or when nozzle blockage occurs

If want to interrupt the sample processing, or when nozzle blockage occurs, please stop sending liquid according to P.26 “— End process —”.

In addition, if want to process another samples, please firstly recycle the products in the collecting container, clean it according to P.36 “About cleaning after use”, and then change to another sample for spray test.

The relation between rotate speed of liquid sending pump and liquid amount/ between blower power and dry air amount (reference)

The corresponding table as below is for rotate speed of liquid sending pump and average liquid sending amount (the calibration liquid is water at 23℃).
Please refer to it during operation. Please pay attention that the density and viscosity of solution have a great influence on the liquid sending amount. If the liquid sending amount is less, the liquid sending pump head may be not pressed tightly, or there is block, deform or damage for the liquid sending hose.

Rotate speed of liquid sending pump	Avg. liquid sending amount (ml/min)
0.0	0
10.0	2.5
20.0	5.1
30.0	7.5
40.0	9.9
50.0	12.5
60.0	14.7
70.0	17.5
80.0	20.3
90.0	23.3
100.0	26.4

The corresponding table as below is for blower output power and average dry air amount. Please refer to it during operation.
If the air amount is too low, the blower filter or the suction filter may be blocked. Clean the filter according to the maintenance method (see P.37 “Filter Cleaning”).
Please refer to the table below for the corresponding dry air volume of each scale value.

When the power supply is 200V-230V 50/60Hz	
Blower output power (%)	Avg. dry air amount (m^3/min)
5	0.12
10	0.15
20	0.22
30	0.28
40	0.35
50	0.41
60	0.47
70	0.54
80	0.61
90	0.67
100	0.73

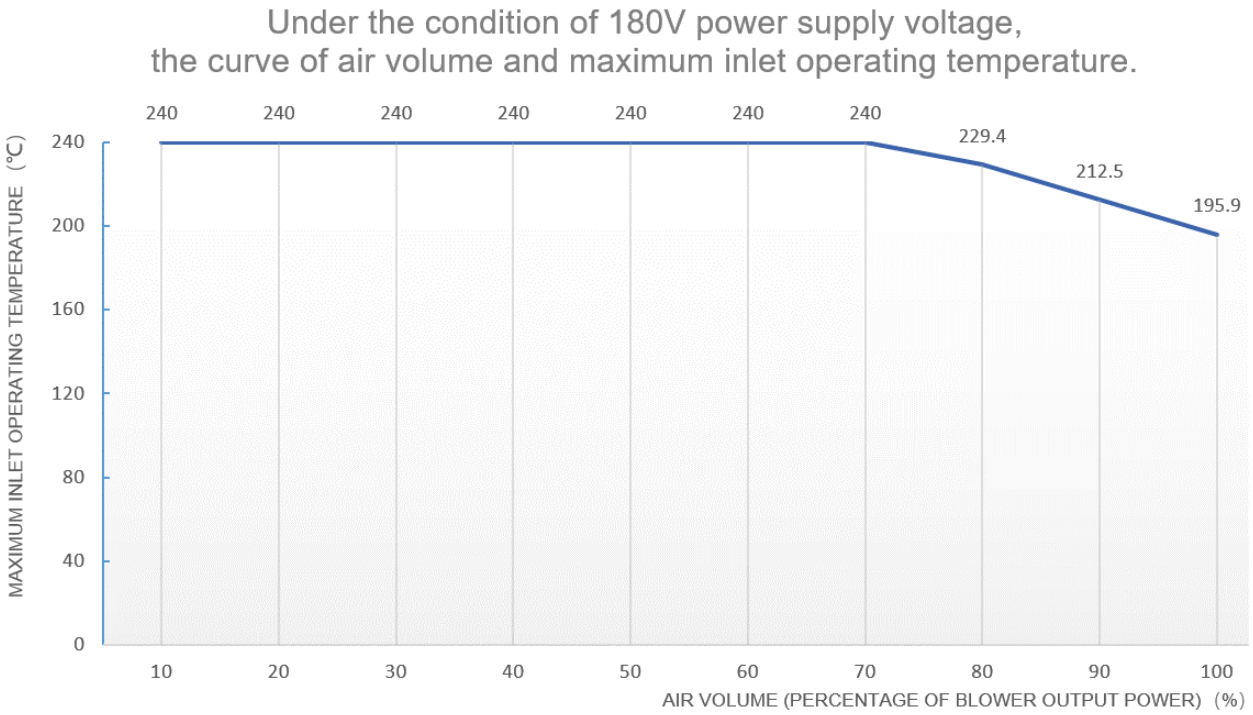
4. Operation method

The relationship between the output power of the blower and the maximum operating temperature of the inlet (Reference)

When the power supply meets the rated voltage 200V-230V of the equipment, the performance of the equipment can be fully exerted. Under the condition of the designed maximum air volume of 0.7m^3/min, the inlet temperature can rise to the maximum set value of 240℃.

A decrease in power supply voltage will significantly reduce the heating output power, resulting in insufficient temperature rising capacity. Therefore, when the power supply voltage is below 200V, the maximum operating conditions of the equipment should be considered as appropriate.

The following table is the corresponding curve between the output power of the blower and the maximum operating temperature of the inlet. (Under the condition of 180V supply voltage)
Please use it as reference during operation.



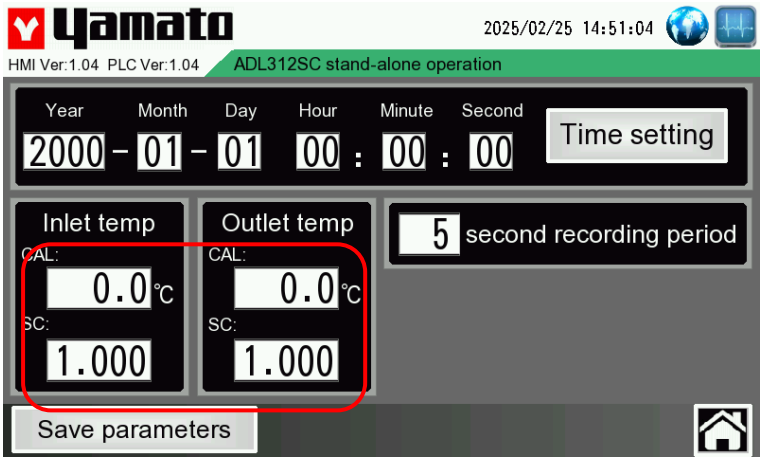
Calibration of temperature sensor

After long-term use, the temperature sensor will have temperature drift, resulting in the deviation of operating temperature.

In this case, you can calibrate the temperature sensor to restore the control temperature to the normal state.

If need to calibrate the temperature sensor, please contact the agent or Yamato Scientific. Calibration of temperature sensor is a paid service.

After calibration, the correction parameters of inlet temperature or outlet temperature (in the red box below) will be modified according to the calibration report of the sensor. Please do not change them before the next calibration.



5. Handling Precautions

⚠ Warning

1. Substances that cannot be used

Never use explosive, flammable or substance that contains them. Otherwise, an explosion or a fire may occur. See P. 58 "15. List of Dangerous Substances".

Connect ADL312SC with the optional GAS series product to form an enclosed and low-oxygen circulation system, which is able to use the organic solvent sprays without the risk of explosion. When using the organic solvents, pay special attention to their explosion conditions, especially the mixture of multiple organic solvents. Please read the GAS series product instruction manual for operations.

2. If a problem occurs

If smoke or strange odor comes out of this unit, turn off the main power supply right away, and pull out the plug. Immediately contact the sales agent or our business office for maintenance. If continue to operate, fire or electric shock may result. Never perform repair work yourself.

3. Do not touch the part with high temperature

During or just after operation, the temperature of drying chamber, cyclone and surrounding area is higher. Do not touch these parts to avoid scalding.

5. Handling Precautions

⚠ Caution

1. Do not put anything on this unit

Do not put anything on this unit. It will cause injury if fall.

2. During a thunder storm

During a thunderstorm, turn off the power key immediately, then turn off the circuit breaker and the main power. If this procedure is not followed, fire or electrical shock may be caused.

3. Do not use corrosive sample

Stainless steel SUS304 is used for the interior; however, it may be corroded by strong acid etc. In addition, the sealing strip and silicon rubber may be corroded by some kind of solvent like acid, alkali, oil, halogen, etc. Do not use the sample containing those substances.

4. Recovery after power outage

During operation, the machine stops due to power outage. When the power is supplied again, it will be restored to the initial state.

5. Take measures against toppling and falling

It may cause injure to a person if this unit falls down or moves by a sudden earthquake, impact, etc. For the sake of safety, please take measures against toppling and falling.

6. Do not disassemble glassware and pipes when the inlet or outlet temperature is above 50℃.

Do not disassemble glassware and pipes when the inlet or outlet temperature is above 50℃. Otherwise, there is a risk of scalding.

The heating pipe inside the machine expands in size at high temperatures. At this time, if disassemble the glassware and pipes for cleaning, the glassware and pipes will shrink due to cold, and the port size will become smaller. The size mismatch will occur when they are re-installed, and the installation by force will cause damage.

5. Handling Precautions

Drying Method under Appropriate Condition

(1) The best appropriate drying condition is differed depending on the sample to be dried. There are some data for reference. Please consult the agent for details.

(2) The attachment on the drying chamber is particularly significant because of high sample concentration, low inlet temperature, too high or too low spray air pressure, or too much liquid sending amount of the sample. When there is an abnormality, the above reasons can be taken into account, and please adjust appropriately.

(3) During operation, when the spray direction is changed due to the sample attachment at the tip of spray nozzle, turn ON the pulse jet switch, and blow off the attachment from the tip of the nozzle using the pressurizing air. If the attachment cannot be blown off, disassemble the spray nozzle and use ultrasound, etc. to clean it.

(4) As for the reasons of the sample attachment on the cyclone part, it can consider about whether the solvent (distilled water or ion-exchange water) is not fully evaporated, or the unique characteristics of the sample (low melting point, absorbability, etc.). In order to make the moisture content of the powder as little as possible, the heat of the sample is the more the better, it's able to increase the inlet temperature and dry air flow, or reduce the liquid sending amount of the sample. That is to reduce the difference between the inlet temperature and the outlet temperature. When the sample has its unique characteristics, please add additives to adjust the sample.

(5) In the case that the hygroscopicity is high, the product may become the moist powder in the container. Change the drying condition following the method in (4), or, if required, heat up the container for product before operation.

(6) The orifice of the spray nozzle is 460μ. If the sample is blocked with suspension at orifice part impetuously, use the 508μ and 711μ nozzles prepared for the orifice as optional (Nozzle main body P.36 “About cleaning after use”, the nozzle main body, the needle, and the ring in the exploded view of the spray nozzle are common with the 406μ nozzle） These 508μ and 711μ nozzles are differed on the point of the size of the spray pattern and particle diameter of the drop slightly compared to the 406μ one, and these differences may affect the interference status. Refer to the Graph 1 for the relation between spray air pressure and spray airflow rate (atmospheric conversion).
When the gas source pressure is different, the maximum adjustable spray flow is different. Take the standard orifice 711μ as an example, the maximum adjustable spray flow under different pressures is shown in the right figure.

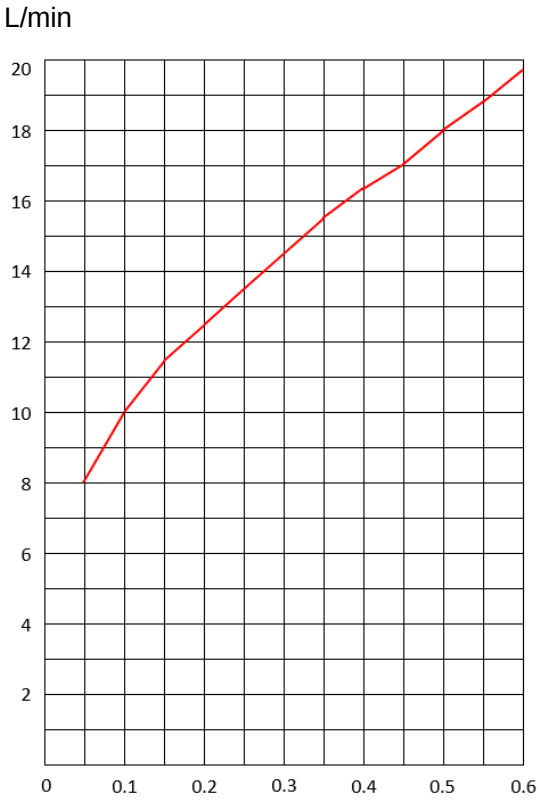


Fig.1

(7) The too small powder (few μ or less) among dried ones is impossible to be collected, and exhausted to the outside through the blower. If this exhausted amount of the too small powder becomes more, decrease either spray airflow rate or spray air pressure. Also, since the particle diameter becomes smaller as the density of the sample is lower, adjust the density of the sample if required.

5. Handling Precautions

Caution during operation

(1) When connecting the power supply, be sure to ground it.

(2) Pressurized air should be controlled at a stable pressure of 0.3-0.6 MPa. Using pressure greater than 0.6MPa will damage the pipe.

(3) The outlet temperature will cause deterioration of the material of the suction/exhaust hose, the material of the filter and the performance of the blower. Please do not use it over 130℃ for a long time. The heater will stop automatically when the temperature exceeds 140℃.

(4) Check the glass chambers are fixed to the specified position with no gap, and then turn on the switches of blower and heater.

(5) The unit is not explosion-proof. Do not use any solvent that contains flammable organic solvents as the samples. ※ **When you use an organic solvent for ADL312SC, connect the optional organic solvent recovery unit (GAS).**

(6) When the heater is ON, do not expose the end cap of drying chamber and mounting port of the spray nozzle to the non-guard status, and do supply the air to the heater part for at least 0.1-0.2m^3/min.

(7) During normal spraying, when the sample cannot be sprayed, the orifice of the spray nozzle may be blocked. Operate the needle button to squeeze out the blockage, or set the automatic needle to prevent the orifice of the spray nozzle from being blocked. Please refer to P.27 “Use of automatic needle spray nozzle”.

(8) When the liquid sending pump cannot send samples, please check if the sample hose is crushed at the roller of the pump, the inner wall of the hose is adhered tightly without restoration, or the inner of the nozzle is blocked. Run again after all the above conditions return to normal.

(9) Do not perform unattended operation. Because idling after the sample being used up and nozzle blockage will cause the outlet temperature to rise, or the sample hose to fall off from the nozzle resulting in sample outflow, unexpected accidents may occur.

(10) If it is a silicone hose, easy to be eroded by halogen solvents and acids (concentrated), then the expansion or fracture may occur, need to pay attention during the operation.

(11) When the inlet temperature is set at high temperature, if the air flow of the blower is excessive, it may not reach the set temperature due to the capacity of the heater. At this time, either turn down the air flow, or increase the set temperature for operation. The set value is inconsistent with the actual inlet temperature when increasing the set temperature.
The heater will stop automatically when the inlet temperature exceeds 260℃ or when the outlet temperature exceeds 140℃.
If this unit is not operated, turn "OFF" the earth leakage breaker on the right side of the unit.

(12) Depending on the sample used, operating environment and conditions, the cyclone may be prone to generate the static electricity. Either install auxiliary grounding terminals at 3 positions of the clamp of the cyclone connection, or install the anti-static brush (optional) on the main body of the cyclone.

(13) If there is a leakage between the product collecting container and the metal cover at the lower of the cyclone, the dried powder will accumulate at the lower of the cyclone and may not fall into the product container. Therefore, pay special attention when installing the product container.

(14) Because the capacity of the product container is about 750mL, when the collected powder is about 200~250g, it accounts for about 80% of its capacity. If continue to operate, it will cause the reduction of the collecting efficiency of the powder. Stop the operation for a while, and take out the collected powder.

(15) Due to the different samples, the cyclone part may be prone to generate the static electricity, please use appropriate methods to remove it. Although the grounding effect of wrapping the metal wire on the glass part is very obvious, using the anti-static brush (optional) to vertically contact with the cyclone part is more convenient.

6. Maintenance Method

Daily Inspection and Maintenance

⚠ Warning

- Disconnect the power cable from the power source when doing an inspection or maintenance unless needed.
- Perform the daily inspection and maintenance after the machine is restored to normal temperature.
- Do not disassemble this unit.

⚠ Caution

- Use a well-drained soft cloth to wipe dirt on this unit. Do not use benzene, thinner or cleanser for wiping. Do not scrub this unit. Deformation, deterioration or color change may result in.

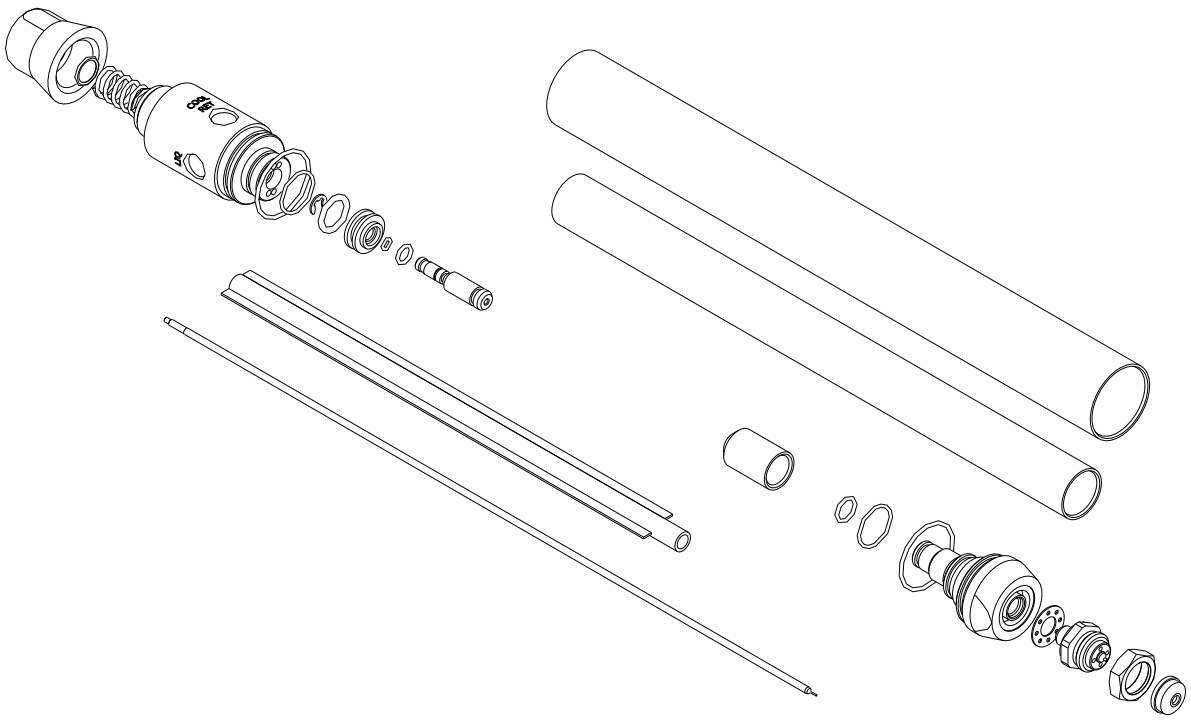
About cleaning after use

(1) After completing the operation, remove the attachments following the process “Preparations” on P. 17 in reverse order.

(2) Clean the portion of attachment to which the powder is adhered.

(3) Flow the distilled water into the sample tube by pressing the pump switch, and remove the contaminant attached to the inner of the part.

(4) Remove the spray air hose and sample liquid sending hose from the spray nozzle, and disassemble the nozzle as shown in the following diagram. After disassembling, clean it using the supersonic cleaner. Remaining the contaminant to the inner of the part may cause the insufficient spray. Therefore, clean it completely.



Spray nozzle exploded drawing

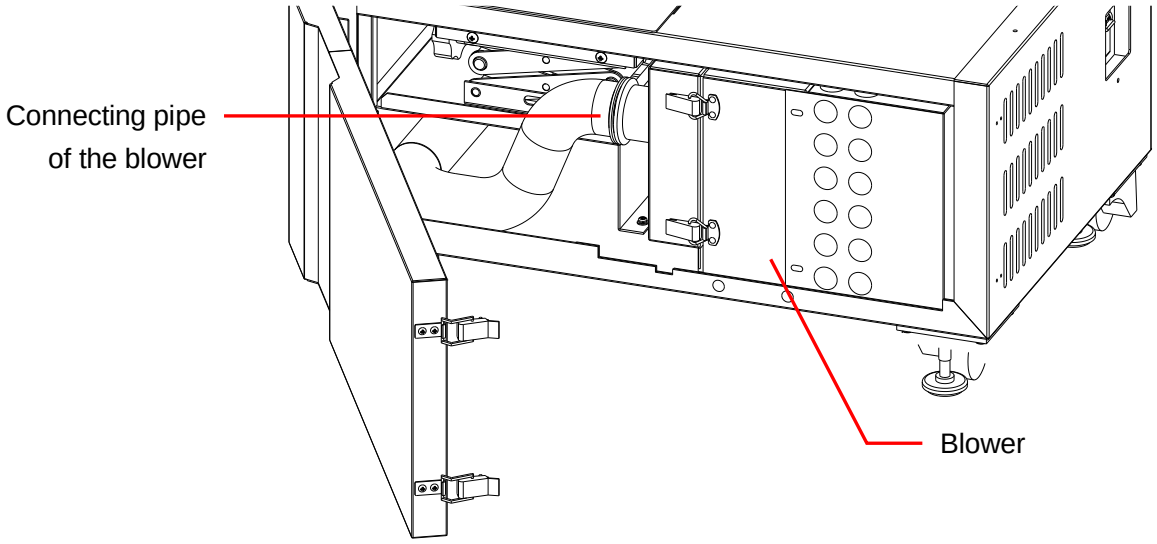
6. Maintenance Method

Filter Cleaning

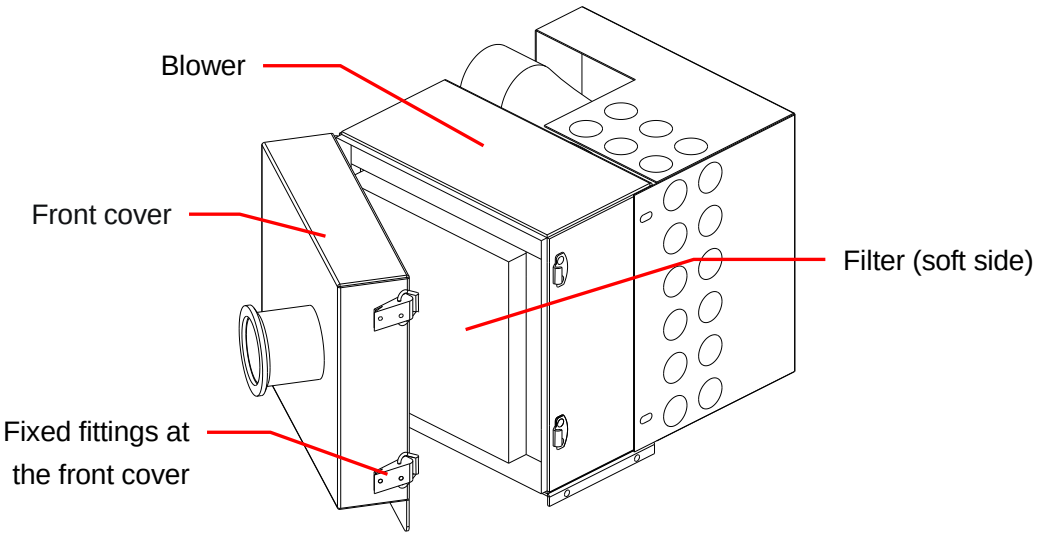
●The filter in blower

Clean up the filter in blower periodically.

1. Please open the door in the front of the main body and remove the connecting pipe of the blower.



2. Please turn on the fixed fittings at the front cover of the blower and take out the filter.



3. The followings are the cleaning procedures of the filter.
   (1) Wash the filter pressing in the water repeatedly, and air-dry it.
   (2) Compressed air blowing.
   (3) Vacuum cleaning with a cleaner.
   (4) Press washing the filter after being immersed into the solvent that hot water (approx. 40℃) and neutral detergent are mixed at a rate of 5:95 one whole day and night, then rinse it with water and air-dry it.
4. Please follow the reverse order of disassembly to install.

   Turn the soft side of the filter to windward when installing the filter.

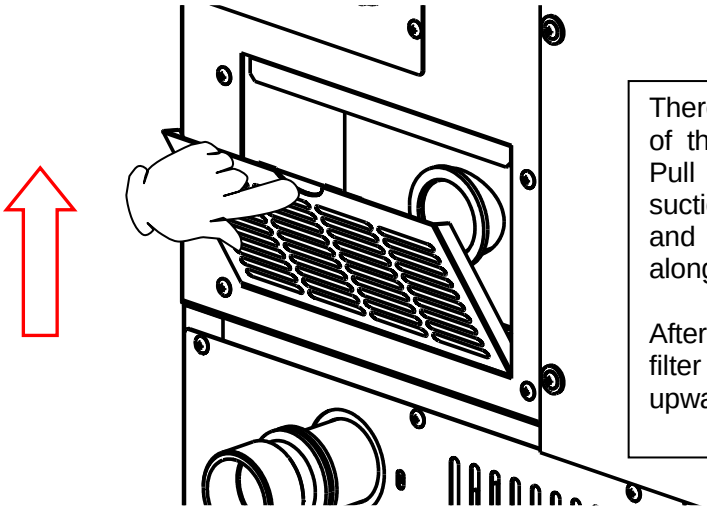
6. Maintenance Method

Daily Inspection and Maintenance

●Suction filter

Regularly clean the suction filter.

1. The suction filter is set in the suction filter cover at the back of the unit body.



There is a buckle at the top of the suction filter cover. Pull out the top of the suction filter cover by hand and turn over to open along the bottom.

After opening the suction filter cover, pull it out upward.

2. Pull the filter out (refer to the step 4, perform the reverse operation).

3. The followings are the cleaning procedures of the filter.

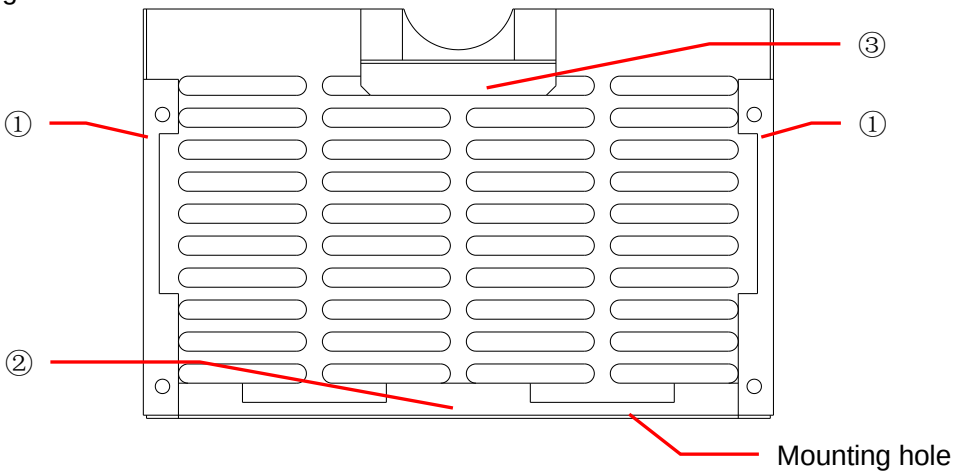
(1) Wash the filter pressing in the water repeatedly, and air-dry it.

(2) Compressed air blowing.

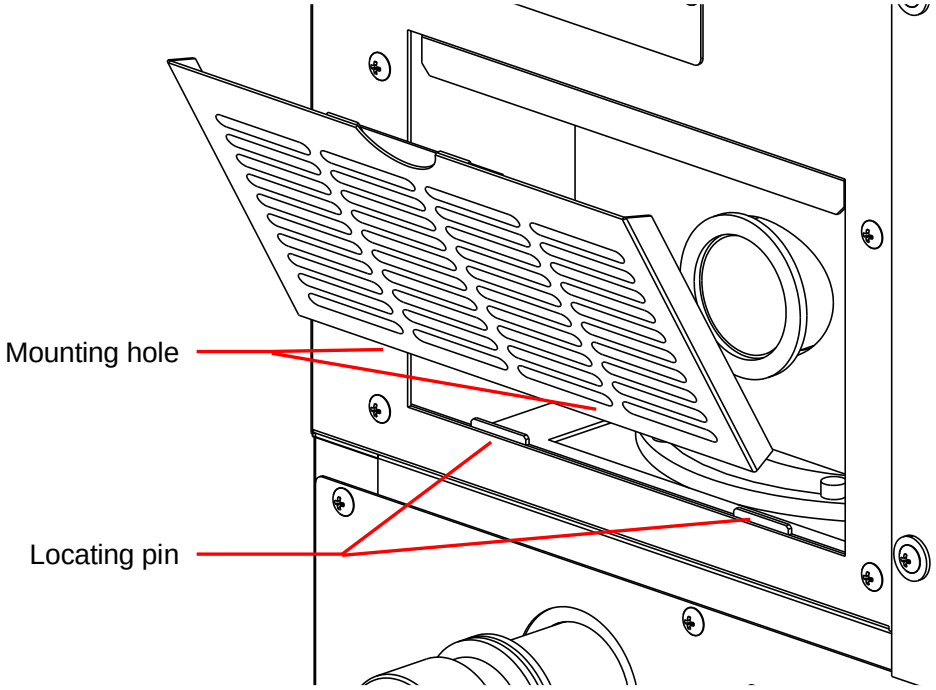
(3) Vacuum cleaning with a cleaner.

(4) Press washing the filter after being immersed into the solvent that hot water (approx. 40℃) and neutral detergent are mixed at a rate of 5:95 one whole day and night, then rinse it with water and air-dry it.

4. When installing the filter, place the back of the suction filter cover up and flat. ① Firstly make the filter stuck into the left and right grooves of the filter cover. ② Push the filter downward into the lower groove of the filter cover. ③ Finally, make the filter stuck into the upper groove of the filter cover.



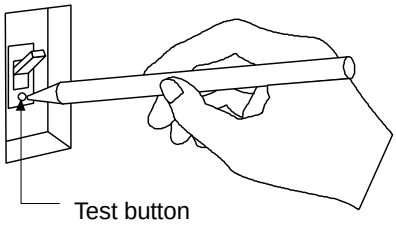
5. Align the mounting holes at the bottom of the suction filter cover with the locating pins on the unit body, and then tilt the suction filter cover to put it in place. Finally, buckle up the top of the suction filter cover.



Monthly maintenance

Check the earth leakage breaker function.

- Connect the power cord and power on before test.
- Turn the breaker on.
- Push the red test switch by a ballpoint pen etc. If there is no problem, the earth leakage breaker will be turned off.



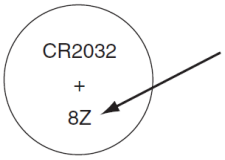
About the use of PLC batteries

●Selection of battery

When need to use a battery, please use a button battery with a production date less than two years.

The model of button battery is CR2032.

The reading of production date



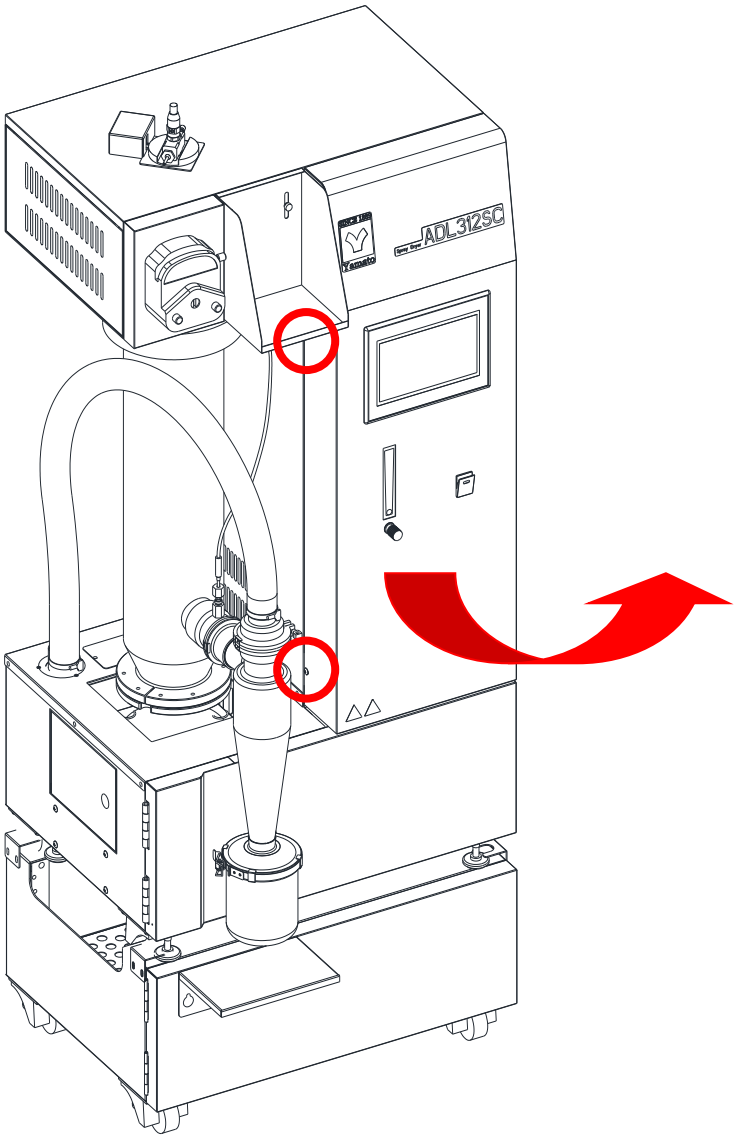
The left character: the rightmost digit of Year

The right character: month (0: October, Y: November, Z: December)

Example: "8Z" indicates the production of December, 2018

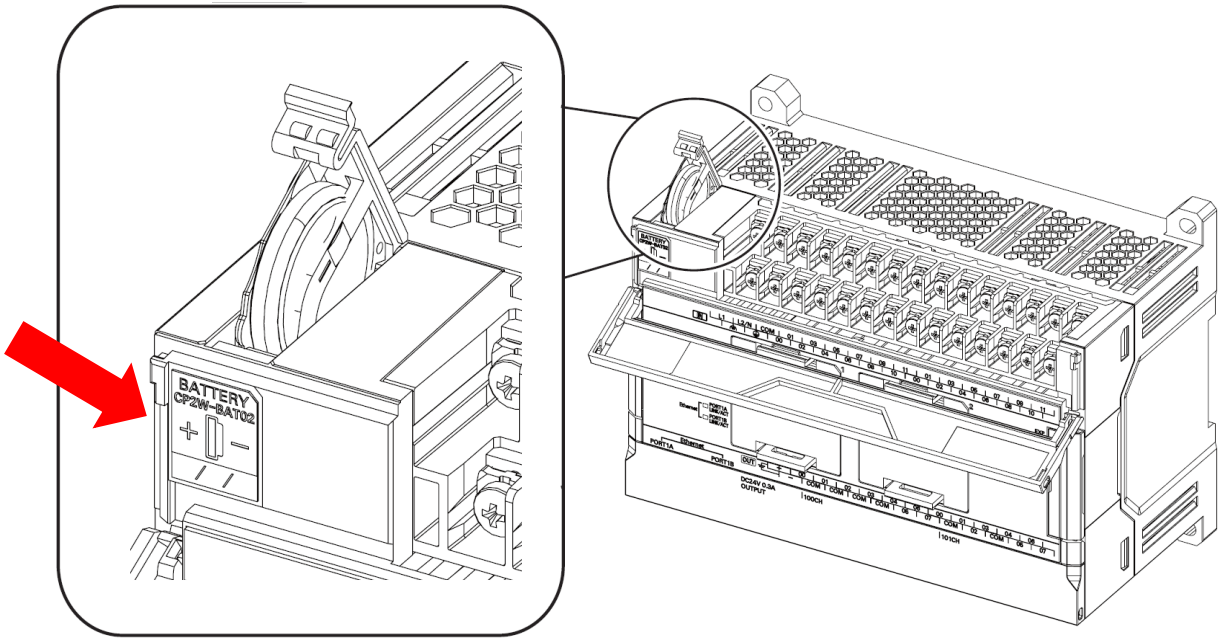
●Installation of battery

Turn off the ELB, remove the 2 fixing screws on the PDC blanking plate by using a M4 cross screwdriver, and open the PDC with the right side of the blanking plate as the axis. See as below:



Open the battery holder of the CPU unit, place the battery into the battery holder and close the battery holder. The installation direction of the battery is shown in the following figure:

※ When replacing with a new battery, take out the old battery and then put in the new battery. The battery replacement must be completed within 5 minutes after powering off the CPU unit to ensure that the clock data is not lost. If this step is not completed within 5 minutes, the clock will stop and the time will be reset to "2001-01-01 01:01:01 Sunday".



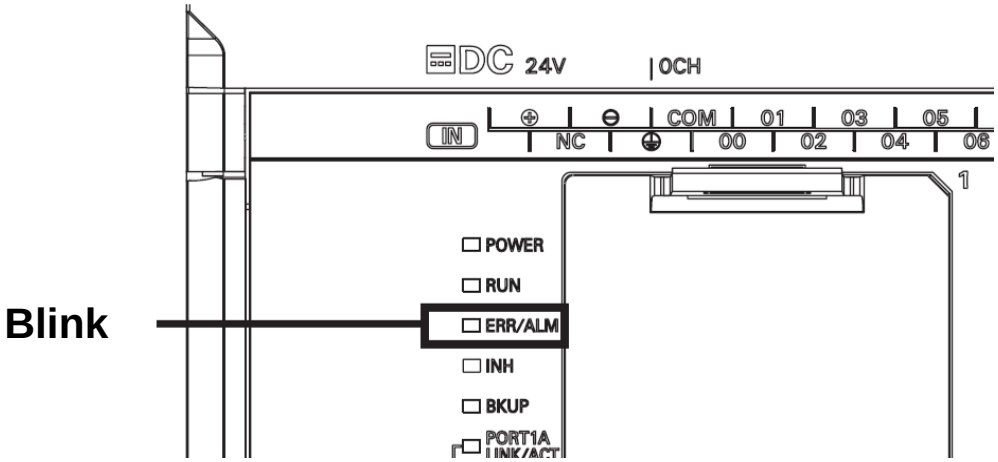
After the installation is completed, perform the reverse operations to restore the device to its original state.

●Battery life

The maximum battery life after installation is 3 years at 25℃, regardless of whether the device is powered on or not. If used at higher temperatures, the battery life will be shortened.

●Low battery power indicator

When the battery power is about to be exhausted, the ERR/ALM indicator lamp in the front of the CPU unit will blink.



7. Long storage and disposal

When not using this unit for long term / When disposing

⚠ Caution	⚠ Warning
When not using this unit for long term… ● Turn off the earth leakage breaker and original power source for safe without fail. Also, store the glass unit after removing it from the main unit. When the glass unit is contacted to the external, it may cause the breakage.	**When disposing…** ● Keep out of reach of children. ● Remove the power cord.

Matters to consider when disposing of the unit

Environmental protection should be considered

・ We request you to disassemble this unit as possible and recycle the reusable parts considering to the environmental protection. The feature components of this unit and materials used are listed below.

Component Name	Material
Parts of Main Unit	
Exterior	Cold rolled steel plate with surface coating
Insulating material	Ceramic fiber
Sample tray	Stainless steel
Label	Polyethylene (PET) resin film
Hose	Silicon rubber, Teflon
Electrical Parts	
Heater	Stainless steel and others
Motor	Iron, Aluminum, Copper wire and others
Circuit boards	Board, capacitor, resistor, transformer, etc.
Power cord & wiring materials and others	Synthetic rubber, resins
Sensor	Stainless steel and others

8. When a trouble occurs

Safety unit and error indications

The table shows possible causes of activation of the safety unit and solutions.

[Error indication]

When an abnormality occurs to the inlet temperature controller or the outlet temperature controller, the touch screen at the operation panel displays the error screen. When an abnormality occurs, confirm the error content and implement appropriate solutions.

Display	Reasons	Solutions
Er01.PLC analog module failure	① The wire connection of the PLC analog module is loose ② The PLC analog module is damaged	① Power off and restart ② If it cannot reset after power off and restart, please contact our service department or agent.
Er02.Inlet temperature transmitter disconnection	① The wire connection of inlet temperature transmitter is loose ② The inlet temperature transmitter is damaged	① Power off and restart ② If it cannot reset after power off and restart, please contact our service department or agent.
Er03.Inlet temperature sensor disconnection	① The wire connection of inlet temperature sensor is loose ② The inlet temperature sensor is damaged	① Power off and restart ② If it cannot reset after power off and restart, please contact our service department or agent.
Er05.Outlet temperature transmitter disconnection	① The wire connection of outlet temperature transmitter is loose ② The outlet temperature transmitter is damaged	① Power off and restart ② If it cannot reset after power off and restart, please contact our service department or agent.
Er06.Outlet temperature sensor disconnection	① The outlet temperature sensor is not installed ②The wire connection of outlet temperature sensor is loose ③ The outlet temperature sensor is damaged	① Install the outlet temperature sensor, click the alarm reset ② If it cannot reset, please contact our service department or agent.
Er08.Blower does not alarm	① The output power of the blower is set too low ② The power supply voltage is too low ③The blower main control relay is disconnected ④The blower main control relay is damaged ⑤ The blower speed controller is disconnected ⑥ The blower speed controller is damaged	Please contact our service department or agent.

8. When a trouble occurs

Safety unit and error indications

Display	Reasons	Solutions
Er12.SSR short circuit alarm	SSR short circuit	Please contact our service department or agent.
Er13.Heater disconnection alarm	① Heater disconnection ② Heater damage	Please contact our service department or agent.
Er14.Heater overheat alarm	Heater overheat (Overheat protector activates)	Please contact our service department or agent.
Er15.Liquid sending pump is overloaded	The pump head is stuck	① Clean the pump head ② Please contact our service department or agent.
Er16.Liquid sending pump is not running	① The wire connection of liquid sending pump is disconnected ② Liquid sending pump damage	Please contact our service department or agent.
Er17.Inlet temperature controller alarm	① The inlet temperature controller reports an error ② The parameters of the inlet temperature controller are abnormal	① Power off and restart ② If it cannot reset after power off and restart, please contact our service department or agent.
Er18.Outlet temperature controller alarm	① The outlet temperature controller reports an error ② The parameters of the outlet temperature controller are abnormal	① Power off and restart ② If it cannot reset after power off and restart, please contact our service department or agent.
Er19.Inlet temperature overheat alarm	① The inlet temperature exceeds 260℃	① Stop heating, blow to drop the inlet temperature, and then click the alarm reset button in the alarm screen. ② If it cannot reset, please contact our service department or agent.
Er20.Outlet temperature overheat alarm	① The outlet temperature exceeds 140℃	① Stop heating, blow to drop the outlet temperature, and then click the alarm reset button in the alarm screen. ② If it cannot reset, please contact our service department or agent.

※ When the temperature is abnormal, the blower ON, the heater OFF and the liquid sending pump stops. The same is true when the temperature sensor is disconnected. After troubleshooting, press the "alarm reset" button to release the alarm, still hold the mode that the blower ON, the heater OFF and the liquid sending pump stops. The abnormal display can be set to Chinese, Japanese or English by language switch.

8. In the Event of Failure…

Safety unit and error indications

When used in connection with GAS, the following table shows the reasons and solutions when the safety device activates:

Display	Reasons	Solutions
Er30. Communication with GAS is interrupted	① The wire connecting to GAS is loose ② The wire connecting to GAS is damaged	① Reconnect the connecting wire. ② Replace the connecting wire. ③ After power off and restart, if it cannot reset, please contact our service department or agent.

※ When GAS alarm occurs, ADL312SC will display the error prompt of GAS, but will not display the error code of GAS. Regarding GAS troubleshooting, please refer to GAS instruction manual.

8. In the Event of Failure…

Trouble Shooting

In case of the following conditions

Symptoms	Possible causes	Countermeasures
The POWER does not turn ON	● The ELB is OFF ● The power switch is OFF ● Malfunction of the power supply ● The power cord is disconnected ● Malfunction of power switch	● Turn the ELB ON ● Turn the power switch ON ● Check the power supply circuit ● Replace the cord ● Replace the power switch
The blower does not activate	● The power supply voltage is too low ● The blower power is too low ● The blower connector is not correctly connected ● The blower input line is disconnected ● Blower switch failure ● Blower motor failure ● Blower motor brush failure ● Blower circuit and wiring failure	● Select the appropriate power supply ● Increase the output power of the blower ● Connect correctly ● Replace the input line ● Replace the touch screen, PLC or temperature controller ● Replace the motor or motor board ● Replace the brush ● Maintain or replace the part
The temperature cannot rise	● The heater button is not ON ● The heater connector is not correctly connected ● Failure of other parts causes the protection circuit activation (error display) ● The blower switch is not ON ● Protection circuit activates ● Heater disconnection ● Heater switch failure ● Heater circuit and wiring failure	● Turn on the heater button ● Connect correctly ● Solve the problem and turn ON the switch ● Turn ON the blower switch, and then turn ON the heater switch ● Check if there is an alarm ● Replace the heater ● Replace the touch screen or PLC ● Maintain the part or replace the temperature controller
The liquid sending pump does not activate	● Pump speed is set to 0 ● Pump switch failure ● Pump motor failure ● Pump circuit and wiring failure ● Nozzle installation failure	● Set the pump rotate speed ● Replace the touch screen or PLC ● Replace the motor or driver ● Maintain the part ● Confirm installation status of nozzle and correct
No air flow for spray	● Flowmeter is not open ● Flowmeter switch failure ● Pressurized air source failure ● Hose connection failure ● Solenoid valve failure ● Pulse jet circuit and wiring failure	● Turn on the flowmeter and adjust ● Maintain or replace the part ● Replace the solenoid valve ● Replace the touch screen or PLC ● Maintain the part

8. In the Event of Failure…

Trouble Shooting

Symptoms	Possible causes	Countermeasures
Temperature controller failure	● The outlet temperature sensor is not installed ● Defective display function ● Sensor failure ● Overheat prevention function failure	● Install the outlet temperature sensor correctly ● Maintain the part or replace the PLC ● Replace the sensor ● Lower the set temperature
Cannot reach the set temperature	● Heater capacity is insufficient due to excessive dry air flow ● Regulating circuit and wiring failure	● No abnormality. During the high-temperature operation, either reduce the dry air flow, or increase the set value of operating temperature ● Maintain the part or replace the PLC

◆ In case if the error other than listed above occurs, please immediately cut off the power supply, pull out the power cord, and contact the sales store or our company's business, customer service center.

9. After Service and Warranty

When requesting a repair

If any trouble occurs, immediately stop operation, turn the power switch off, pull out the power plug and contact your dealer, our sales office or our customer service center.

Information necessary for requesting a repair

- Model name of the product
- Serial number
- Date (y/m/d) of purchase

See the warranty card or the nameplate on the unit.
See the section “3.Names of parts and their function” on page 9.

- Description of trouble (as in detail as possible)

Be sure to indicate the warranty card to our service representative.

Warranty card (attached separately)

- Warranty card is given by your dealer or one of our sales offices and please fill in your dealer, date of purchase and other information, and then store it securely.

- Warranty period is one full year from the date of purchase. Repair service for free is available according to the conditions written on the warranty card.

- For repairs after the warranty period consult your dealer, one of our sales offices or our customer service center.
  Paid repair service is available on your request when the product’s functionality can be maintained by repair.

Minimum holding period of repair parts

The minimum holding period of repair parts for this product is seven years after end of production.
Repair parts here refer to parts necessary for maintaining performance of the product.

10. Specification

Specifications of main unit

Model		ADL312SC
Suitable for solvent recovery unit		GAS510C (optional)
Temperature		5℃ to 35℃ (Indoor use only)
Altitude		Up to 2,000 meters
Relative humidity		≤75%RH
Function		Spray drying
Drying object samples		Solution, suspension, emulsion (for flammable and explosive substances, please use when connected with GAS510C)
Spray mode		Two-fluid nozzle (orifice diameter about Φ0.7)
Spray and hot air contact mode		Vertical downward spray and parallel flow
Water evaporation ※1		Max. about 1500mL / Hr
Structure	Temperature controller	PID temperature controller
	Heater	3.2kw（220V～）Stainless steel pipe heater
	Blower	Brushless blower
	Liquid sending pump	Peristaltic pump
	Blowout mechanism for pressurized air	Continuous spraying
	Automatic cleanout needle	Use the needle in the nozzle to realize the automatic orifice cleaning (The air cylinder in the nozzle is driven by solenoid valve, electronic timer and pressure air)
	Nozzle blower	Blow off the powder attached to the nozzle tip (using of solenoid valve, pressure air)
Control part	Temperature adjustment range	Inlet temperature: 0-240℃, Outlet temperature: 0-100℃
	Temperature adjustment accuracy ※1	±1℃
	Temperature display	Digital display of inlet temperature and outlet temperature (display accuracy 0.1℃)
	Spray air flowmeter	Measurement range: 0-30L/min (the max. flow rate is related to the pressure of the spray gas source)
	Adjustable range of liquid sending volume	0 – 26 ml/min variable (the max. drying capacity 25 ml/min)
	Adjustable range of drying air volume ※1	0.15-0.7m³/min (when a single blower runs independently)
Spec.	External dimension (mm) (W×D×H) ※2	580×420×1125
	Power supply	Single phase 200-230V～ 50/60Hz 17-20A
	Weight	Approx. 80kg
	Total weight	Approx. 91kg（Including GF301C）

Attached accessories			
・ Outlet temperature sensor	1	・ Sample hose: silicone, I.D.2mm×O.D.4mm×1m	2
・ Fuse 250V 2A	1	・ Exhaust hose: made from vinyl chloride, I.D.50mm×2m	1
・ Earth wire	1	・ Hose tie: ＃64	1
・ Exhaust connector	1	・ Hose: 5m (for connecting pressurized air)	2
・ Stand	1	・ Hose clamp	1
・ Protection cover	1	・ Air tube A Φ6×0.6 m （NOZZLE A）	1
・ Warranty card	1	・ Air tube B Φ6×0.6 m （NOZZLE B）	1
・ Instruction manual	1	・ Clamp	1

※1 Performance value: under the circumstance of power supply 220V～, room temperature 23℃ ±5℃, humidity 65% RH±10%, no load.

※2 External dimensions do not include protruding parts.

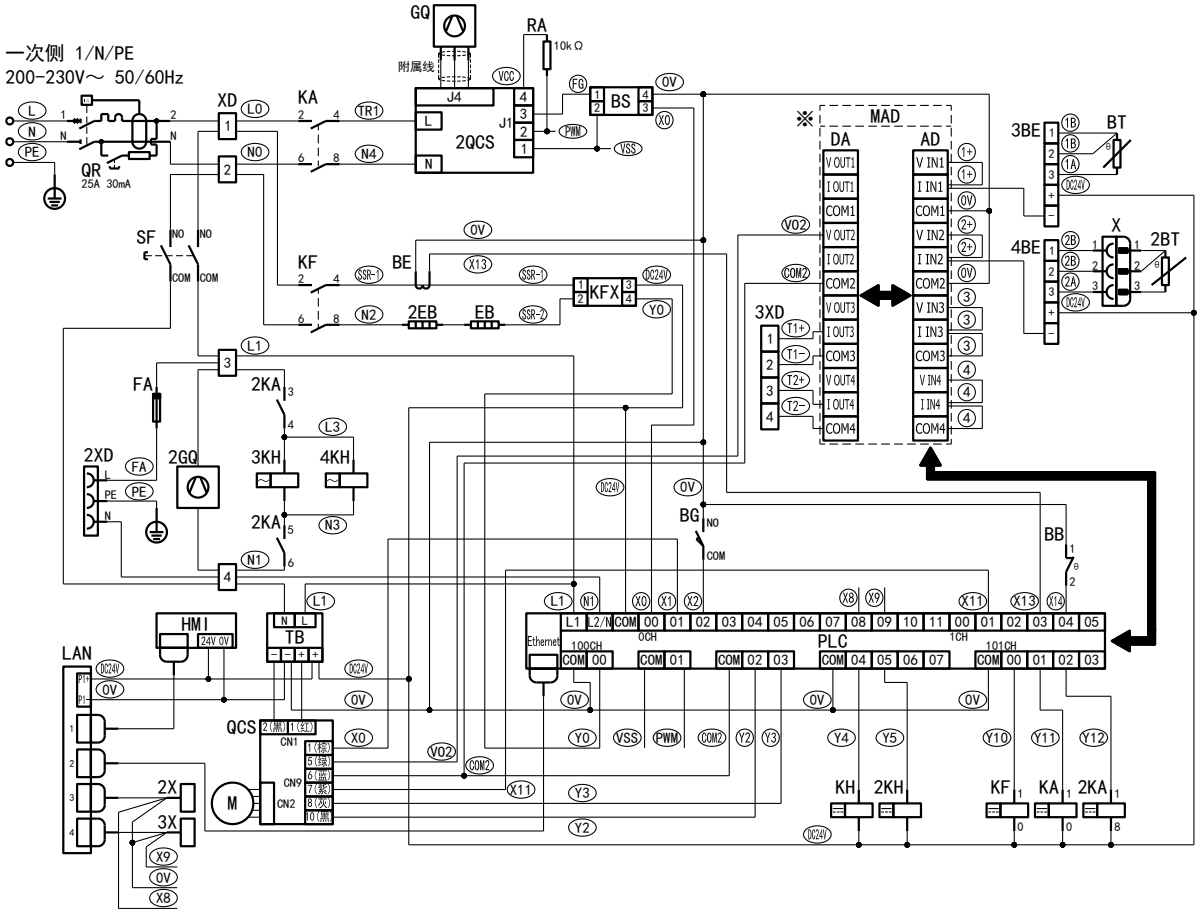
10. Specification

Mini Splay Accessories〔GF301C〕	Model	GF301C
	Amount of water evaporation	Max. Approx. 1500ml/h
	Spray nozzle	Two-fluid nozzle 1A
	Drying chamber	Made of super hard glass
	Cyclone	Made of super hard glass
	Product collecting container	Made of super hard glass
	Dust removal of nozzle tip	Pulse jet type (use the pressuring air blowout mechanism for GB210 model)
	Weight	Approx. 11kg
	Parts list	Cyclone 1 set Drying chamber 1 set Product collecting container 1 Container holding band 1 Packing 40A、50A 1 each Power clamp 40A、50A 1 each Cap 1 Connecting ferrule (D) 1 PFA corrugated pipe 1·1/2 3 feet (for connecting the cyclone) 1 Hose clip 2 Distributor (O-rings P16, P135 included) 1 Hex bolt M6×20 3 Flat washer M6 3 Spring washer M6 3 Aluminum honeycomb 1 Pipe 1 Spray nozzle 1 Wrench 1 Plastic container for 100g of 5% sodium chloride solution 1 Warranty card 1

Please remind that this product may be changed the specification and others for revision without any announce to the user.

11. Wiring Diagram

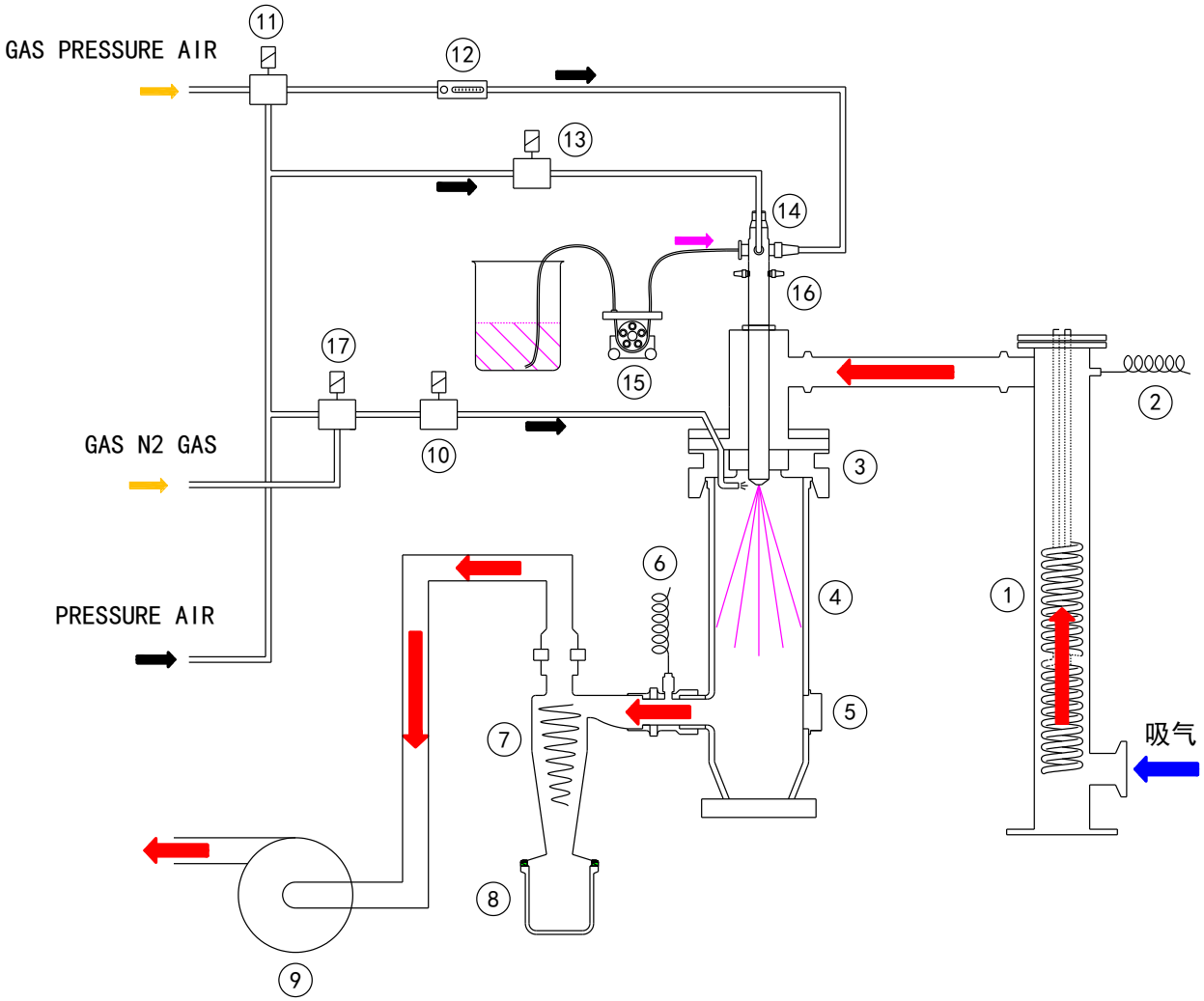
ADL312SC Wiring Diagram



Symbol	Part name	Symbol	Part name
QR	Earth leakage breaker (30mA)	HMI	Touch screen
XD	AC power distribution wiring terminal block	2X,3X	Network interface socket for online use
SF	Panel power switch	LAN	Network switch
2GQ	Heat dissipation fan	KA	Intermediate relay
FA	Program unit	KH	Pulse jet nozzle solenoid valve
2XD	Temperature sensor	2KH	Pneumatic cleaning nozzle
KF	Heating control main relay	3KH	GAS connection solenoid valve
BE	Heater current inductive switch	4KH	Spray solenoid valve
KFX	Solid state relay	BG	Nozzle detection switch
EB,2EB	Heating pipe	BB	Overheat protector
2KF	Blower control main relay	BT	Inlet temperature sensor (Pt100)
2QCS	Blower driver	2BT	Outlet temperature sensor (Pt100)
BS	Optocoupler integrated module	3BE	Inlet temperature transmitter
RA	10kΩ resistor	4BE	Outlet temperature transmitter
GQ	Blower	AD	Analog input module
TB	DC power supply (DC24V)	DA	Analog output module
QCS	Liquid sending pump driver	(MAD)	Analog input and output module
M	Liquid sending pump drive motor	X	Outlet temperature sensor quick plug
PLC	Programmable controller	3XD	Temperature output terminal block

12. System diagram

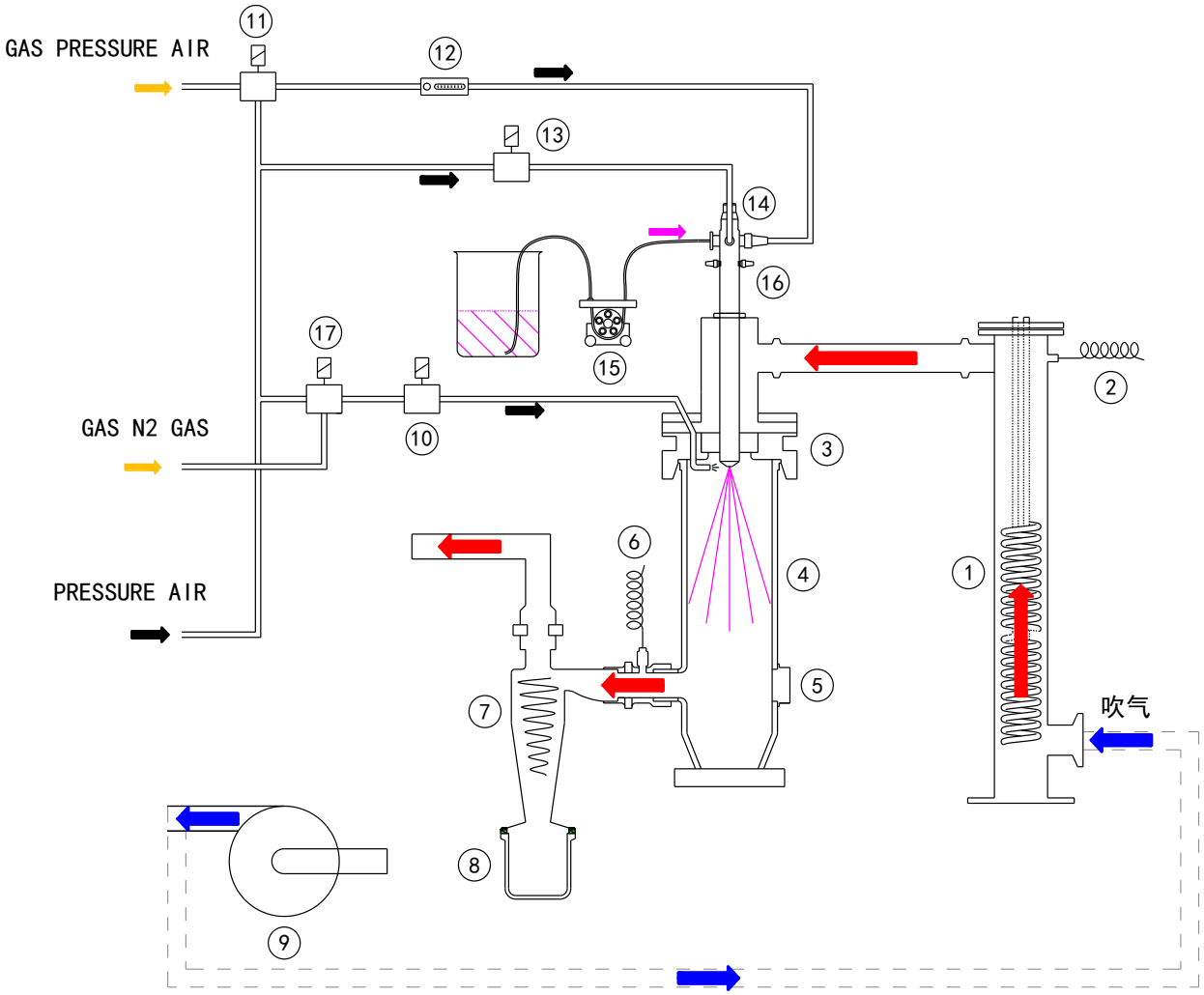
Standard mode system diagram



No.	Part name	No.	Part name
①	Heater	⑩	Solenoid valve
②	Inlet temperature sensor	⑪	Three-way solenoid valve
③	Distributor	⑫	Flow meter
④	Drying chamber	⑬	Flow meter
⑤	Cap	⑭	Solenoid valve of automatic cleanout needle
⑥	Outlet temperature sensor	⑮	Liquid sending pump
⑦	Cyclone	⑯	Nozzle cooling connector
⑧	Product collecting container	⑰	Three-way solenoid valve of pulse jet gas source switchover
⑨	Blower		

12. System diagram

PUSH mode system diagram



No.	Part name	No.	Part name
①	Heater	⑩	Solenoid valve
②	Inlet temperature sensor	⑪	Three-way solenoid valve
③	Distributor	⑫	Flow meter
④	Drying chamber	⑬	Flow meter
⑤	Cap	⑭	Solenoid valve of automatic cleanout needle
⑥	Outlet temperature sensor	⑮	Liquid sending pump
⑦	Cyclone	⑯	Nozzle cooling connector
⑧	Product collecting container	⑰	Three-way solenoid valve of pulse jet gas source switchover
⑨	Blower		

13. Operation principle

Operation principle of standard mode

Refer to P. 52 "Standard mode system diagram"

The sample is sent from the appropriate container to ⑭ spray nozzle with ⑮liquid sending pump. Moreover, the compressed air from the air compressor is regulated by ⑫ flow meter, and sent to ⑭ spray nozzle. At the tip of the nozzle, the compressed air is mixed with the sample, and the mixed sample is sprayed into the ④ drying chamber. This sample becomes drop shape that the particle diameter is approx. 20 μ and the surface area is 3,000 cm^2 per 1 litter of sample.
On the other side, the air is sucked into the unit by ⑨ blower, and heated up by ① heater to the set temperature. Since the contact area of the heated air and the sample is very large, the approx. 90% or more of the moisture will be evaporated in the drying chamber momentarily.
The dried sample that became fine particles is sent to ⑦ cyclone after further drying, and separated from the water vapor here, and then sent to ⑧ product collecting container. The time after the sample is sprayed with the nozzle till it is collected into this container does not take 0.5 seconds. Moreover, since the sample particles are always surrounded by the solvent vapor (water vapor), the temperature does not rise extremely around the fine particles due to the vaporization heat. However, the heat-sensitive material, such as enzyme, may be damaged even if the outlet temperature is about 80℃.
The evaporated moisture is evacuated to outside via the blower.
The temperature conditions in the experiment are displayed on the display panel through the inlet temperature sensor and the outlet temperature sensor. Moreover, the airflow rate that dries the sample is regulated by the blower.
In case that the sample attachment on the nozzle tip is too much, turn on ⑩ solenoid valve to make the pressurized air blow to the nozzle tip from ③ distributor in order to remove the attachment. If necessary, remove ⑤ cap to lead the external gas into the inside of the chamber.

Operation principle of PUSH mode

Refer to P. 53 "PUSH mode system diagram"

The sample is sent from the appropriate container to ⑭ spray nozzle with ⑮liquid sending pump. Moreover, the compressed air from the air compressor is regulated by ⑫ flow meter, and sent to ⑭ spray nozzle. At the tip of the nozzle, the compressed air is mixed with the sample, and the mixed sample is sprayed into the ④ drying chamber. This sample becomes drop shape that the particle diameter is approx. 20 μ and the surface area is 3,000 cm^2 per 1 litter of sample.
On the other side, the air is pushed into the unit by ⑨ blower, and heated up by ① heater to the set temperature. Since the contact area of the heated air and the sample is very large, the approx. 90% or more of the moisture will be evaporated in the drying chamber momentarily.
The dried sample that became fine particles is sent to ⑦ cyclone after further drying, and separated from the water vapor here, and then sent to ⑧ product collecting container. The water vapor is discharged through the exhaust pipe. In PUSH mode, air is pushed into the unit by the blower. When the high-temperature solvent vapor (water vapor), which dries the sample particles, is discharged, even if there is a high-temperature air flow, it will not influence the blower, and it can be discharged to the outside through the exhaust pipe.
PUSH mode can be used for high outlet temperature test conditions, the blower will not be influenced by high temperature and thus reduce its service life.
The temperature conditions in the experiment are displayed on the display panel through the inlet temperature sensor and the outlet temperature sensor. Moreover, the airflow rate that dries the sample is regulated by the blower.
In case that the sample attachment on the nozzle tip is too much, turn on ⑩ solenoid valve to make the pressurized air blow to the nozzle tip from ③ distributor in order to remove the attachment. If necessary, remove ⑤ cap to lead the external gas into the inside of the chamber.

14. Replace parts list

Replacement parts for ADL312SC

	Part name	Specifications	Manufacturer	Code No.
※	Packing (C)	AD311S-40440	Yamato Scientific	B081999025
※	Packing (D)	AD311S-40430	Yamato Scientific	B081999026
※	Packing (E)	AD311S-40550	Yamato Scientific	B081999017
※	Filter	AD311S-40540	Yamato Scientific	B040300005
※	Heat resistant hose	GS type 38×42×L650	TIGERS POLYMER	B080807016
※	Filter	AD311S-40400		B040300004
※	Sheathed heater	ADL311SC_01_03_02	Yamato Scientific	H090101023
	Corrugated pipe	40KF L=160	Yamato Scientific	A041500019
	Blower motor	NXK60-800-FZ05 (800W)	Yamato Scientific	A080103043
※	Teflon hose	φ8×φ6×L1000	Yamato Scientific	A080807007
	Clamp	40KF Center ring with O-ring	Yamato Scientific	A041500010
※	Center ring	40KF	Yamato Scientific	A041500010
※	O-ring	P23 4-types D Viton For upper sleeve	Yamato Scientific	F0020058
※	O-ring	P145 4-types D Viton For upper sleeve	Yamato Scientific	B081902003
	Flow meter	LZB-10WBF 3～30L/min	Yamato Scientific	A040409027
	Switch	LB22 Rocker switch 220V	Yamato Scientific	A011501005
	Motor	FY8PF15N-D3 For sending liquid	JAPAN SERVO	B011603002
	Drive circuit board	FYD815SD3 For sending liquid	JAPAN SERVO	B011401014
	Gear head	8H30FBN-100 For sending liquid	JAPAN SERVO	B080400001
	Solenoid valve	AG43-02-4-E-AC220V	Yamato Scientific	A040403102
※	Teflon hose	φ6.35×φ4.35×200	Yamato Scientific	B080807003
	Temperature sensor (inlet)	ADL311SC_03_01-03	Yamato Scientific	H090101056
	Temperature sensor (outlet)	ADL311SC_03_01-04	Yamato Scientific	H090101057

14. Replace parts list

Part name	Specifications	Manufacturer	Code No.
Touch screen	NB7W-TW11B	Yamato Scientific	A020400014
PLC	CP2E-N30DT-A	Yamato Scientific	A020300066
Earth leakage breaker	BV-DN 1P+N 25A 30mA	Yamato Scientific	A010410002
SSR	KS15/D-38Z40-L with protective cover RPC-1	Yamato Scientific	A011006024
Relay	HF116F-3/024DF2HTFW	Yamato Scientific	A011001013
Switching power	LRS-100-24	Yamato Scientific	A010801045
Liquid sending hose	Φ2*Φ4	Yamato Scientific	B080807050
Fuse	250V 2A	Yamato Scientific	A010301005
Micro switch	SS-01GL2	Omron	B011505003
Solenoid valve	VX3334Q-02-1G1-B	SMC	B040403001
Overheat protector	350℃	Yamato Scientific	B020103001

Note: Parts marked with * are consumable parts.

14. Replacement parts table

Replacement parts for GF301C

	Part name	Standards	Manufacturer	Code No.
	Drying chamber system	GF300-30000 Ultra hard glass	YSC	LT00028136
	Cyclone set	GF300-30060 Ultra hard glass	YSC	LT00028785
	Container holding band	GF300-40000 Stainless steel	YSC	LT00027540
	1 set of automatic spray assy	S00360-00-316L-ASSM	YSJ	Q110901009
※	O-ring	P16 4 types D Viton	YSC	4210026021
※	Aluminum honeycomb	91.5mm×45mm×27mm×φ3.0 mm	YSJ	A080199062
※	O-ring	P135 4 types D Viton	YSC	F0020073
※	Cap	GF300-40100 Silicone	YSC	LT00027544
	Connecting ferrule (D)	GF300-40080	YSC	LT00027543
※	PFA wave formed tube	1-1/2, 3 feet (915mm) long	YSC	LT00027545
	Hose clip	JCS-Win-2A ϕ35～50	YSC	LT00027550
※	Packing	40A Silicone	YSC	F0220141
※	Packing	50A Silicone	YSC	F0220143
	Power clamp	40A	YSC	R0100009
	Power clamp	50A	YSC	R0100012
	Product collecting container	GF300-30090	YSC	LT00027539
※	Clean out needle Additional machining drawing	S00360-07-01	YSJ	A080999122
※	sealing gasket of liquid cap	CP3612-TFE	YSJ	A080999032
※	O-ring-1	Inside diameter Φ31.5*1.8m	YSJ	A081902073
※	O-ring-2	Inside diameter Φ19*1.5mm	YSJ	A081902072
※	O-ring-3	Inside diameter Φ14*2.65mm	YSJ	A081902071
※	O-ring-5	Inside diameter Φ6*2mm	YSJ	A081902069
※	O-ring-6	Inside diameter Φ10*1.8mm	YSJ	A081902070

Note: Parts marked with * are consumable parts.

15. List of Dangerous Substances

Never use explosive substances, flammable substances and substances that include explosive or flammable ingredients in this unit. Otherwise explosion or fire may result

ADL312SC supports organic solvents by connecting it to the optional GAS series product. Carefully read the operation manual of GAS series product and take special care for handling of organic solvents.

Explosive substance	Explosive substance	①Nitroglycol, glycerine trinitrate, cellulose nitrate and other explosive nitrate esters
		②Trinitrobenzen, trinitrotoluene, picric acid and other explosive nitro compounds
		③Acetyl hydroperoxide, methyl ethyl ketone peroxide, benzoyl peroxide and other organic peroxides
Flammable substances	Explosive substances	Metal “lithium”, metal “potassium”, metal “natrium”, yellow phosphorus, phosphorus sulfide, red phosphorus, celluloids, calcium carbide (a.k.a, carbide), lime phosphide, magnesium powder, aluminum powder, metal powder other than magnesium and aluminum powder, sodium dithionous acid (a.k.a., hydrosulphite)
	Oxidizing substances	①Potassium chlorate, sodium chlorate, ammonium chlorate, and other chlorates
		②Potassium perchlorate, sodium perchlorate, ammonium perchlorate, and other perchlorates
		③Potassium peroxide, sodium peroxide, barium peroxide, and other inorganic peroxides
		④Potassium nitrate, sodium nitrate, ammonium nitrate, and other nitrates
		⑤Sodium chlorite and other chlorites
		⑥Calcium hypochlorite and other hypochlorites
	Flammable substances	①Ethyl ether, gasoline, acetaldehyde, propylene chloride, carbon disulfide, and other substances with ignition point at a degree 30 or more degrees below zero.
		②n-hexane, ethylene oxide, acetone, benzene, methyl ethyl ketone and other substances with ignition point between 30 degrees below zero and less than zero.
		③Methanol, ethanol, xylene, pentyl acetate, (a.k.a.amyl acetate) and other substances with ignition point between zero and less than 30 degrees.
		④Kerosene, light oil, terebinth oil, isopenthyl alcohol(a.k.a. isoamyl alcohol), acetic acid and other substances with ignition point between 30 degrees and less than 65 degrees.
	Combustible gas	Hydrogen, acetylene, ethylene, methane, ethane, propane, butane and other gases combustible at 15℃ at one air pressure.

(Quoted from the separate table 1 in Article 6, the enforcement order of the Industrial Safety and Health Law)

16. Standard installation manual

*Follow the items below to make installation. (Check the procedures separately for optional parts or products of special specifications.)

Model	Serial number	Date	Installation manager (company name)	Installation manager	Judgment

№	Item	Implementation method	Table of contents No. Section for reference in manual	Judgment
Specification				
1	Accessories	Check of quantity according to the accessory columns	10.Specifications	
2	Installation	・ Visual check of the environmental status Caution: Surrounding environment	2. Before using this unit ・ At the installation site...	
Operation related matters				
1	Source voltage	・ Measure customer side voltage (ELB etc.) with a tester ・ Measure voltage while the heater is operating (Shall meet the standards) Caution: Use a power supply that meets the standard when you are going to install it on a plug or an ELB.	2. Before using this unit ・ Be sure to connect the earth wire... ・ Use the dedicated outlet for power supply 4. Operating procedures Preparations (1) & (2) 10. Specifications ・ Power supply	
2	Installation of the attachment	Preparations ・ Connecting the exhaust duct ・ Connection to the compressor ・ Connection of the spray nozzle cooling mechanism (as necessary) ・ Checking the contents of the GF301C set ・ Installation of the distributor ・ Installation of the nozzle guide ・ Installation of the drying chamber ・ Installation of the temperature sensor Installation of the cyclone, the product collecting container, the cap, and the hose ・Insert the spray nozzle from the ceiling of the main unit and then connect the liquid sending tube and the pressurized air tube	4. Operating procedures, preparations ・ (3) Connection of the exhaust duct ・ (4)Rear of the upper frame... ・ (5)Cooling the spray nozzle ・ (6)Mini spray... ・ (7)On the top of the main unit... ・ (8)...In the center of the distributor... ・ (9)Stage positioning... ・ (10)...The temperature sensor... ・ (11)...The cyclone... Operating method ・ Set referring to the left drawing in section(7)	

16. Standard installation manual

№	Item	Implementation method	Table of contents No. Section for reference in manual	Judgment
3	Operation start (Commissioning)	Perform commissioning ・ELB and the power switch ON ・Set the setting select to INLET and set the INLET temperature to 150℃ ・Installation of the mini spray attachment ・Set the BLOWER switch ON and to air amount 0.45m^3/min Adjusting volume: 3.3（50Hz）/5（60Hz） ・Set the liquid sending pump to be 20rpm ・Turn the heater switch ON ・Setting the liquid sending tube and distilled water ・Spraying pure water Set the spray pressure to 0.1MPa when the outlet temperature has risen to around 80℃. Adjust liquid sending speed so that the outlet temperature will be slightly lower than about 75℃ ・Change from distilled water to the sample and shift to the powder collecting operation	4. Operating procedures Operating method ・(1)・(2) ・(3) on the operation panel... ・(4)Mini spray... ・(5)Blower switch... ・(6) the heater switch... ・(7) the liquid sending tube... ・(8)・(9) ・(10) When the outlet temperature has become stable...	
4	Operation stop	Stop operation ・Change from the sample to distilled water and wash inside the spray nozzle Approx.5 min→PUMP switch OFF→ Choke spray pressure to 0 ・Turn the HEATER switch OFF ・Turn the BLOWER switch OFF when the outlet temperature dropped to 45℃ or less ・Turn the POWER switch OFF ・Collect powder ・Clean the containers according to the maintenance method	4. Operating procedures Operating procedures ・(11)When specimen has been... ・(12)Turn the heater OFF... ・(12)Turn the heater OFF... ・(13)...The power switches... ・(14)...The container holding band... ・(15)...to the maintenance method 6. Maintenance procedures	
Description				
1	Description of operation	Description of operation of each part to the customer according to the manual	1. Safety precautions to 13.List of hazardous materials	
2	Error codes	Description of the error codes and countermeasures to the customer according to the manual	8. When a trouble occurs to 9. After-sales service and warranty	
3	Maintenance & inspection	Description of operation of each part to the customer according to the manual	6. Maintenance procedures ・Daily inspection/care	
4	Completion of installation Matters to note	・Indicate the installation date and the manager name on the nameplate of the main unit. ・Fill in the warranty card with necessary matters and hand it over directly to the customer. ・Description of after-sales service route	9. After-sales service and warranty	

Responsibility

Please follow the instructions in this document when using this unit. Yamato Scientific has no responsibility for the accidents or breakdown of device if it is used with a failure to comply. Never conduct what this document forbids. Unexpected accidents or breakdown may result in.

Note

- The contents of this document may be changed in future without notice.
- Any books with missing pages or disorderly binding may be replaced.

Instruction Manual
Spray Dryer
ADL312SC
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