SINCE 1889

Yamato

CE

# SPRAY DRYER

# DL411C

The 1st edition

- Thank you for purchasing the "Spray Dryer DL411C" produced by Yamato Scientific Co., Ltd.
- To use this unit properly, read this "Instruction Manual" thoroughly before using this unit. Keep this instruction manual properly for referring at any time.

**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 Symbols

### About the Symbols

A variety of symbols 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 symbols

This symbol indicates a matter that encourages the user to adhere to warning (“caution” included).
Specific descriptions of warning are indicated near this symbol.

This symbol indicates prohibitions
Specific prohibitions are indicated near this symbol.

This symbol indicates matters that the user must perform
Specific instructions are indicated near this symbol.

# 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 · Caution**

## ⚠ 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, a fire or explosion may occur. Please ventilate the room frequently and be careful not to let the air concentration in the environment reach the explosion limit. (Refer to P.54 “15. List of Dangerous Substances”)

**Always ground this unit**

Be sure to connect the ground wire correctly. The electric leakage may cause electric shock and fire.

**Please use the rated power supply**

Be sure to use the rated power supply. If a power supply other than the rated voltage・power supply is used, it may cause fire and electric shock.

**Prohibition of use for error**

If a smoke or abnormal smell occurred, turn off the power switch of the main unit immediately, and turn off the original power source, and contact to the agent or our sales office. Keep running may cause 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 may overheat and cause fire.

**Do not damage power cord**

Do not damage power cord by bending, pulling, or twisting forcedly. It may cause fire or electric shock. Besides, operating the unit with something on the cord may cause overheat and result in a 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 54. **Connect DL411C 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**

Drying chamber, cyclone and some parts of the unit are very hot during and after operation. It may cause scald, do not touch.

**Never try to disassemble or alter the unit**

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

# 1. Safety precautions

**Warning · Caution**

## ⚠ Caution

**During a thunder storm**

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

**If an electric failure occurs**

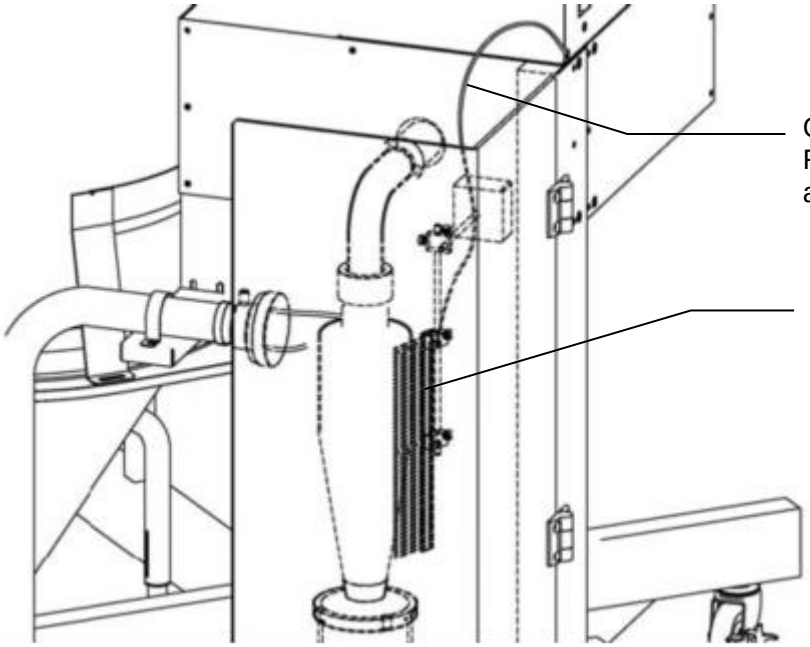
When power is shut off during operation (while the blower is operating or liquid is being sent) due to turning the ELB to "OFF" or a power failure, all operation modes will reset to the initial states after recovery. When the temperature inside the chamber is higher, keep operating the blower until the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

Due to the sample used and the operating environment and conditions, there may be static electricity on the cyclone part. Use an antistatic brush to remove the static electricity. Install the antistatic brush as shown in the following figure. Install the brush head on the cyclone part and fix the ground wire to the M4 screw at the unit body.



# 2. Before using this unit

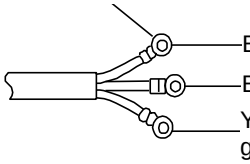
## Precautions when installing the unit

### ⚠ 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 unit 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.

M4 O-terminal




| 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

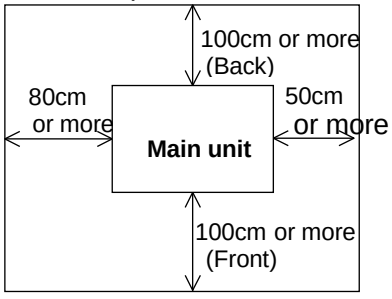
Use a power supply that matches the power supply capacity.
Electrical capacity: single phase 200-230V～ 50/60Hz 23-27A (Protection circuit breaker operating current is 32A)
If the power supply is ON, but the equipment does not start, check whether the main power supply voltage is lower or share a power cord with other machines. Please use the power cord separately from other machines. In consideration of the safety of the unit 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°C 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.



# 2. Before using this unit

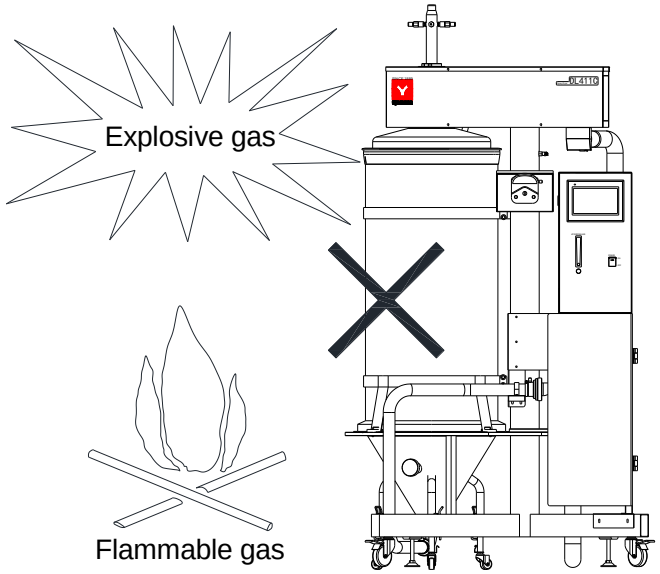


**Warning**

## 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 or explosion may occur.

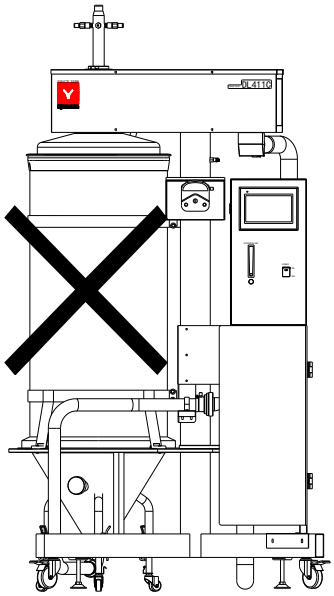
Refer to P.54 “15. List of Dangerous Substances”.




## 5. Do not modify

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

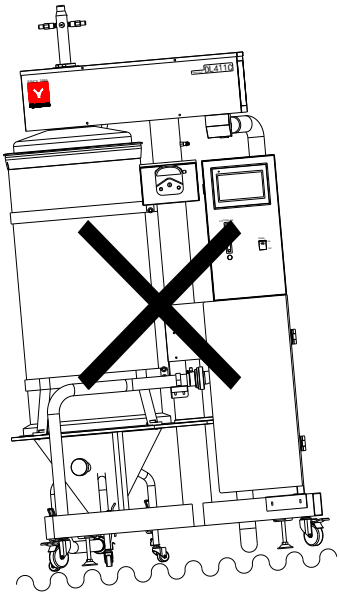
**Modification**



## 6. Do not topple or tilt this unit

Flat

Set this unit to a flat 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

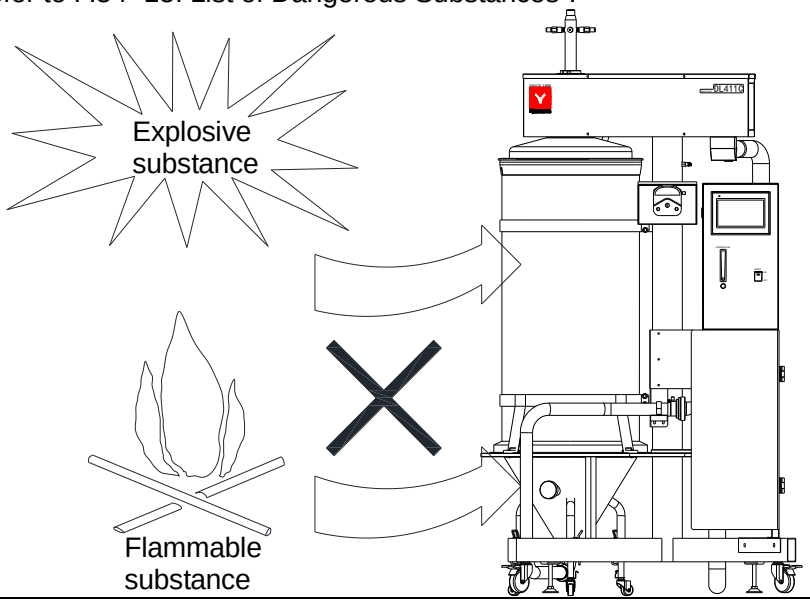
## Precautions when installing the unit

### ⚠ 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. **DL411C 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 P.54 “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 cord

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 socket, which is supplied appropriate power and voltage.

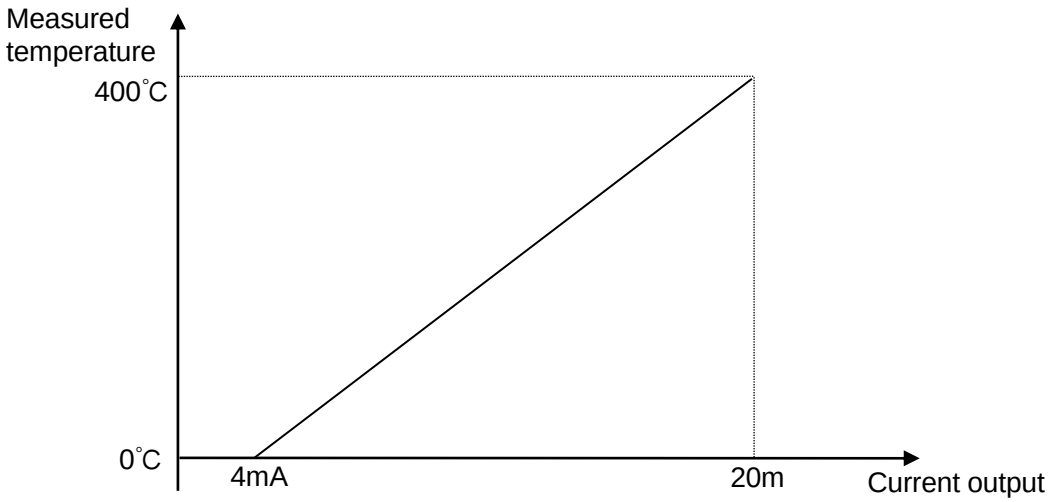
## Service socket capacity

Apply the 200-230V～ service socket for this unit.
Connecting the service socket with its capacity over 1A will blow out the fuse, and the power supply to the service socket will be 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 0-400℃, the current output is 4-20mA.

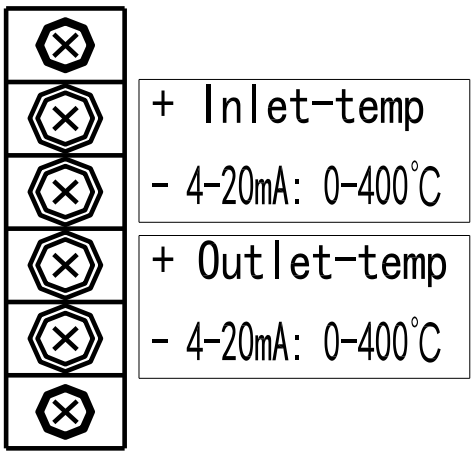
[Current output 4-20mA： Measured temperature 0-400℃]




Conversion formula: Current output I (mA) ＝ Measured temperature T (℃) ÷ 25 + 4

Measured temperature T (℃)＝ 25 × [Current output I (mA)－ 4]

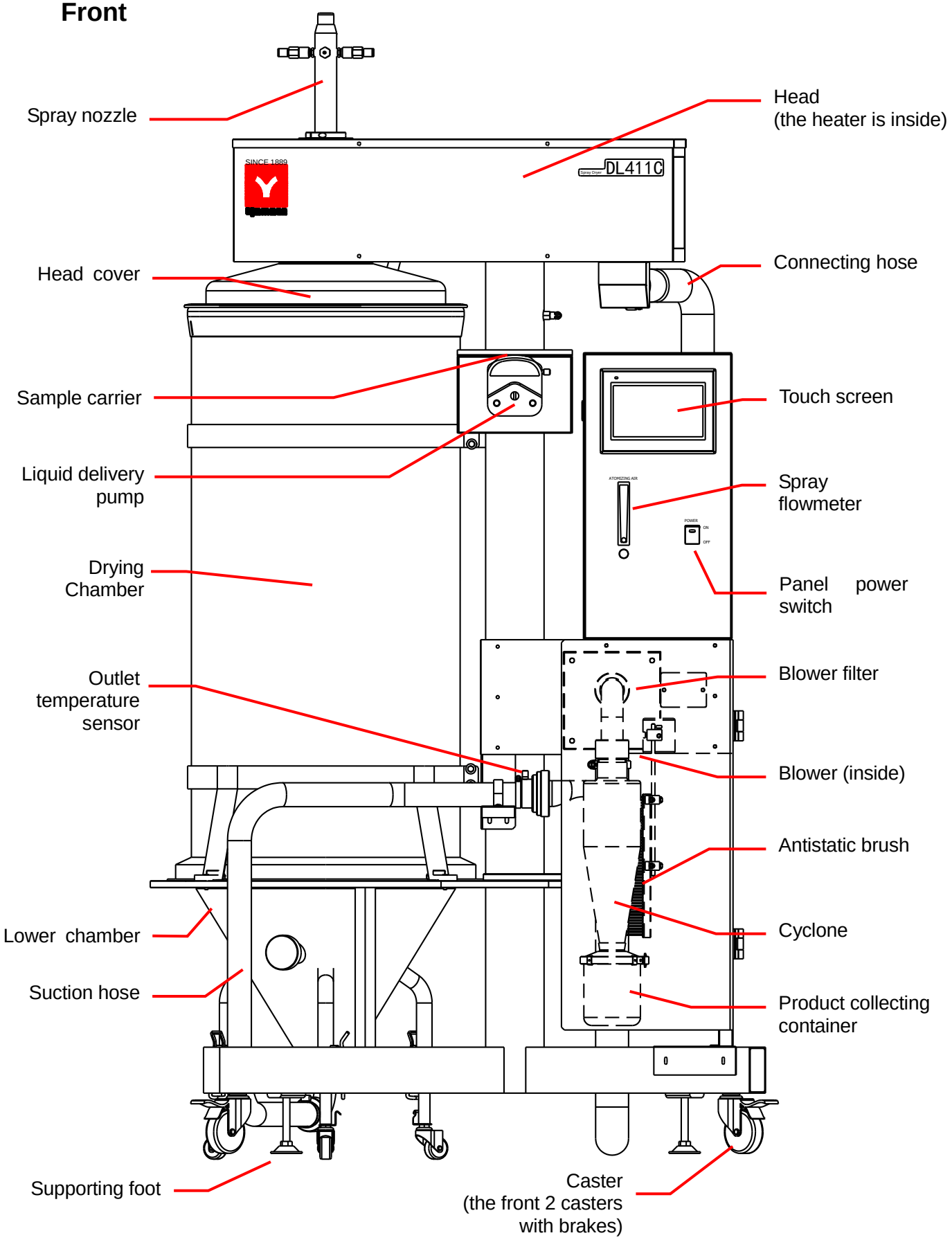
When you connecting to the voltage input of the recorder, connect a fixed resistor (shunt resistor) of 300Ω or lower to the voltage input of the recorder.



# 3. Name and Function of each part

**Unit body**

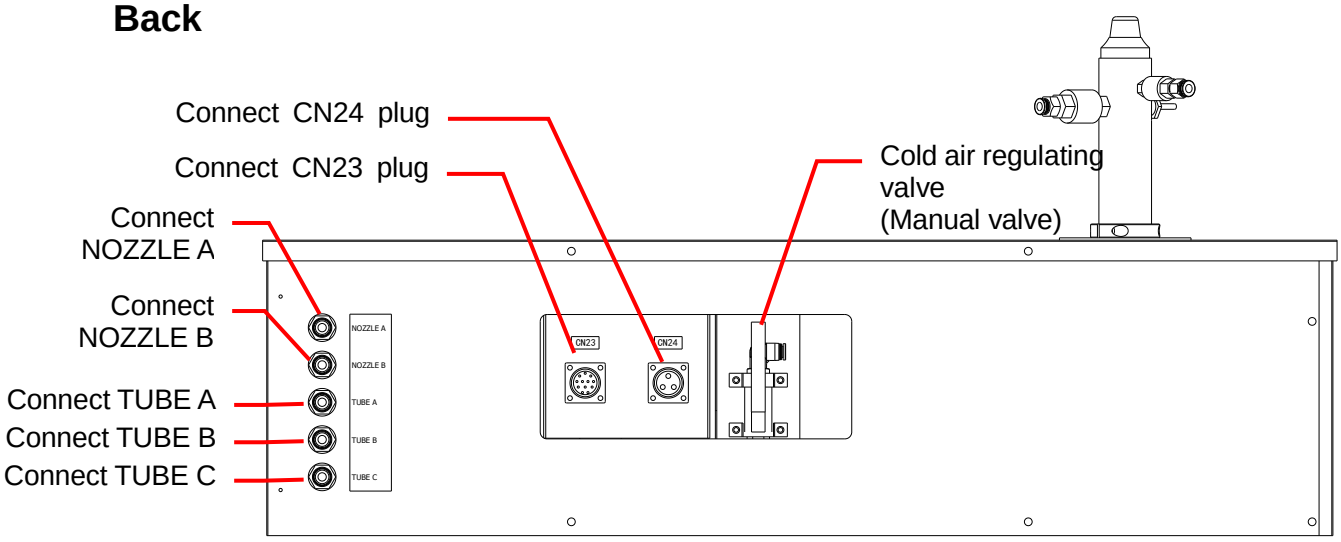
## Front

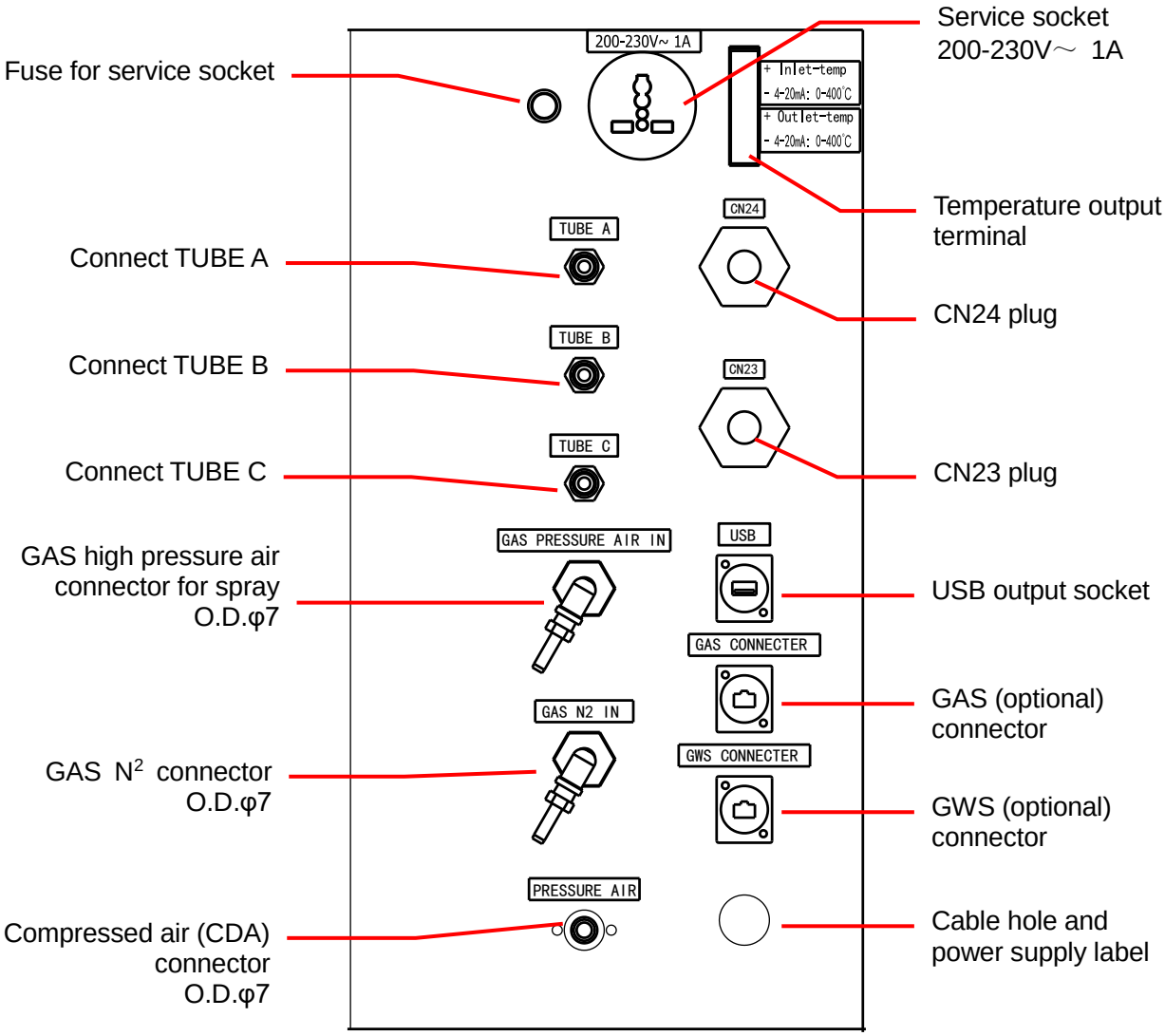


# 3. Name and Function of each part

**Unit body**

## Back



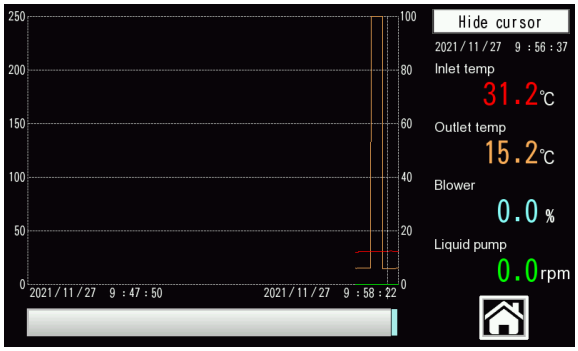



# 3. Name and Function of each part

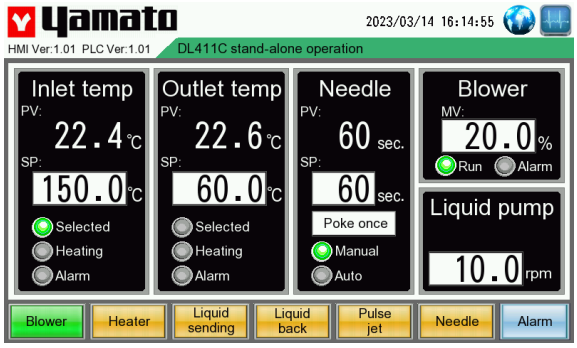
## Operation interface overview

### Initial interface


### Operation curve interface

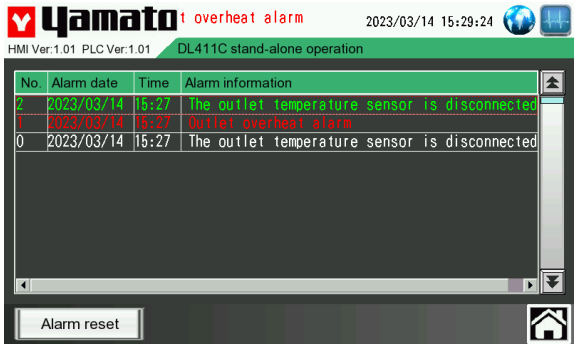



### Operation interface

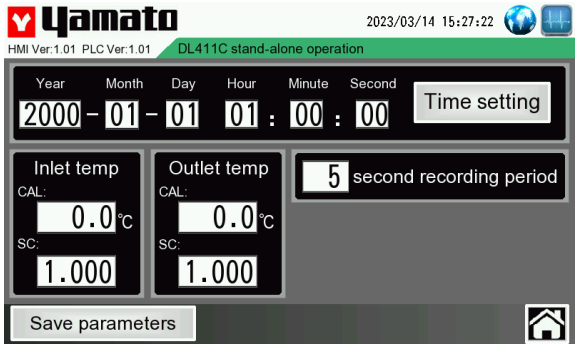



### Language selection pop-up interface


### Alarm interface




### System parameters interface



# 3. Name and Function of each part

## 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.

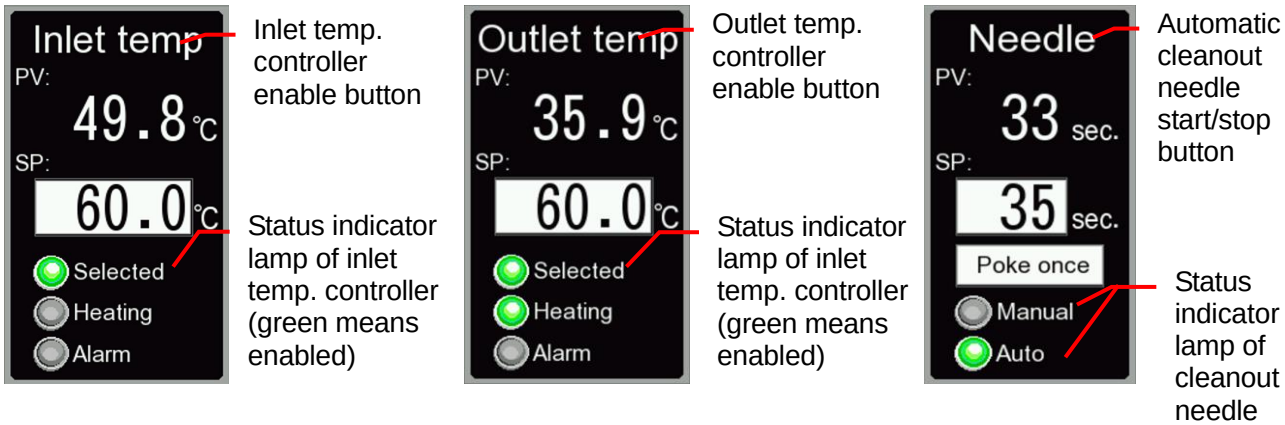
This kind of button has no power-off memory function, and it will be in OFF state after power outage recovery. Its corresponding function can only be activated by the operator.

| | |
|---|---|
|  | Initial state: OFF<br>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<br>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<br>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.

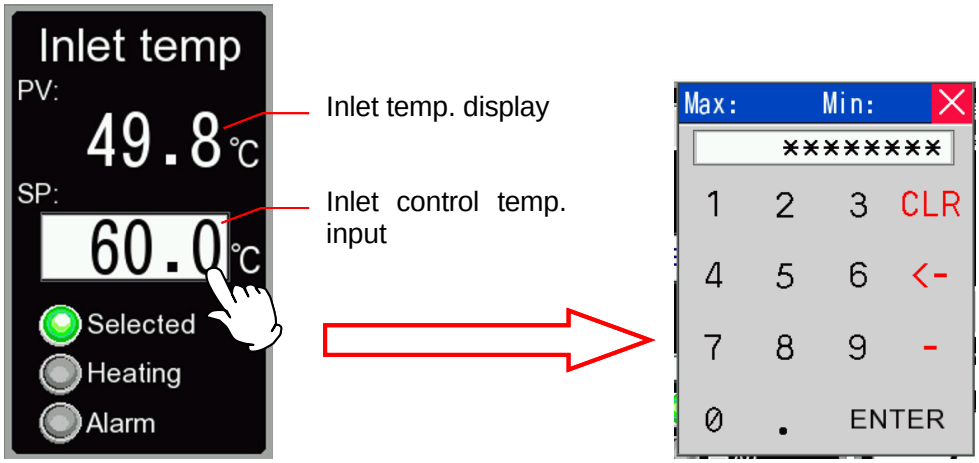
# 3. Name and Function of each part

## Value display and input description in the interface

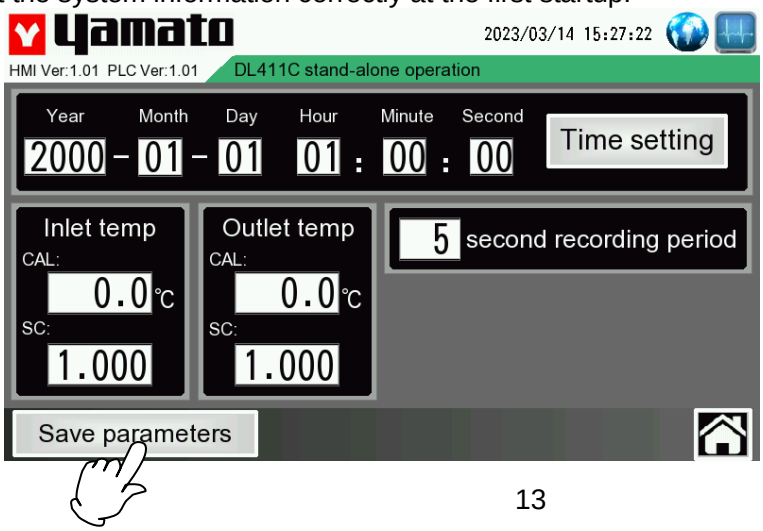
In the operation interface of touch screen, the values can be divided into two types: only display but no input; display and input.

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. Refer to P.39 “About the use of PLC batteries”.



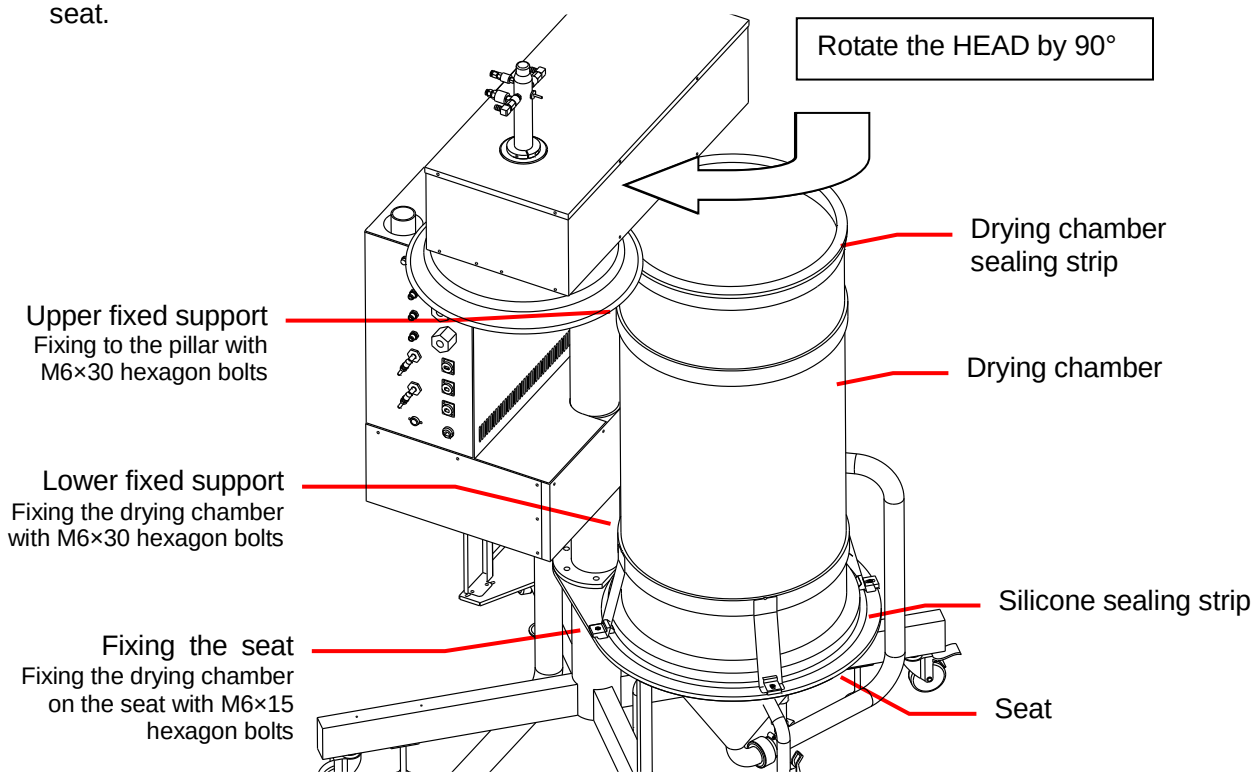

※ Special note: when the data setting in the system parameter interface is completed, click the Save Parameter button in the lower left, the parameters will be saved only after the button turns green. If the modified data is not saved or the equipment is powered off, the data will be restored to the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



# 4. Operation method

## Preparations before operation

(1) Place the stand on a flat surface, fixed with caster stopper.
(2) Disassemble the fixing bands at the seat and the support, and take out the corrugated carton.
(3) Connect the cable from the backside of the upper frame (Head) with the plug CN23 and CN24 at the backside of the control box.
(4) Make sure the power cord must be single-phase and above 200-230V～, 32A.
(5) Make sure the cable is grounded.
(6) Use the attached pressure hose to connect the nipple Air IN at the back side of the control box, as well as the compressed air unit like compressor, then fix with hose band. To remove the water and oil in the exhausted air, the air filter is set on the compressor, and the pressure reducing valve is needed to keep the pressure at stable value. (set pressure of the pressure reducing valve: 0.5 Mpa. If the pressure is greater than 0.6MPa, it will damage the pipe. If the pressure is less than 0.4MPa, it will cause the head to fail to lift.)
(7) Insert the attached nylon tube (O.D. 6mm, length 1m) into the hose connector TUBE A and TUBE B at the backside of control box and head part.
(8) Insert the nozzle through the nozzle hole on the upper frame.
(9) Use Tube A to connect the nipple AIR of the nozzle to the hose connector NOZZLE A at the backside of the upper frame (Head). Likewise, use Tube B to connect the nipple CYL to the NOZZLE B at the backside of the upper frame (Head).
(10) Start the compressed air unit such as compressor to supply the compressed air to the unit.
(11) Turn on the earth leakage breaker at the backside of the control box, and then turn on the power switch. At this moment, the initial screen of the touch panel will display for about 6 secs before jumping to the standby screen. Press the HEAD button to lift the HEAD (The HEAD will rotate by 90° when it's lifted by 5cm). At this moment, please help it to lift by hand.
(12) Lay the silicone sealing strip flat on the seat (the silicone sealing strip is embedded between the drying chamber and the seat to prevent glass from colliding with metal).
(13) Open the package, take out the drying chamber (which is made of super-hard glass, I.D.Φ457 and 975cm height), then place it on the seat. The chamber is made of glass, the weight is about 40kg and the volume is large, you'll need at least 2 persons to carry it.
(14) Use the upper and lower fixed supports to fix the drying chamber to the unit body pillar and on the seat.

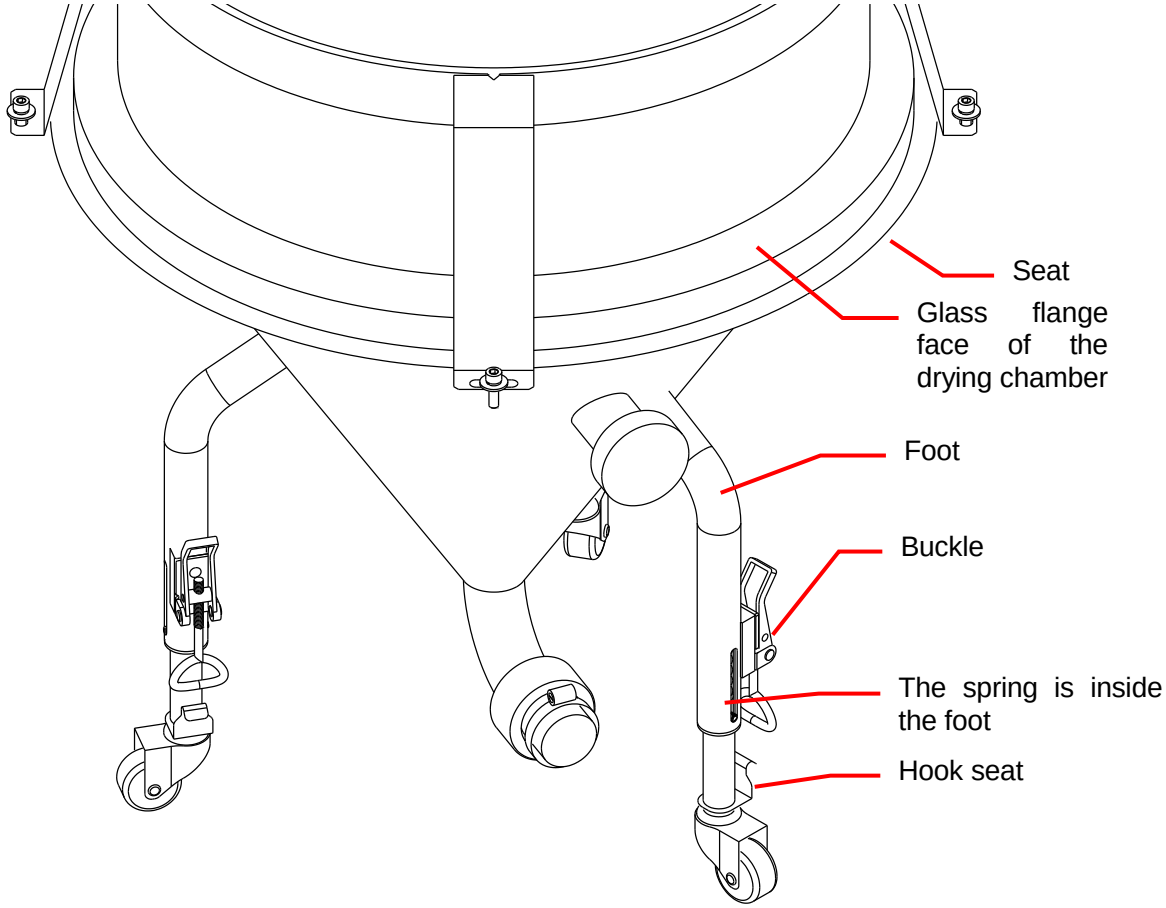



(15) Press the HEAD button, hold the head cover with your hand, make the head cover slowly returns to the position just above the drying chamber, and then lower it, so that the head cover tightly presses the sealing strip of the drying chamber.

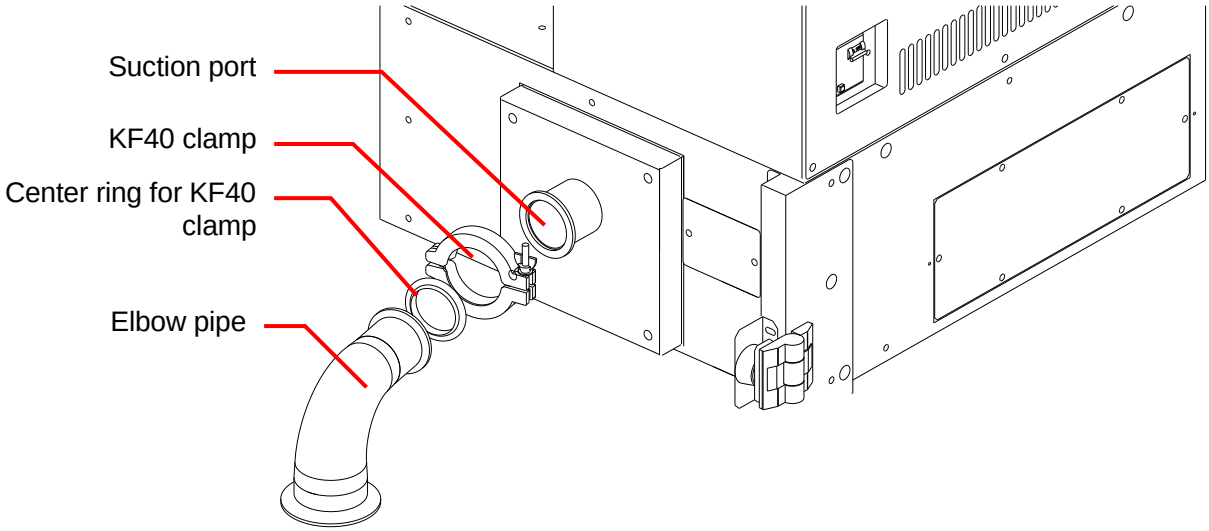
# 4. Operation method

## Preparations before operation

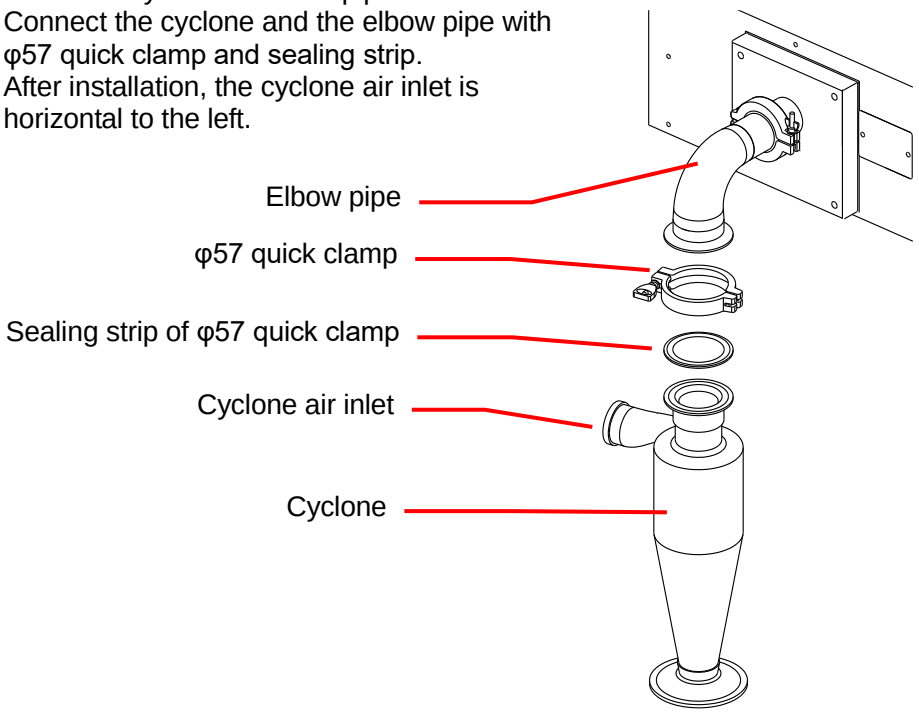
(16) There is a spring in the foot of the lower chamber, please firstly open the buckle at the foot, make the buckle hook move down, hang the hook on the hook seat, and then buckle up forcibly, at this time the spring is compressed and the foot becomes shorter. Using the same procedure, shorten the three feet in turn so that the lower chamber can be smoothly placed under the seat. After the funnel mouth is aligned with the seat, unfasten the buckles of three feet in turn. Under the action of the spring, the lower chamber rises. It must be ensured that the glass flange face of the drying chamber is tightly pressed against the sealing strip of the lower chamber.




(17) Install the elbow pipe on the suction port under the operation panel. One end of the pipe is stuck to the suction port by using a KF40 clamp and center ring, and the other end is straight down.

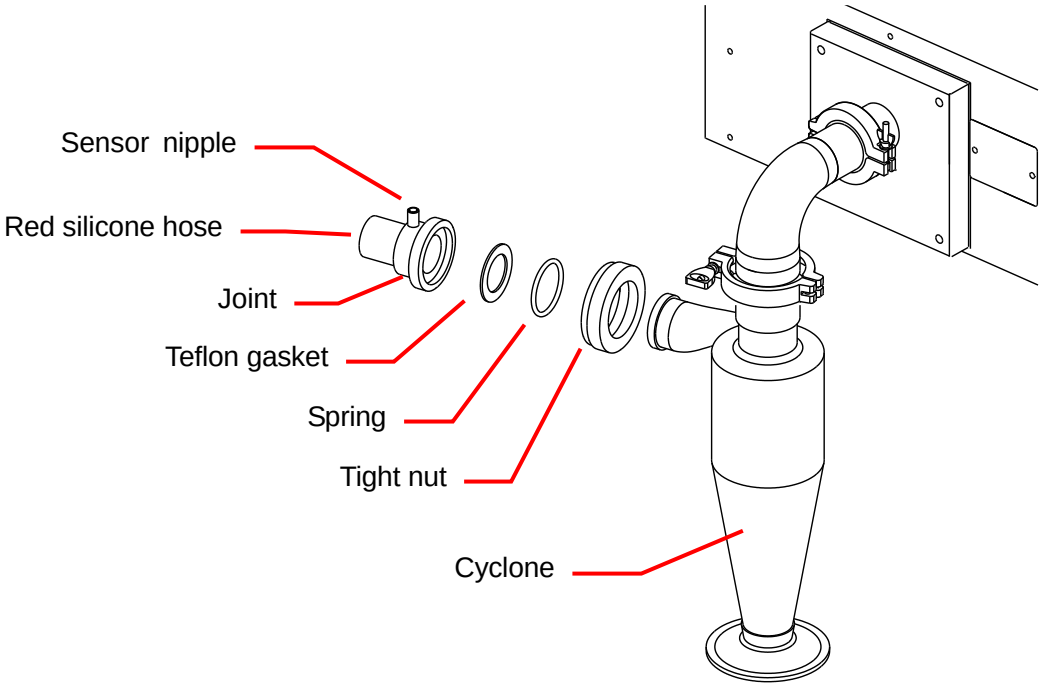


(18) Install the cyclone to elbow pipe.
Connect the cyclone and the elbow pipe with φ57 quick clamp and sealing strip.
After installation, the cyclone air inlet is horizontal to the left.

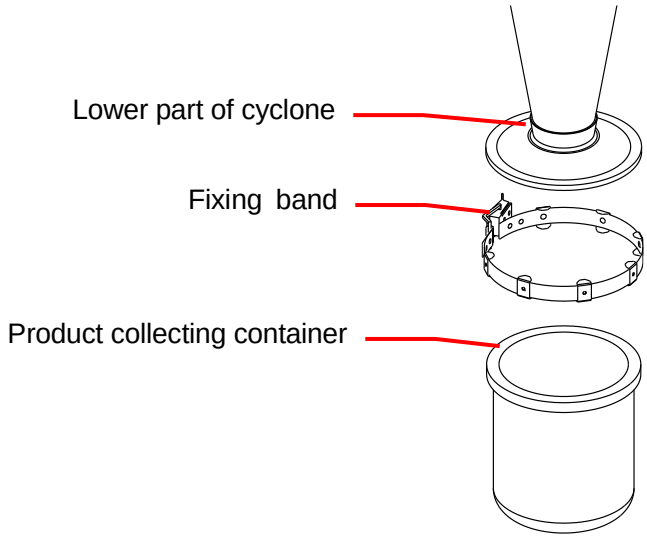



(19) Use the connecting hose (made of silicone, I.D. Φ38mm, length about 1m, red, both ends are installed with a joint) to connect the lower container with the cyclone. Firstly, install the tight nut at the cyclone air inlet, then install the spring, and then make the Teflon face of the joint of the connecting hose and the glass flange face fit with each other, and finally tighten with the tight nut. Next, tighten the other end of the connecting hose to the lower container. The cyclone is made of glass, please handle it with special care.

(20) Install the outlet temperature sensor at the nipple of the connecting hose joint. The sensor plug is inserted into the socket on the left side of the operation panel.

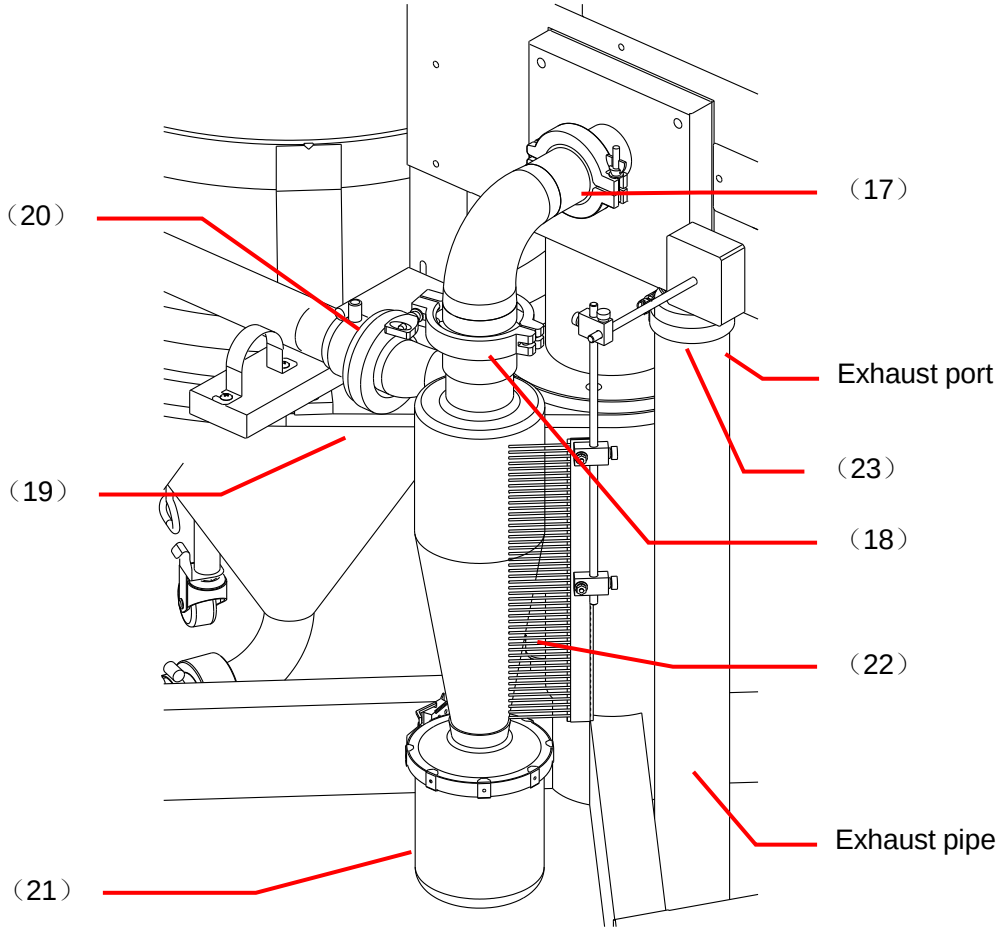


(21) Make the O-ring of the lower part of the cyclone and the flange face of the product collecting container fit with each other, make sure there is no leakage, and then tighten them with the fixing band.

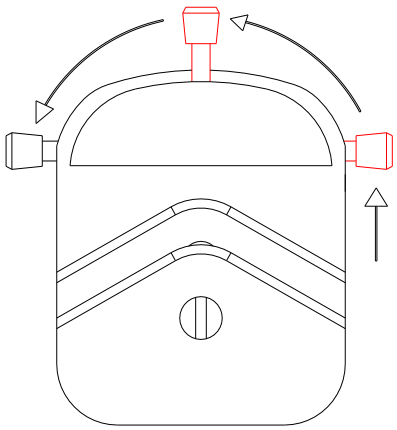


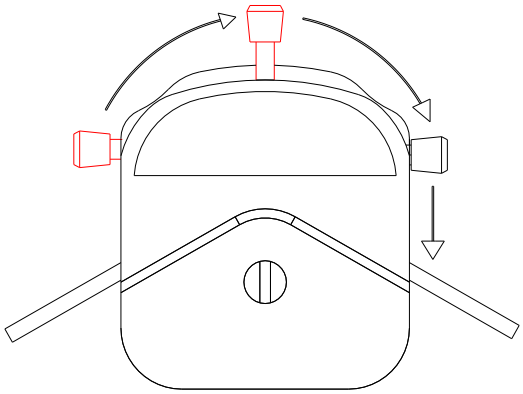

(22) Attach the seat of the antistatic brush to the unit body. Make the bristles evenly contact with the cyclone part (conical part). Connect the ground wire of the antistatic brush to the M4 metal screw of the unit body.

(23) To solve the problem of hot air and fine powder generated by the blower, install the attached exhaust pipe (I.D. Φ50mm, length 3m and with a clamp on one side) at the exhaust port of the blower to vent air to the ventilation container or outdoor.

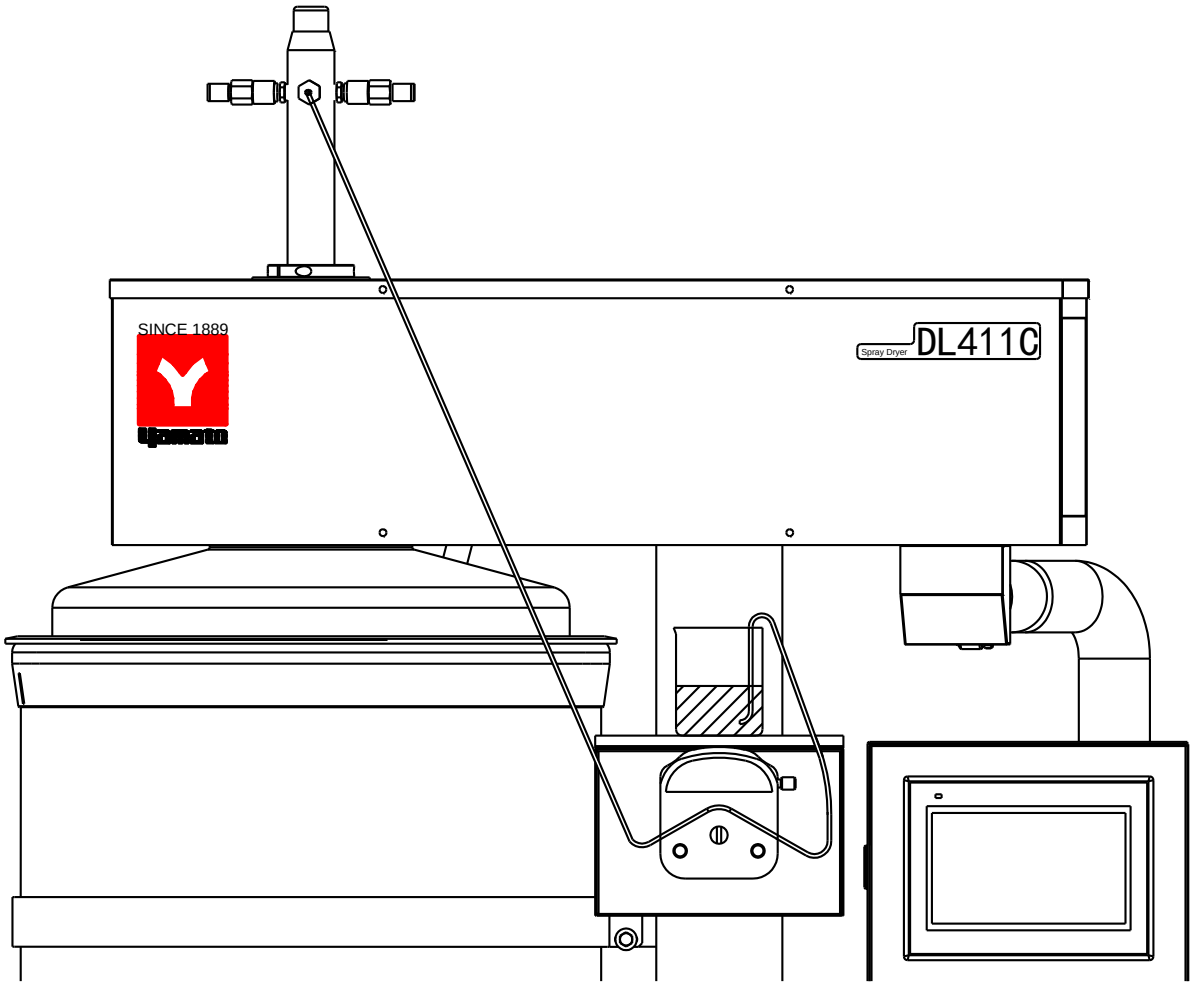


(24) Set the liquid delivery hose as shown below. Turn the pull rod of the liquid delivery pump CCW to open the pump head, put the liquid delivery hose in it, and then turn the pull rod CW to make the liquid delivery hose stuck tightly.

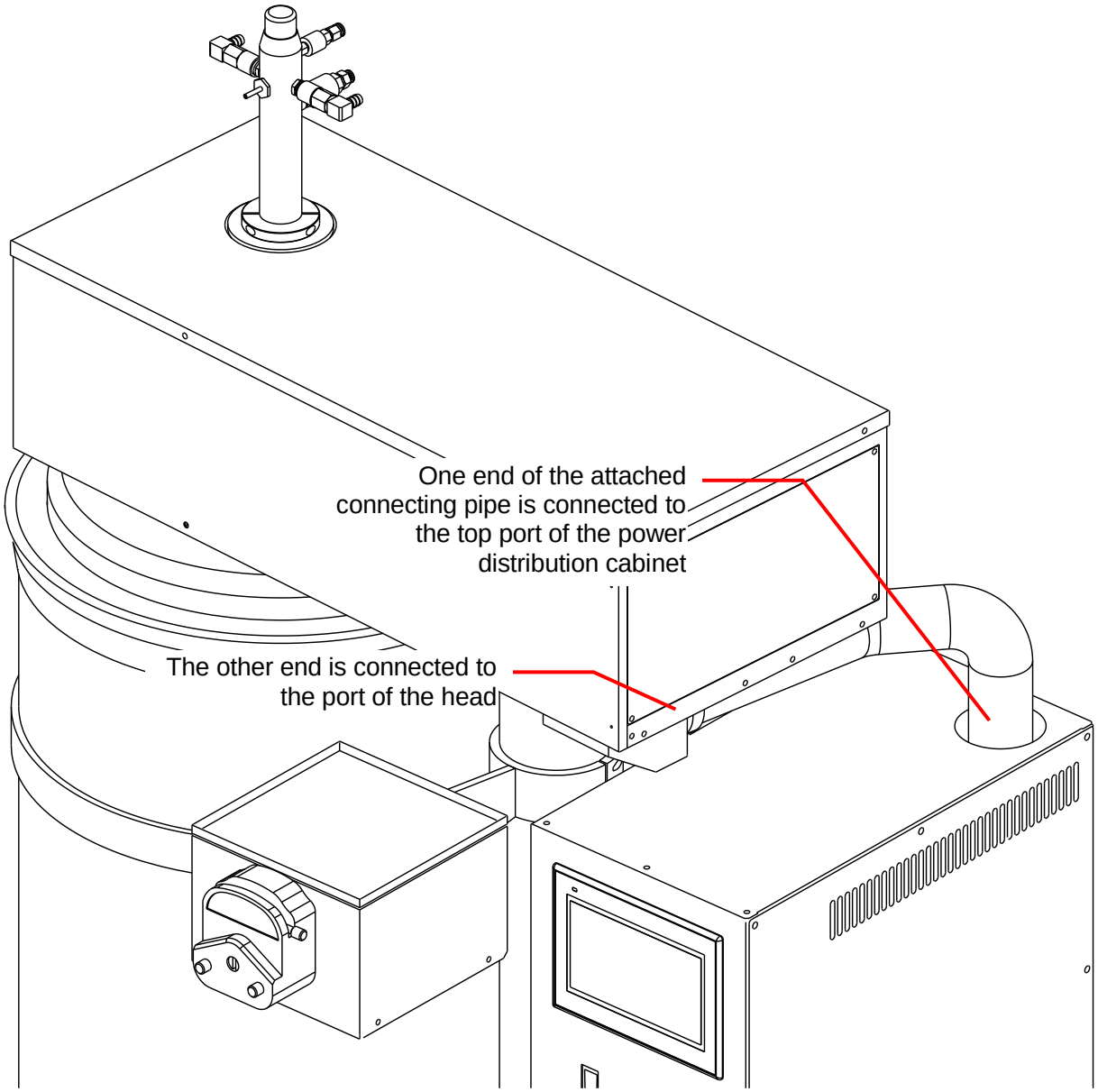




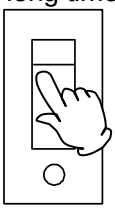
(25) As shown in the figure below, put one end of the liquid delivery hose into the sample and insert the other end into the liquid delivery connector of the spray nozzle.
Note: the two ends of the liquid delivery hose should not be inverted.



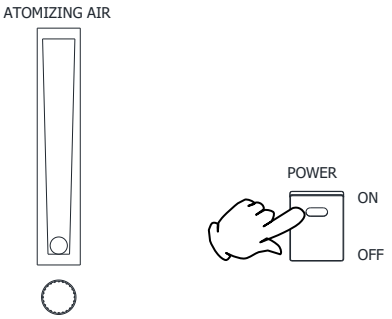
(26) As shown in the figure below, one end of the attached connecting pipe is connected to the top port of the power distribution cabinet, and the other end is connected to the port of the head.



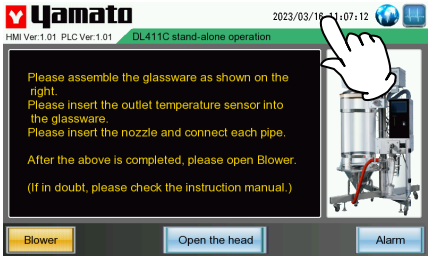
(27) Set the system parameters before using the system for the first time or when it has not been used for a long time.



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

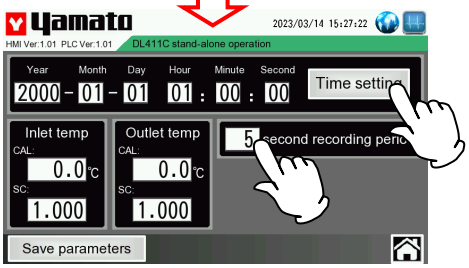



② Turn ON the Power switch on the operation panel of the main unit, touch screen display.



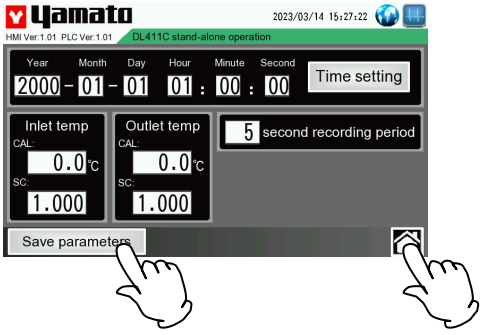

③ Press the time display area for more than 5 secs to jump to the system parameter screen.

※ 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.**

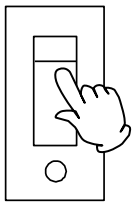
※ It is not necessary to set the inlet temp. and outlet temp. correction at the first use. If the temp. sensor has deviation after a long-time use, **please refer to P. 31 "Calibration of temperature sensor".**



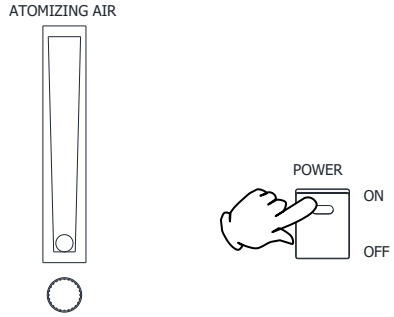

④ Click the Save Parameters button until it turns green. Finally click the Return button to return to the initial screen.

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

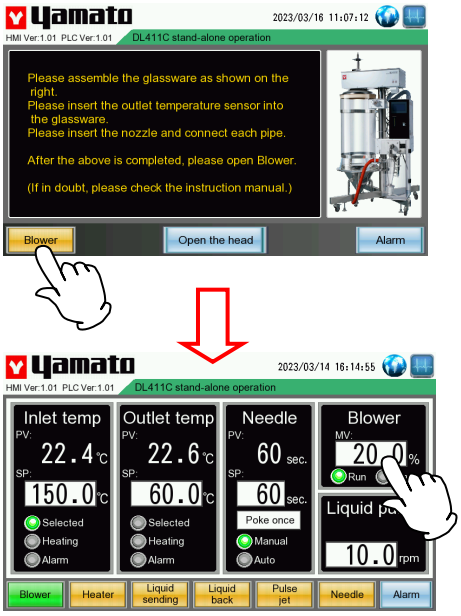
(1) Mini spray accessories are installed in the order described above (P.14 to P.19).



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



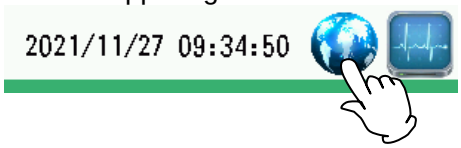

(3) Turn ON the Power switch on the operation panel of the main unit, touch screen display.

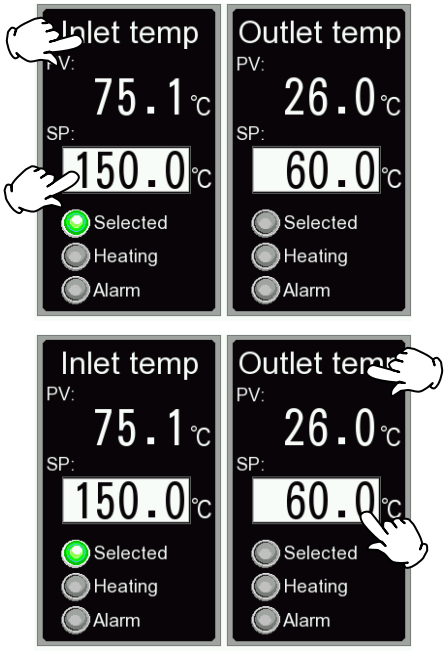



(4) Please switch the blower ON to jump to the running screen for blower output power setting.

e.g.: blower output power 40.0% (the air volume is about 0.4m$^3$/min)
(Please refer to P.28 “The corresponding table as below is for 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.

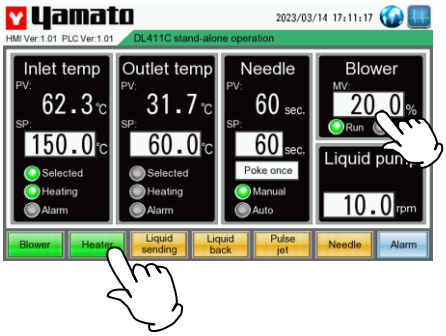
PV value displays the real-time temp. of the temp. sensor, SP value is black characters on white background, click to set the operating temp.

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

Inlet temp. setting range: 0 — 300℃

Outlet temp. setting range: 0 — 100℃

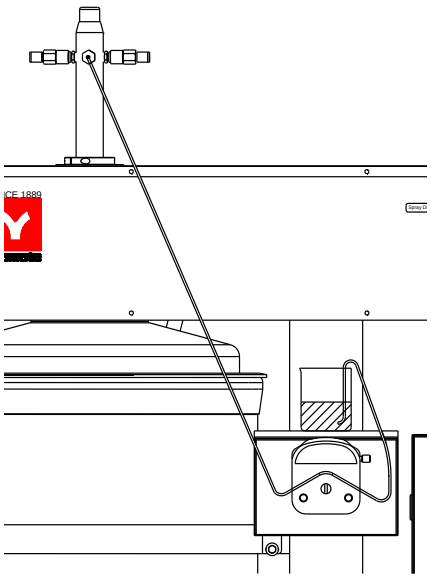
e.g.: select the inlet control, set the inlet temp. as 150℃.



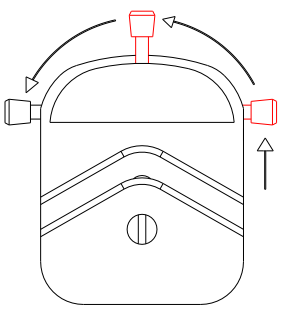

(6) Turn ON the Heater switch. Start heating up.

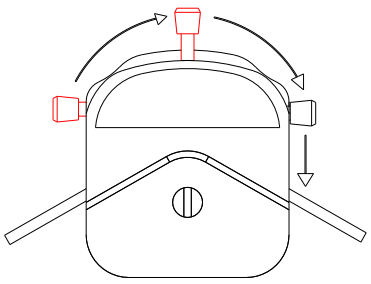
**※ After heating, the function switch between inlet temp. control and outlet temp. control will become invalid to prevent the mistake contact in the experiment. If need to switch the control function, firstly turn OFF the Heater switch, switch to inlet temp. control or outlet temp. control, and then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

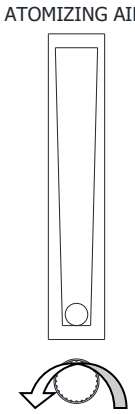
**※ When the outlet temperature control is used and the set power of the blower is less than 20%, it is best to use 40% of the power to preheat the cylinder. After preheating, switch to the set power control to prevent the overheat alarm of inlet temperature.**



(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. Put one end of the liquid-sending hose into the sample, and insert the other end into the liquid-sending interface of the spray nozzle. Please use the distilled water as the sample.



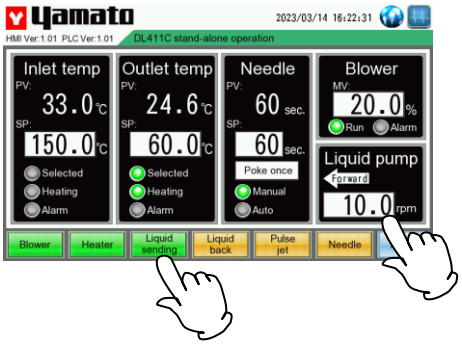





(8) After the inlet and outlet temp. reach the desired temp., set the spray flow and liquid-sending speed, and turn ON the liquid-sending switch to transport the distilled water.

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 10rpm (about 7.8mL/min). (Please refer to P.28 “The corresponding table as below is for rotate speed of liquid sending pump and average liquid sending amount”) Adjust the liquid-sending speed to make the outlet temp. be stable and 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.



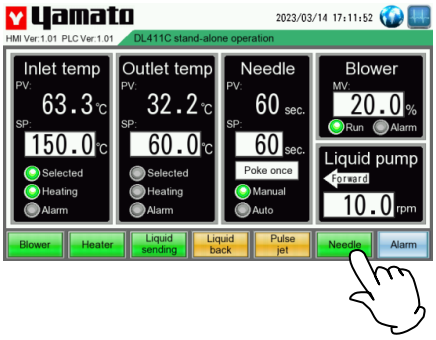

e.g.: Adjust the liquid-sending speed to make the outlet temp. be stable and slightly lower than 75℃.

～ 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).

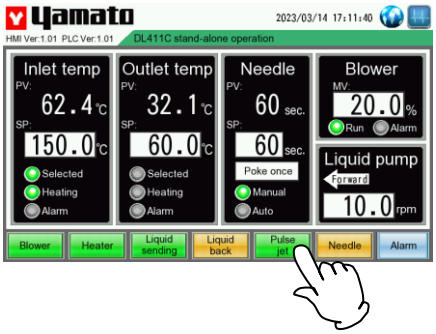
(10) When the outlet temp. is stable, replace the samples with the actually used samples. At this point, the outlet temp. will change more or less, if necessary, please adjust the liquid-sending speed again.

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



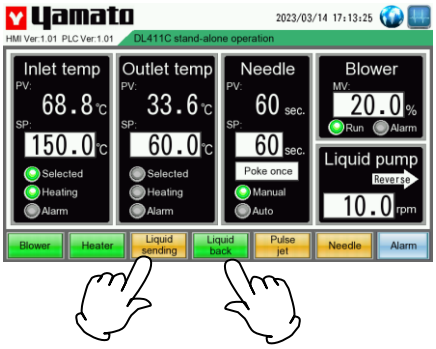

(11) During normal spraying, when the sample cannot be sprayed, the orifice of the spray nozzle may be blocked. The needle button can be operated to squeeze the blockage out of the orifice. The automatic needle also can be set to prevent the orifice of the spray nozzle from being blocked. Please refer to P.26 “Use of automatic needle spray nozzle”

When the blockage in the orifice of the spray nozzle cannot be cleaned by the needle, 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.25 “**End process**”, stop the equipment.
According to P.35 “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 press the needle button to see whether the attachment can be squeezed out.

If it can't be squeezed out, please click the Pulse jet button in the operation screen, the pulse jet air tap next to the nozzle will open, and the high pressure air will blow off the attachment near the nozzle orifice.

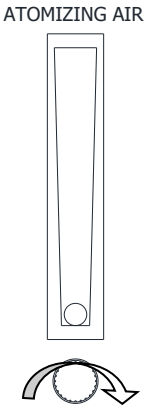



If it still cannot be cleaned out, please click the Liquid Sending button to stop the liquid sending, and then long press the Liquid back button to make the sample in the liquid-sending hose return to the sample container.

Turn the Heater button OFF, when the inlet temp. is lower than 60℃ and the outlet temp. is lower than 50℃, take out the nozzle and use a knife to scrape off the attachments near the nozzle.

**※ 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.**

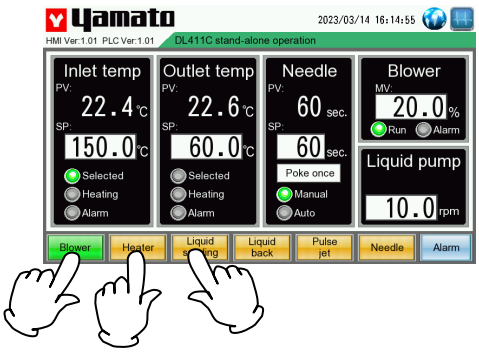
**※ Liquid Sending and Liquid back cannot operate at the same time. When the liquid-sending pump is sending liquid, the operation of Liquid back button is invalid. Similarly, when the liquid-sending pump is making liquid back, the operation of Liquid Sending button is also invalid.**



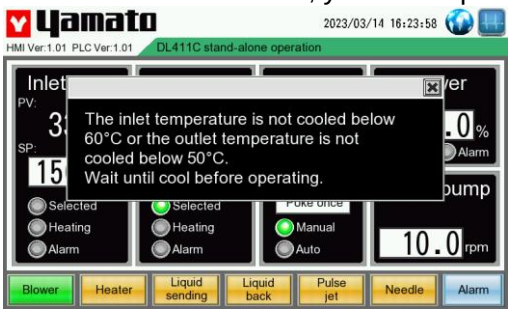

### ～ End process ～

(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.

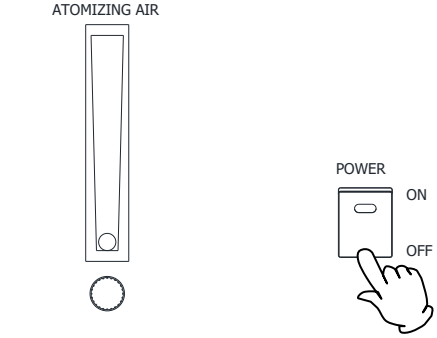
e.g.: After about 15mins, when the process of 100g sending liquid is finished, please replace the samples with the distilled water.



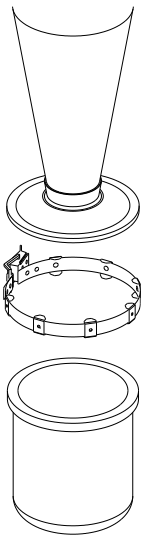

(14) Turn the Heater button OFF, when the inlet temp. is lower than 60℃ and the outlet temp. is lower than 50℃, please turn the Blower button OFF. Otherwise, you will be prompted:




**※ 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.



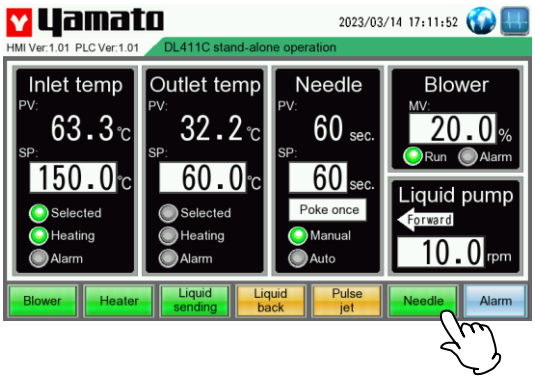
(16) Remove the container fixing clamp and take out the product collecting container. At this point, please note that the back of the cyclone cover also has powder attached.

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

(17) Wash the containers according to P.35 “About cleaning after use”.

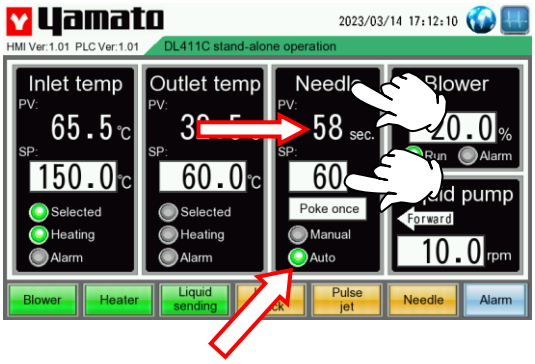
**※ When use a sample such as sodium chloride that corrodes metals, break down the spray nozzle and wash thoroughly.**

## Use of automatic needle spray nozzle

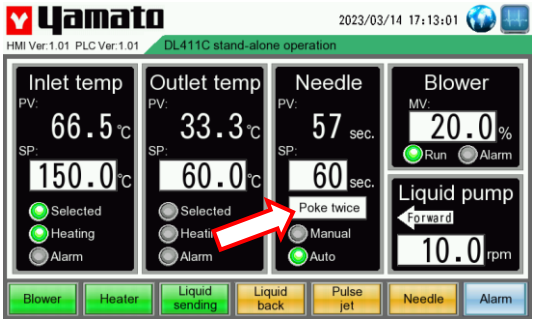



During normal spraying, if the sample cannot be sprayed, possibly because the orifice of the spray nozzle is blocked.

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.



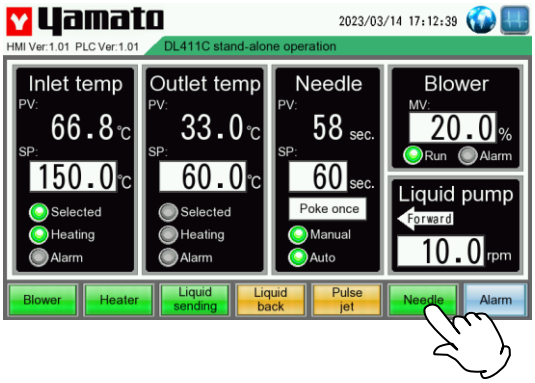

When it is estimated that the blocking will occur in the test, click the icon of needle controller to turn on the automatic needle function while switching from the distilled water to the samples. The manual mode indicator lamp of the needle controller goes off and the automatic mode indicator lamp lights 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.

# 4. Operation method

## 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.25 “**End process**”.

In addition, if want to process another samples, please firstly recycle the products in the collecting container, clean it according to P.35 “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 (rpm) | Avg. liquid sending amount (ml/min) |
|---|---|
| 0.0 | 0 |
| 10.0 | 7.84 |
| 20.0 | 15.77 |
| 30.0 | 23.97 |
| 40.0 | 27.39 |
| 50.0 | 34.25 |
| 60.0 | 41.92 |
| 70.0 | 49.07 |
| 80.0 | 56.10 |
| 90.0 | 63.41 |
| 100.0 | 70.57 |

The corresponding table as below is for blower output power and average dry air amount. (Measured value of blower operating independently at 230V ~ standard voltage)
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 (P.35 “About cleaning after use”).

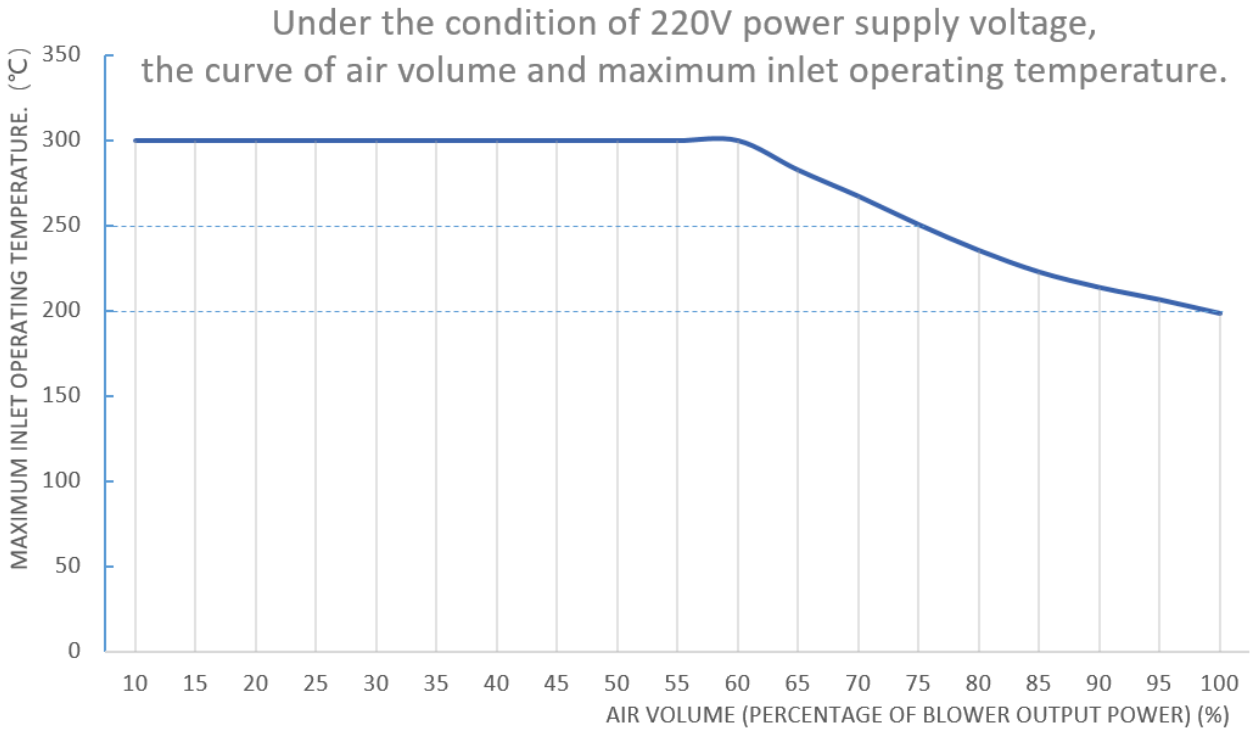
| Percentage of blower output power (%) | Avg. dry air amount ($m^3$/min) |
|---|---|
| 10 | 0.13 |
| 20 | 0.23 |
| 30 | 0.33 |
| 40 | 0.43 |
| 50 | 0.53 |
| 60 | 0.63 |
| 70 | 0.73 |
| 80 | 0.83 |
| 90 | 0.92 |
| 100 | 1.00 |

# 4. Operation method

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

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 220V supply voltage)
Please use it as reference during operation.

※ When the air volume is too large, the wind speed is too fast, resulting in a reduction of the heat transfer time of the air in the heating sleeve, and the air cannot raise enough temperature in a short time, and eventually the maximum operating temperature of the inlet will drop.



# 4. Operation method

## Use of external storage function

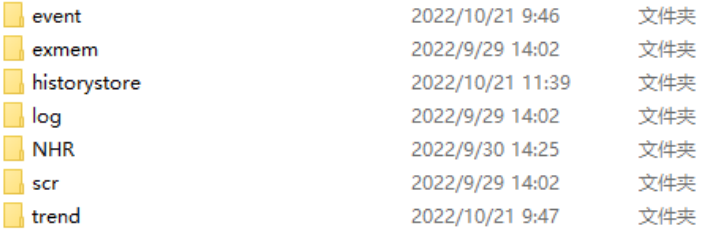
Do not install the USB disk before the installation is completed. The equipment can perform all the actions and functions without a USB disk, but the data cannot be saved.
After the installation is completed, test run the equipment and all functions are normal, shut down the equipment, and then install the USB disk according to the following steps.

Press the connector separation button


Remove the dust cover of the connector and plug the USB disk

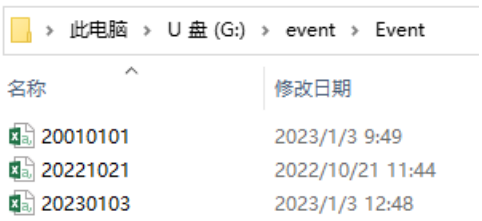

**※ Plugging or pulling out the USB disk should be carried out when the equipment is shut down. Ensure the safety of operator and data.**

After opening the USB disk, the data is classified according to the folder, as shown in the figure below:




See the following path for historical data of temperature, blower and liquid sending pump:


See the following path for historical data of alarm:




All data are saved as CSV files by date, and the file name is the date.

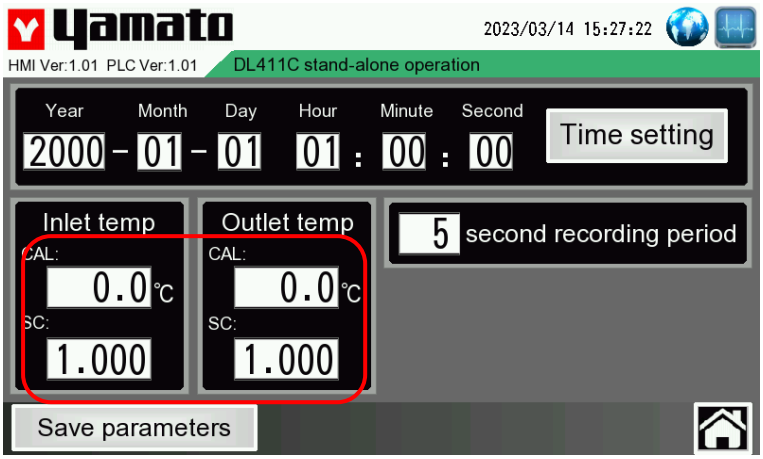
## Calibration of temperature sensor

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

At this time, the control temperature can be restored to the normal state through the calibration of temperature sensor.

If need to calibrate the temperature sensor, please contact your agent or Yamato Scientific. The calibration of temperature sensor is paid service.

After calibration, the modified parameters of inlet temperature or outlet temperature (in the red box below) will be modified according to the calibration report of the sensor. Please be sure not to 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.54 “15. List of Dangerous Substances”.

**Connect DL411C 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 parts 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.

## ⚠ 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 electric 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 these 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 711μ. When the sample is suspension and the orifice is seriously blocked, the nozzles with the orifice of 1016μ and 1524μ are prepared as optional parts. (Nozzle main body P.34 “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 711μ nozzle). The droplet particle sizes sprayed by nozzles of different sizes will be different, which may affect the drying state. Please adjust the appropriate spray flow.

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.

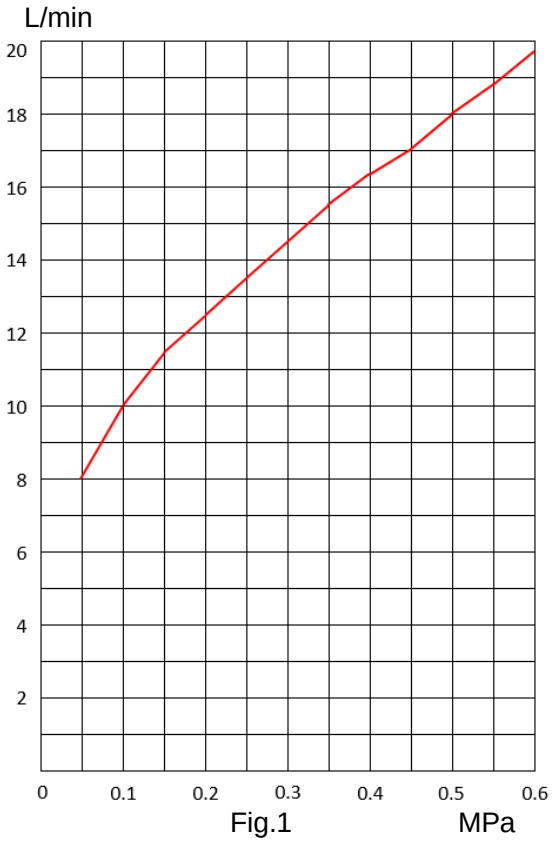


Fig.1

(7) The too small powder (few μ or less) among dried powder 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 dry airflow or spray air pressure. Also, since the powder particle diameter becomes smaller as the concentration of the sample is lower, adjust the concentration of the sample if necessary.

# 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 about 0.5Mpa.

(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 DL411C, connect the optional organic solvent recovery unit.**

(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 0.1~0.2$m^3$/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.26 “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 320℃ 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. Deformation, deterioration or color change may result in.

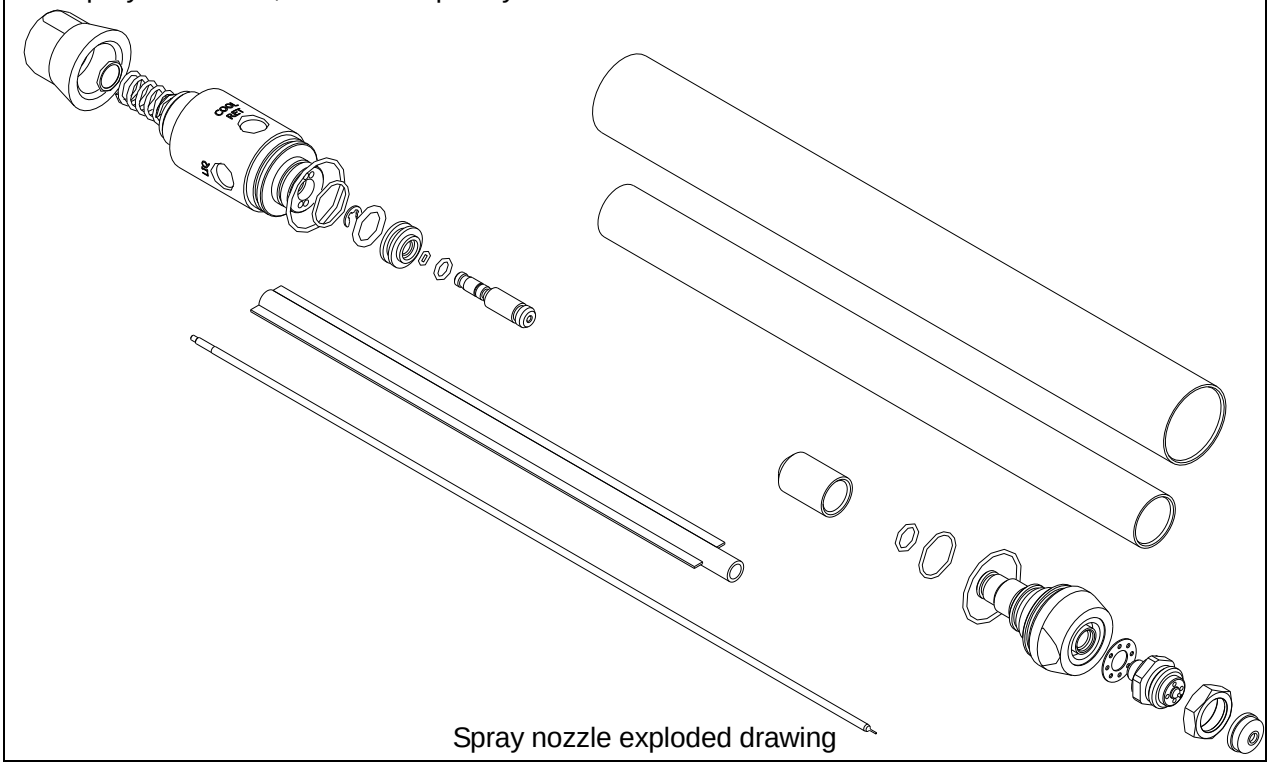

### About cleaning after use

(1) After completing the operation, remove the attachments following the process “Preparations before operation” on P. 18 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 per the following figure. 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.



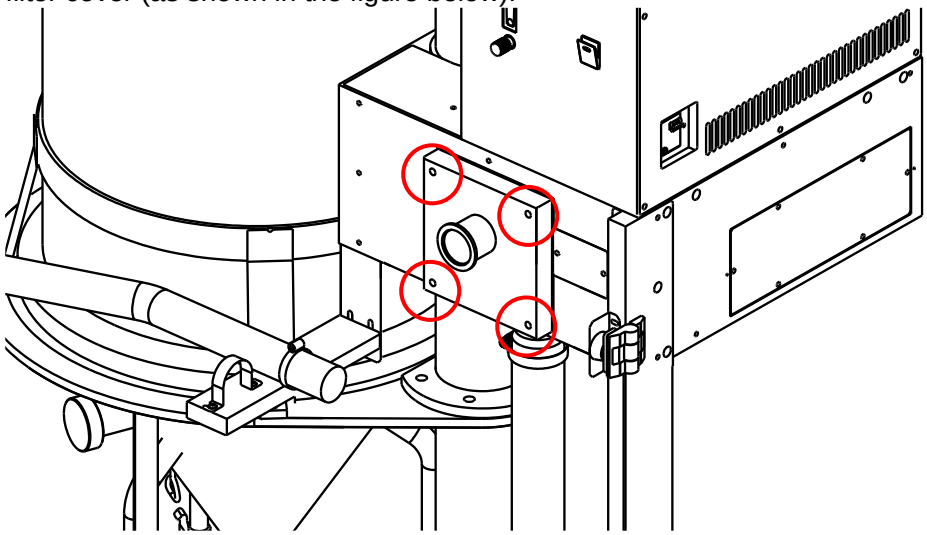
Spray nozzle exploded drawing

## Filter Cleaning

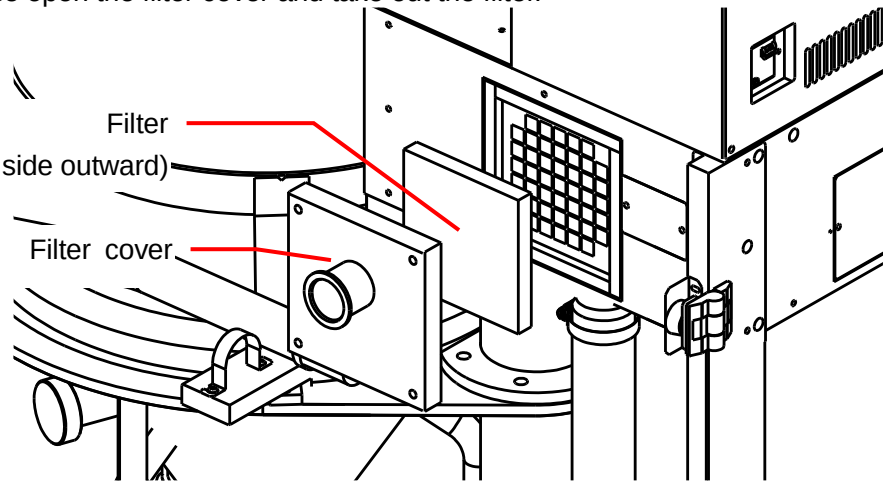
● The filter in blower

Regularly clean the filter in blower.

1. Please remove the cyclone and remove the antistatic brush. Remove the 4 fixing screws of the filter cover (as shown in the figure below).



2. Please open the filter cover 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 warm 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.

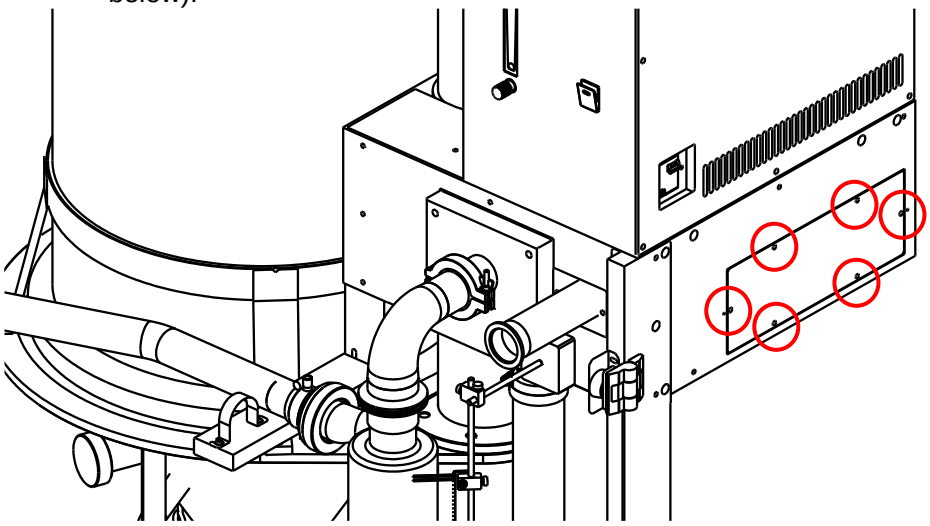
4. Please follow the reverse order of disassembly to install.

Turn the soft side of the filter outward when installing the filter.

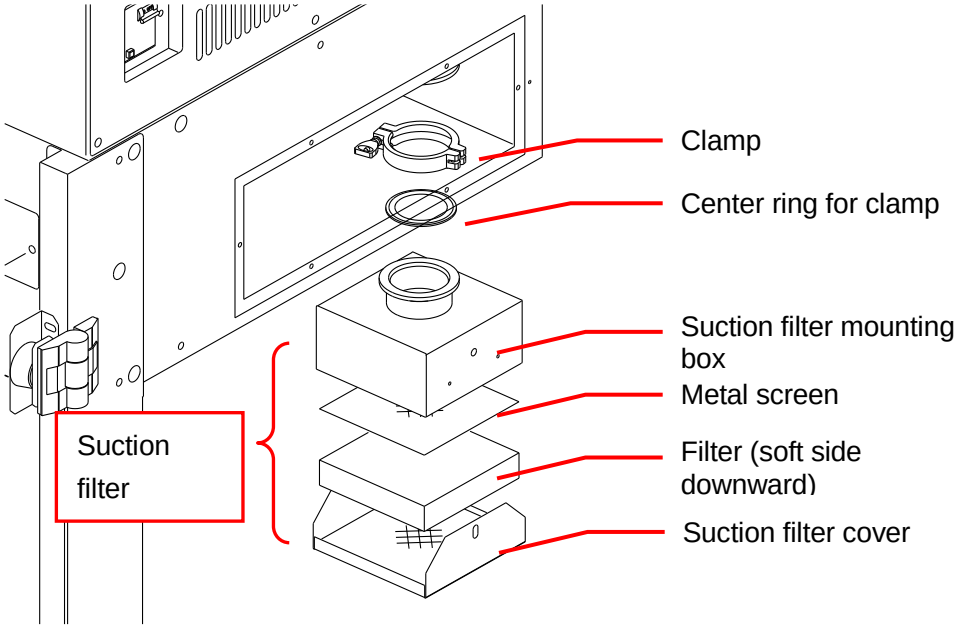
● Suction filter

Regularly clean the suction filter.

1. Remove the 6 fixing screws from the lower right blanking plate (as shown in the figure below).



2. Open the lower right blanking plate, loosen the clamp and remove the suction filter. Then unscrew the 2 fixing screws of the suction filter cover, open the suction filter cover, 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 warm 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 downward when installing the filter.

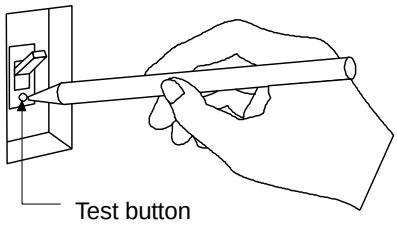
# 6. Maintenance Method



## 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.



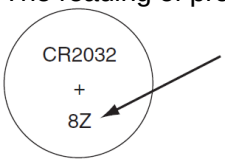
## About the use of PLC batteries

●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



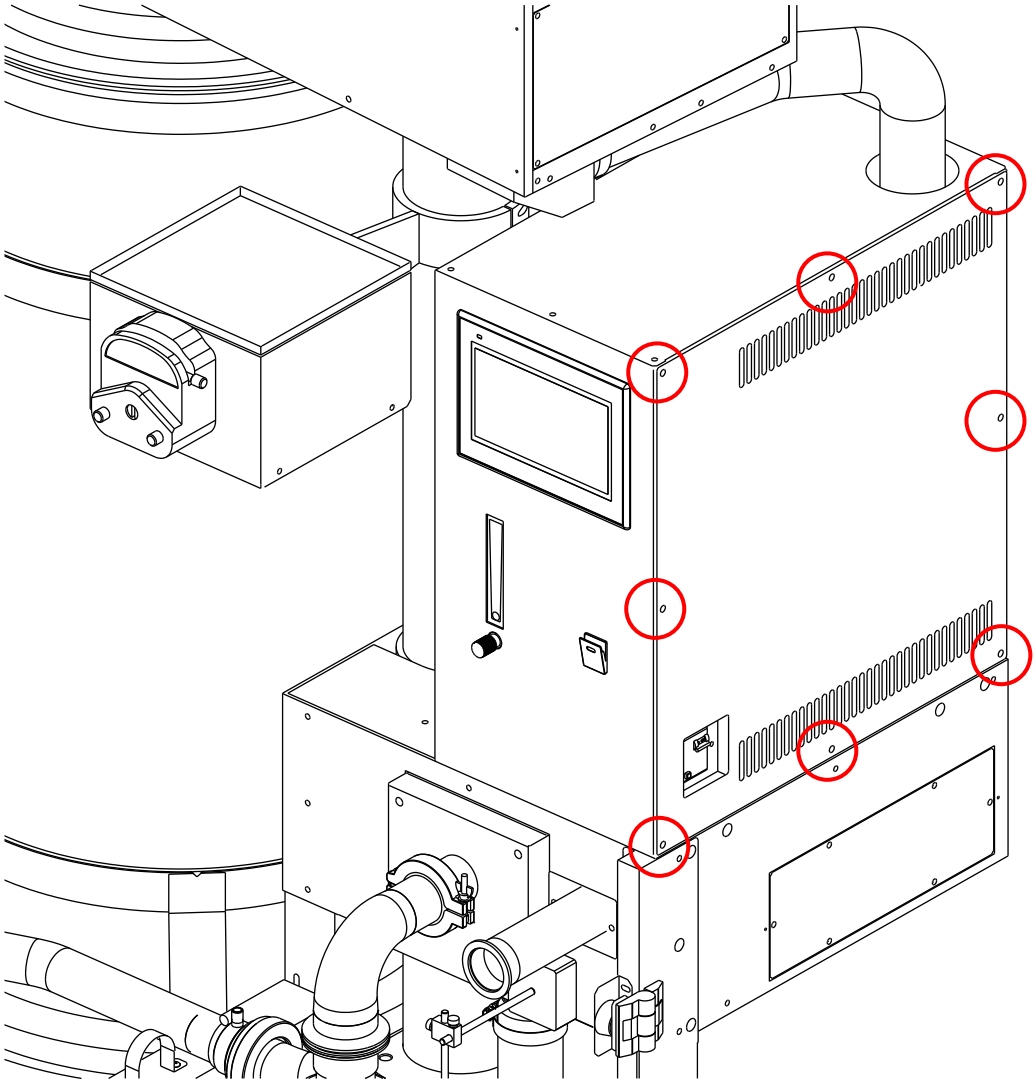

The left character: the rightmost digit of Year

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

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

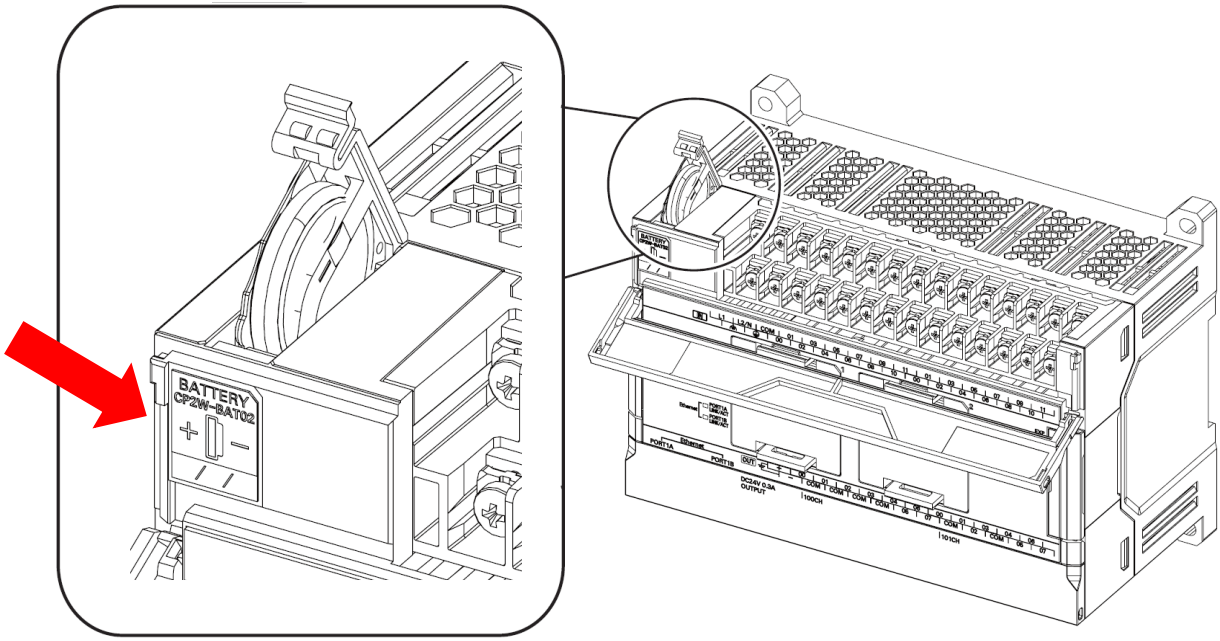
●Installation of battery

Turn off the ELB, and remove the power cord from the power supply. Remove the 8 fixing screws on the PDC blanking plate by using a M4 cross screwdriver, and then open the PDC. 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".



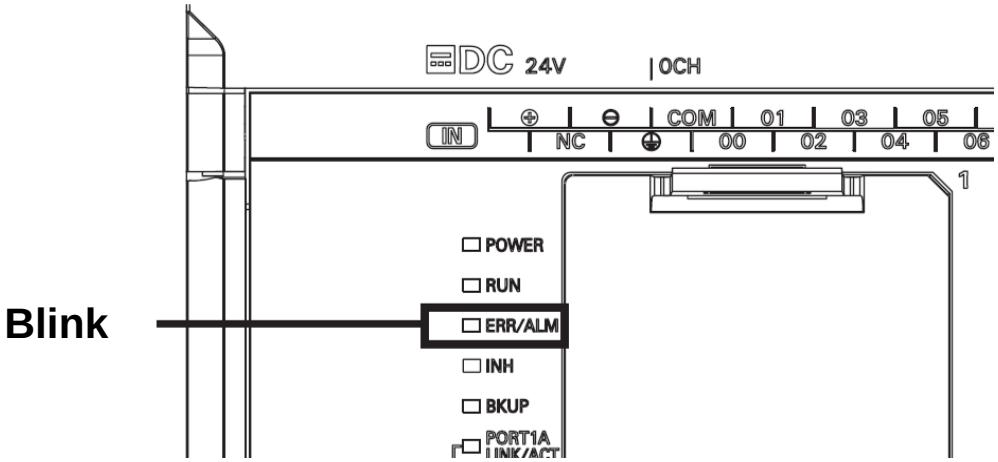

After the installation is completed, perform the reverse operations to restore the device to its original state.

●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…**<br><br>● 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…**<br><br>● Keep out of reach of children.<br><br>● 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 device 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<br>② The PLC analog module is damaged | ① Power off and restart<br>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<br>② The inlet temperature transmitter is damaged | ① Power off and restart<br>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<br>② The inlet temperature sensor is damaged | ① Power off and restart<br>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<br>② The outlet temperature transmitter is damaged | ① Power off and restart<br>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<br>② The wire connection of outlet temperature sensor is loose<br>③ The outlet temperature sensor is damaged | ① Install the outlet temperature sensor, click the alarm reset<br>② If it cannot reset, please contact our service department or agent. |
| Er10.Air volume transmitter is faulty | ① Air volume transmitter disconnection<br>② Air volume transmitter damage | Please contact our service department or agent. |
| Er11.Low air volume alarm | ① The output power of the blower is set too low<br>② The pipe is not connected correctly<br>③ The power supply voltage is too low<br>④ The blower main control relay is disconnected<br>⑤ The blower main control relay is damaged<br>⑥ The blower speed controller is disconnected<br>⑦ The blower speed controller is damaged | ① Please increase the output power of blower<br>② Please connect the pipe correctly<br>If cannot reset, please contact our service department or agent. |

# 8. When a trouble occurs

## Safety device 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<br>② Heater damage | Please contact our service department or agent. |
| Er14.Heater overheat alarm | Heater overheat | Please contact our service department or agent. |
| Er15.Liquid sending pump is overloaded | The pump head is stuck | ① Clean the pump head<br>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<br>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<br>② The parameters of the inlet temperature controller are abnormal | ① Power off and restart<br>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<br>② The parameters of the outlet temperature controller are abnormal | ① Power off and restart<br>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 320℃<br>② Use the outlet temperature control, if the set air volume is too small, no preheating. | ① Stop heating, blow to drop the inlet temperature, and then click the alarm reset button in the alarm screen.<br>② Refer to P.22 「(6) Turn ON the Heater switch. Start heating up.」 for preheating operation.<br>③ 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.<br>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.When a trouble occurs

## Safety device and error indications

| Display | Reasons | Solutions |
|---|---|---|
| Er21. Heater temperature transmitter disconnection | ① The wire connection of heater temperature transmitter is loose<br>② The heater temperature transmitter is damaged | ① Power off and restart<br>② If it cannot reset after power off and restart, please contact our service department or agent. |
| Er22. Heater temperature sensor disconnection | ① The wire connection of heater temperature sensor is loose<br>② The heater temperature sensor is damaged | ① Power off and restart<br>② If it cannot reset after power off and restart, 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.

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<br>② The wire connecting to GAS is damaged | ① Reconnect the connecting wire.<br>② Replace the connecting wire.<br>③ After power off and restart, if it cannot reset, please contact our service department or agent. |

※ When GAS alarm occurs, DL411C 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. When a trouble occurs

## Trouble Shooting

In case of the following conditions

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

# 8. When a trouble occurs

## Trouble Shooting

| Symptoms | Possible causes | Countermeasures |
|---|---|---|
| Temperature controller failure | ● The outlet temperature sensor is not installed<br>● Defective display function<br>● Sensor failure<br>● Overheat prevention function failure | ● Install the outlet temperature sensor correctly<br>● Maintain the part or replace the PLC<br>● Replace the sensor<br>● Lower the set temperature |
| Cannot reach the set temperature | ● Heater capacity is insufficient due to excessive dry air flow<br>● 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<br>● 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 and 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. Name and Function of each part” 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

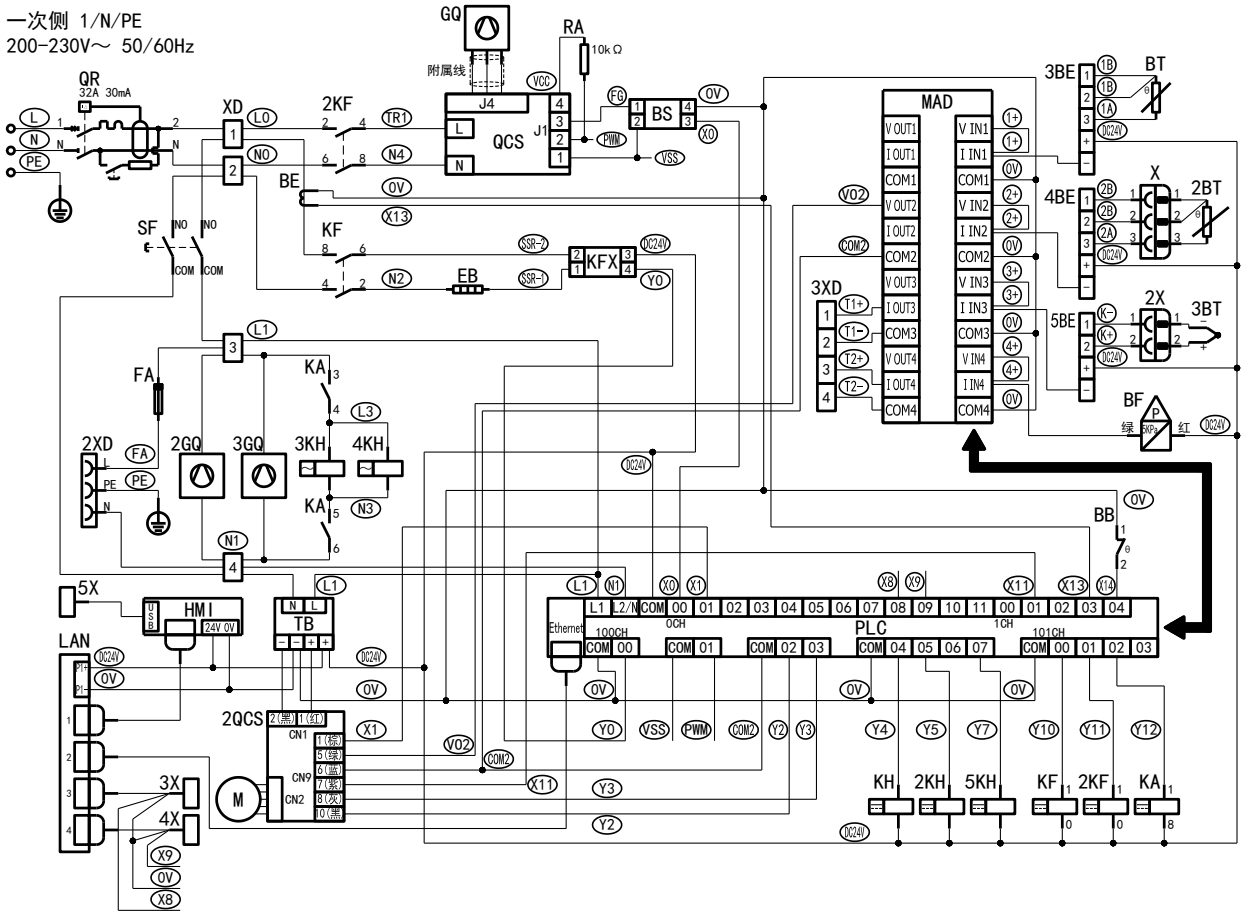
| | | |
|---|---|---|
| Model | | DL411C |
| Suitable for solvent recovery unit | | GAS510C (optional) |
| Temperature | | 5℃ to 35℃（Indoor use only） |
| Altitude | | Up to 2,000 meters |
| Relative humidity | | ≤75%RH |
| Function | | Spray drying |
| Drying object samples | | Solution, suspension, 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 3000mL / Hr |
| Structure | Head lifting mechanism | Automatic rise and fall of head (use solenoid valve, pressure air to drive the air cylinder in the upper frame) |
| | Temp. adjuster | PID temp. adjuster |
| | Heater | 4kw（220V～）Stainless steel pipe heater |
| | Blower | Brushless motor blower |
| | Liquid sending pump | Quantitative 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 | Temp. setting range | Inlet temp.: 0-300℃, outlet temp.: 0-100℃ |
| | Temp. adjusting accuracy ※1 | ±1℃ |
| | Temp. display | Inlet temp. and outlet temp. value display (display accuracy 0.1℃) |
| | Spray air flowmeter | Measuring range: 0-30 L/min (the max. flow rate is related to the pressure of the spray gas source) |
| | Adjustable range of liquid sending volume | 0 – 70 ml/min variable (the max. drying capacity 50 ml/min) |
| | Adjustable range of drying air volume ※1 | 0.13-1.00$m^3$/min (when a single blower runs independently) |
| Spec. | External dimension ※2 | 1060mm×880mm×1750mm (W×D×H) |
| | Power supply | single-phase 200-230V～ 50/60Hz 23-27A |
| | Weight | Approx. 180kg |
| Accessories | | ·Sample hose: silicone I.D.Φ3.2mm×O.D.Φ6.4mm×2m 2<br>·Connecting pipe: vinyl chloride I.D.Φ50mm×length 0.8m (with cuffs on both sides) 1<br>·Exhaust pipe: vinyl chloride I.D.Φ50mm×length 3m (with cuff on one side) 1<br>·Connecting hose: silicone I.D.Φ38 mm×O.D.Φ42 mm (with couplings on both sides) 1<br>·Outlet temperature sensor: Pt100 thermal resistance 1<br>·Nozzle pipe A: nylon 11 I.D.Φ4×O.D.Φ6 (with coupling) 1<br>·Nozzle pipe B: nylon 11 I.D.Φ4×O.D.Φ6 (with coupling) 1<br>·Connecting pipe A: nylon 11 I.D.Φ4×O.D.Φ6 1<br>·Connecting pipe B: nylon 11 I.D.Φ4×O.D.Φ6 1<br>·Pressure hose: I.D.Φ7.9mm×length 3m 1<br>·Liquid sending pipe sleeve Teflon I.D.Φ7×O.D.Φ9×30mm 2<br>·Instruction manual 1<br>·Warranty card 1 |

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

※2 External dimensions do not include protruding parts.

# 11. Wiring Diagram

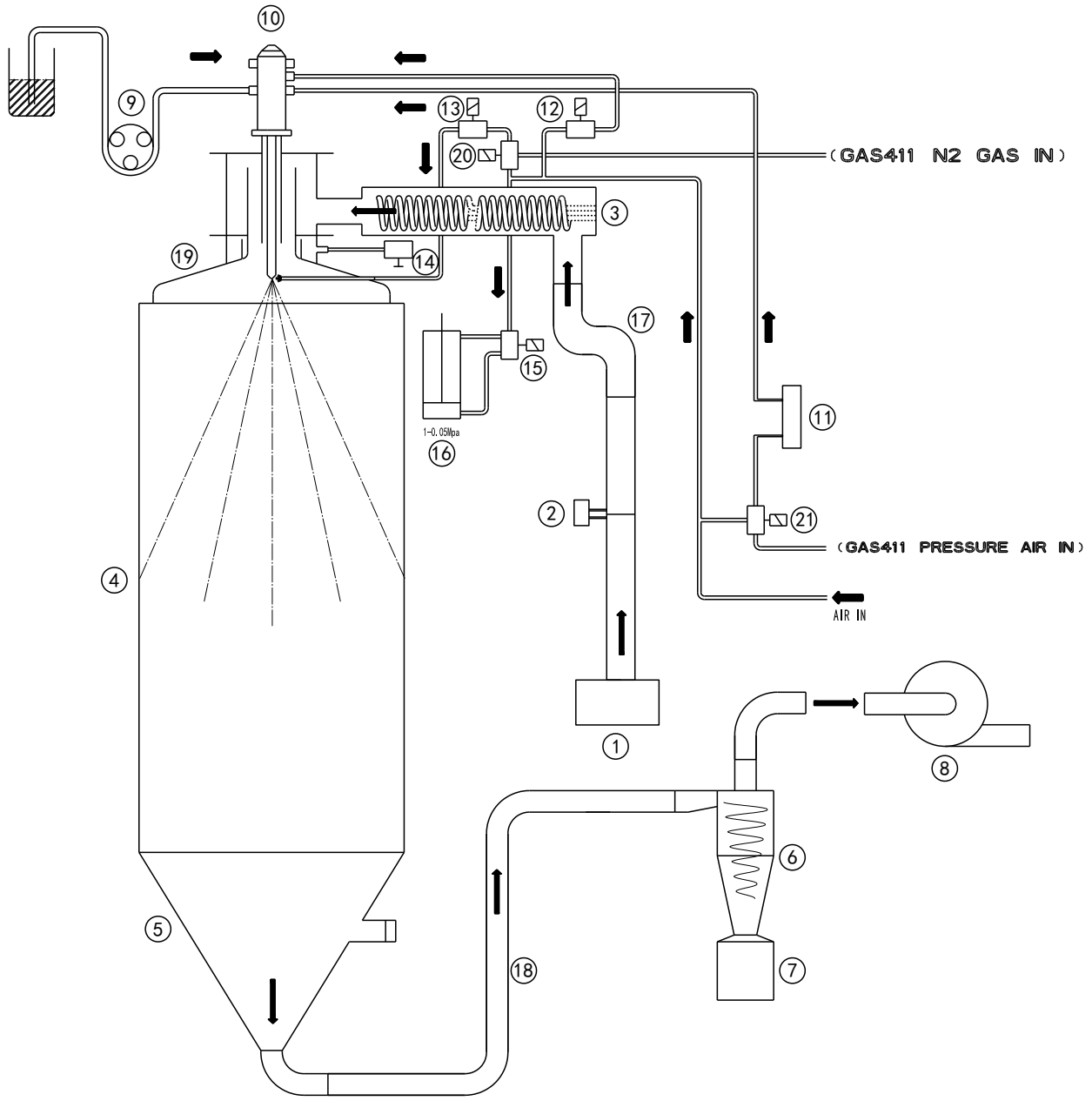
## DL411C Wiring Diagram




| Symbol | Part name | Symbol | Part name |
|---|---|---|---|
| QR | Earth leakage breaker (30mA) | LAN | Network switch |
| XD | AC power distribution wiring terminal block | 3X,4X | Network interface socket for online use |
| SF | Panel power switch | KA | GAS411C on-line relay |
| 2GQ | Heat dissipation fan | 2KA | Spray relay |
| FA | Fuse | KH | Pulse jet nozzle solenoid valve |
| 2XD | Service socket | 2KH | Pneumatic cleaning nozzle |
| 5X | External storage interface (USB2.0) | 3KH | GAS411C connection solenoid valve |
| KF | Heating control main relay | 4KH | Spray solenoid valve |
| BE | Heater current inductive switch | 5KH | Head lift solenoid valve |
| KFX | Solid state relay | BB | Heater overheat protector |
| EB,2EB | Heating pipe | BT | Inlet temperature sensor (Pt100) |
| 2KF | Blower control main relay | 2BT | Outlet temperature sensor (Pt100) |
| QCS | Blower speed control panel | 3BT | Heater Temperature Sensor (K type) |
| GQ | Blower | 3BE,4BE,5BE | Temperature transmitter |
| TB | DC power supply (DC24V) | BF | Air volume sensor |
| 2QCS | Liquid sending pump driver | MAD | Analog input/output module |
| M | Liquid sending pump drive motor | X | Outlet temperature sensor socket |
| PLC | Programmable controller | 2X | Heater temperature sensor quick plug |
| HMI | Touch screen | 3XD | Temperature output terminal block |

# 12. System diagram

**System diagram**




| | | |
|---|---|---|
| ① Inlet air filter | ⑧ Blower | ⑮ Solenoid valve for head lifting |
| ② Air volume transmitter | ⑨ Liquid sending pump | ⑯ Cylinder for head lifting |
| ③ Heater | ⑩ Spray nozzle | ⑰ Air inlet connecting pipe |
| ④ Drying chamber | ⑪ Spray flowmeter | ⑱ Air outlet connecting pipe |
| ⑤ Lower chamber | ⑫ Solenoid valve for nozzle ventilation | ⑲ Upper chamber |
| ⑥ Cyclone | ⑬ Solenoid valve for nozzle pulse jet | ⑳ Solenoid valve for pulse jet gas source switchover |
| ⑦ Product collecting container | ⑭ Cold air regulating valve (manual valve) | ㉑ Solenoid valve for spray gas source switchover |

# 13. Operation principle

**Operation principle**

Refer to P.54 “15. List of Dangerous Substances”

The sample is sent from the appropriate container to ⑩ spray nozzle with ⑨ liquid sending pump. The compressed air from the air compressor is regulated by ⑪ flow meter, and sent to the 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.

In the meantime, the air is sucked into the unit by ⑧ blower, and heated up by ③ heater to the set temperature. After the hot air is sucked into the drying chamber, it will contact with the sprayed sample droplets, thus dry the sample instantaneously.

The dried sample that becomes fine particles is sent to ⑥ cyclone after further drying, and separated from the water vapor here, and then sent to ⑦ product collecting container. The evaporated water will be discharged to the outside through the blower.

Then, through the ⑭ cold air regulating valve (manual valve), the external air along the wall of ⑲ upper chamber is leaded in, it will have the effect of inhibiting powder attached to the upper chamber.

As for the temperature conditions in the test, it will be displayed on the temperature regulator through the inlet temperature sensor and the outlet temperature sensor. If the temperature recorder is connected to the temperature output terminal, the temperature data can be recorded. In addition, as for the air flow for drying sample, the corresponding air volume value is displayed on the touch screen by using the signal of ② air volume transmitter.

If the orifice at the nozzle end is blocked, the needle switch on the touch panel can be operated to start the ⑫ solenoid valve, thus make the needle in the nozzle move up and down to remove the blockage at the orifice. In addition, if the sample powder adhesion problem at the nozzle end is serious, the nozzle pulse jet switch can be operated to start the ⑬ solenoid valve, thus blow the compressed air to the nozzle end to remove the external attachment.

Moreover, when cleaning the drying chamber and other components after the test, the head switch can be operated to start the ⑮ solenoid valve. Using the ⑯ air cylinder to lift the upper frame to open the upper part of the drying chamber.

# 14. Replace parts list

| Part name | Specifications | Manufacturer | Code No. |
|---|---|---|---|
| Drying chamber | DL410-30432 | YSC | B080699006 |
| Cyclone | DL410-30610 | YSC | B080699001 |
| Product collecting container | DL410-41251 | YSC | B080604007 |
| Automatic spray ASSY | S00360-00-316L-ASSM | YSJ | Q110901009 |
| Heater | DL411C_01_03-06 | YSJ | H090301102 |
| Temperature sensor | DL410C_03_01-03 | YSJ | H090301087 |
| Inlet temperature sensor | DL411C_03_01-01 | YSJ | H090301100 |
| Heater temperature sensor | KPS-IN600-K-1.5-600 | YSJ | A010502043 |
| Solenoid valve for head lifting | 4KA210-06-DC24V | CKD | A040403109 |
| Solenoid valve for pulse jet | 3PA210-06-P-3(DC24V) | CKD | A040499060 |
| Spray flowmeter | LZB-10WB1BL4G 3-30L/min | YSJ | A040409027 |
| Brushless motor + Driver | NXK60-800-FY01 | YSJ | A080103038 |
| Motor | FY8PF15N-D3<br>for liquid sending | Japan servo | B011603002 |
| Drive | FYD815SD3<br>for liquid sending | Japan servo | B011401014 |
| Gear head | 8H30FBN-100<br>for liquid sending | Japan servo | B080400001 |
| Pump head of peristaltic pump | YZ15 :ID3.2mm×OD6.4mm | YSJ | A080400227 |
| Bearing | NAG4900UU | TOMSON | B080200002 |
| Touch screen | NB7W-TW01B | OMRON | A020400011 |
| PLC_CPU unit | CP2E-N30DT-A | OMRON | A020300066 |
| Analog input/output module | CP1W-MAD44 | OMRON | A020399053 |
| Industrial switch | T605F | YSJ | A120102019 |
| Intelligent temperature transmitter | NHR-213 | YSJ | A010599023 |
| Differential pressure transmitter | HALO-FY-WG 0-5KPa<br>4-20mA DC24V | YSJ | A010508024 |
| SSR | KS15/D-38Z40-L<br>with protective cover RPC-1 | YSJ | A011006024 |
| Current inductive switch | LC11-0.5A-8mm | YSJ | A011599074 |

# 14. Replace parts list

| | Part name | Specifications | Manufacturer | Code No. |
|---|---|---|---|---|
| | Earth leakage breaker | BV-DN IP+N 32A 30mA | Mitsubishi | A010410005 |
| | DC relay | HF116F-3/024DF2HTFW | YSC | A011001013 |
| | Switch power supply | EDR-120-24 | YSC | A010801057 |
| | AC axial flow fan | SJ1225HA2BAT | YSJ | A080104002 |
| | High current rocker switch | LB22 silver panel, holding type - Green 220V | YSJ | A011501005 |
| | Terminal block | T3052-6-4P-CLO | YSJ | A011302002 |
| | Fuse holder | 10A 250V for ADL | YSJ | A010305002 |
| | Fuse tube | 2A 220V | YSJ | A010301005 |
| | Overheat protector | 350℃ | YSJ | B020103001 |
| ※ | Sample hose | Φ3.2×Φ6.4 silicone | YSC | B080807047 |
| ※ | Sealing ring (for lower chamber) | (DL-41)212708-193-1 silicone | YSC | B081999062 |
| ※ | Suction hose | φ34*φ42 1M silicone | YSC | B080807040 |
| | Spring A (connecting hose and suction pipe) | (DL-41)212708-151 I.D.Φ38 | YSC | 212708151 |
| | Spring B (for cyclone) | (DL-41)212708-151 I.D.Φ45 | YSC | 212708149 |
| | Fixing band | | YSC | 212708000I |
| ※ | Pipe | Nylon 11 O.D.Φ6 | YSC | B080807048 |
| | Single side straight joint | GWS6-8 (PT1/4) | CKD | A080804013 |
| | Single side straight joint | GWS6-6 (PT1/8) | CKD | A080804012 |
| | Single side bend joint | GWL6-8 | CKD | A080804009 |
| | Single side bend joint | GWL6-10 | CKD | A080804008 |
| | Long bend joint | GWL6-8-L | CKD | A080804007 |
| | D type manifold joint | GWT6-6-D | CKD | A080804002 |
| | D type manifold joint | GWT6-8-D | CKD | A080804003 |
| | Spacer plate joint | GWS6-0-X | CKD | A080804014 |
| | TSP coupler (for Nozzle A pipe) | 2TSF BS | NITTO-KOHKI | R0150004 |
| | TSP coupler (for Nozzle B pipe) | 1TSF BS | NITTO-KOHKI | R0150002 |
| | Cold air regulating valve | 600 type PT1/4 | YSJ | A040407005 |
| | Intake filter | DL410-40540 | YSC | B080199005 |
| | Exhaust filter | AD311S-40540 | YSC | B040300005 |

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.

**DL411C 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 |
| | | ② Potassium perchlorate, sodium perchlorate, ammonium perchlorate, and other perchlorates |
| | | ③ Potassium 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. |
| | | ② n-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. |

# 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<br>Caution: Surrounding environment | 2. Before using this unit<br>・ At the installation site... | |
| Operation related matters | | | | |
| 1 | Source voltage | ・ Measure customer side voltage (ELB etc.) with a tester<br>・ Measure voltage while the heater is operating<br>(Shall meet the standards)<br>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<br>・ Be sure to connect the earth wire...<br>・ Use the dedicated outlet for power supply<br>4. Operating procedures<br>Preparations (1) & (2)<br>10. Specifications<br>・ Power supply | |
| 2 | Installation of the attachment | Preparations<br>・ Connecting the exhaust duct<br>・ Connection to the compressor<br>・ Connection of the spray nozzle cooling mechanism<br>(as necessary)<br>・ Checking the contents of the GF301C set<br>・ Installation of the distributor<br>・ Installation of the nozzle guide<br>・ Installation of the drying chamber<br>・ Installation of the temperature sensor<br>Installation of the cyclone, the product collecting container, the cap, and the hose<br>・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<br>・ (3) Connection of the exhaust duct<br>・ (4)Rear of the upper frame...<br>・ (5)Cooling the spray nozzle<br>・ (6)Mini spray...<br>・ (7)On the top of the main unit...<br>・ (8)...In the center of the distributor...<br>・ (9)Stage positioning...<br>・ (10)...The temperature sensor...<br>・ (11)...The cyclone...<br><br>Operating method<br>・ 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<br>・ELB and the power switch ON<br>・Set the setting select to INLET and set the INLET temperature to 150℃<br>・Installation of the mini spray attachment<br>・Set the BLOWER switch ON and to air amount 20.0% (0.4m$^3$/min)<br>・Set the liquid sending pump to be 40rpm<br>・Turn the heater switch ON<br>・Setting the liquid sending hose and distilled water<br>・Spraying pure water<br>Set the spray pressure to 10L/min 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℃<br>・Change from distilled water to the sample and shift to the powder collecting operation | 4. Operating procedures Operating method<br>・(1)・(2)<br>・(3) on the operation panel...<br>・(4)Mini spray...<br>・(5)Blower switch...<br>・(6) the heater switch...<br>・(7) the liquid sending tube...<br>・(8)・(9)<br>・(10) When the outlet temperature has become stable... | |
| 4 | Operation stop | Stop operation<br>・Change from the sample to distilled water and wash inside the spray nozzle<br>Approx.5 min → PUMP switch OFF→<br>Adjust spray pressure to 0<br>・Turn the HEATER switch OFF<br>・Turn the BLOWER switch OFF when the outlet temperature dropped to 50℃ or less<br>・Turn the POWER switch OFF<br>・Collect powder<br>・Clean the containers according to the maintenance method | 4. Operating procedures Operating procedures<br>・(11)When specimen has been...<br>・(12)Turn the heater OFF...<br>・(12)Turn the heater OFF...<br>・(13)...The power switches...<br>・(14)...The container holding band...<br>・(15)...to the maintenance method<br>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 15. List of Dangerous Substances | |
| 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<br>・Daily inspection/care | |
| 4 | Completion of installation<br>Matters to note | ・Indicate the installation date and the manager name on the nameplate of the main unit.<br>・Fill in the warranty card with necessary matters and hand it over directly to the customer.<br>・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
DL411C
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YAMATO SCIENTIFIC CO., LTD.
Harumi Triton Square Y-36F, 1-8-11 Harumi,
Chuo-ku, Tokyo 104-6136, Japan
Tel : +81-3-5548-7122
Fax : +81-3-5548-0132
https://www.yamato-scientific.com/