Solvent Recovery Unit
GAS411C

- First edition -

●Thank you for purchasing “Solvent Recovery Unit GAS411C" of Yamato Scientific Co., Ltd.

●To use this unit properly, read this "Instruction Manual" thoroughly before using this unit.
Keep this instruction manual around this unit for referring at anytime.

⚠: WARNING!:

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

Yamato Scientific Co.,Ltd.

Contents

1. Safety precautions

Explanation of pictograms

About pictograms

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

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

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

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

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

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

Meanings of pictograms

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

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

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

1. Safety precautions

List of symbols

Warning

General warnings

Danger!: High voltage

Danger!: High temperature

Danger!: Moving part

Danger!: Hazard of explosion

Caution

General cautions

Electrical shock!

Burning!

Caution for no liquid heating!

Caution for water leak!

For water only

Poisonous material

Prohibitions

General bans

Fire ban

Do not disassemble

Do not touch

Compulsions

General compulsions

Connect ground wire

Install levelly

Pull out the power plug

Regular inspection

1. Safety precautions

Warning · Cautions

Warning

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

Never use this unit in an area where there is flammable or explosive gas. This unit is not explosion-proof. Always try to assure sufficient ventilation in the room and take extreme care so that the atmosphere will not reach the explosive limit concentration. See “13. List of Dangerous Substances” on P. 47 for explosive or flammable gases.

Always ground this unit

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

Apply the source of rated power or more

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

Prohibition of use for error

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

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

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

Do not damage power cord

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

Never try to touch a hot part.

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

Never try to disassemble or alter the unit.

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

1. Safety precautions

Warning · Cautions

⚠ Caution

During a thunder storm

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

After power outage

When power is shut off due to turning the ELB “OFF” or a power failure during operation (while the blower is in operation or liquid is being sent), the mode will return to ① or ② after recovery.

① The mode will return to the initial state when the inlet temperature is 60℃ or less or the outlet temperature is 50℃ or less.

② When the temperature inside the path is high, the unit will continue operation until the inlet temperature drops to 60℃ or less or the outlet temperature drops to 50℃ or less while only the blower returns.

Do not perform unattended operation during activating the unit

Do not perform unattended operation during activating the unit. Since the unit is in idling status and the nozzle is blocked of after the operation using sample, the temperature around outlet is increased and the remaining sample is flown from the sample tube disconnected from the unit, and this failure may cause the indeterminism accident.

Any people other than the qualified personnel shall never attempt to operate the unit.

Take sufficient care for the control of the unit so that any people other than the qualified personnel shall never have a chance to operate the unit.

Always monitor and check the oxygen concentration.

Always monitor the oxygen concentration in the unit to assure safety.

Take care when opening the unit.

Be sure to confirm that the oxygen concentration has returned to 21% and avoid putting your face close to the exhaust port carelessly when opening the unit.

Notes when using solvents.

The unit has been designed to use ethanol.

Service lives of a filter element or packing may be influenced depending on the type of solvent used. When gas leakage or other trouble occurs inside the unit, immediately replace the defective part with a new one. Check whether a solvent can be used or not, please refer to “About the organic solvents” in the section 5. Handling precautions.

Take care for the use of water based solvents.

When you are going to use a water based solvent, do not connect to GAS411C and only use the spray dryer.

If need to use the water based solvent when connecting with GAS411C, please refer to “Restrictions by the melting point” in the section 5. Handling precautions.

2. Before using this unit

Precautions when installing the unit

⚠ Warning

1. Always ground this unit

- Be sure to connect the earth wire (the green cable of power cord) to the grounding conductor or ground terminal to prevent electric shock caused by electric leakage.
- This unit needs a single phase 200-230V～ 50Hz power supply. Please entrust the nearest electrical contractor to carry out the works including power connection.
- The protection impedance of the unit is 0.5Ω or less, ground the unit according to the local technical requirements of the electrical equipment. If the technical requirements are unclear, the grounding works should be constructed and accepted according to the grounding resistance 4Ω or less.
- Do not use 60Hz power supply. The single phase 200-230V～ 60Hz power supply will cause the refrigeration compressor to overheat or even damage.
- Do not connect the earth wire to gas or water pipes. If not, fire disaster may be caused.
- Do not connect the earth wire to the grounding of telephone wire or lightning conductor. If not, fire disaster or electric shock may be caused.

2. Pay attention to the color of each core wire when connecting the power cord

Be sure to check that the breaker on the power source equipment side is turned "OFF" when connecting power cord without fail. Note that this unit does not attach the power plug as standard component. Select the appropriate power plug and terminal matching to the power capacity of the power source equipment to be connected, and connect them.

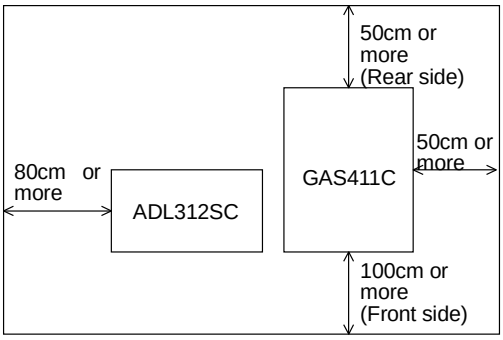
Core Wire Color	In-house Wiring
Black	Voltage Side (L)
White	Voltage Side (N)
Green	Ground Side

3. Choose a proper place for installation

Do not install this unit in a place where:

- Rough or dirty surface.
- Flammable gas or corrosive gas is generated.
- Ambient temperature bellow 5℃ or above 30°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.

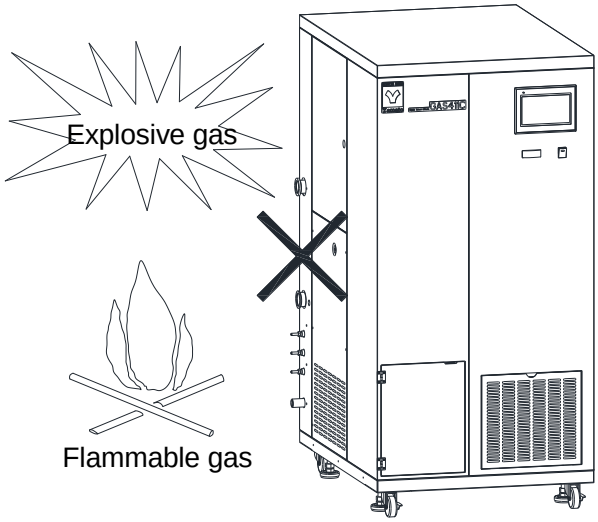


⚠ Warning

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

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

Refer to page 47 “13. List of Dangerous Substances”.

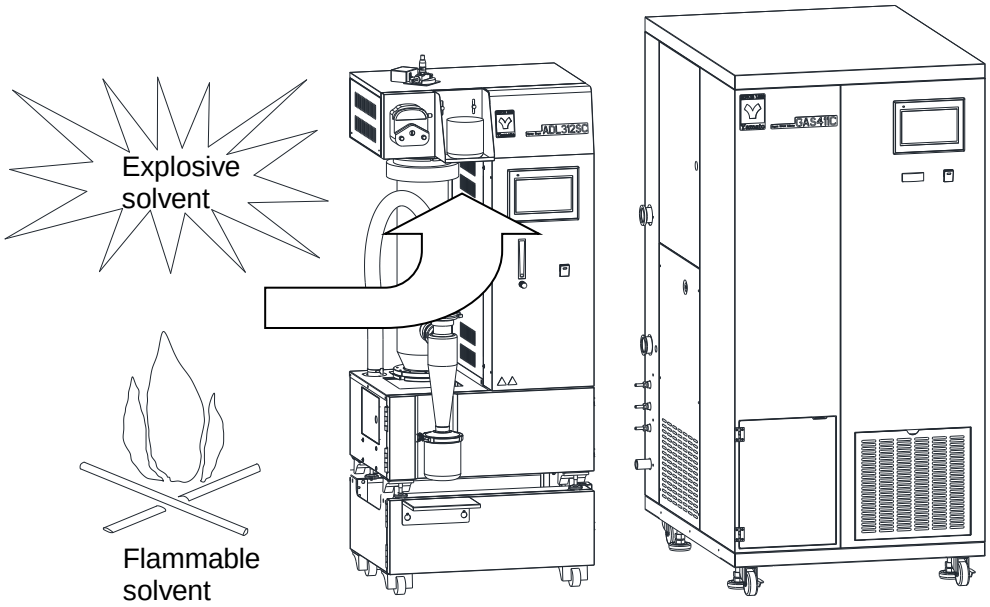


5. Pay attention to the use of flammable and explosive solvents.

Take extreme care for use of an explosive or a flammable solvent. Such a solvent may cause an explosion or a fire.

Check whether a solvent can be used or not, please refer to “About the organic solvents” in the section 5. Handling precautions. (P.27)

Always monitor the oxygen concentration in the unit during operation to assure safety.



2. Before using this unit

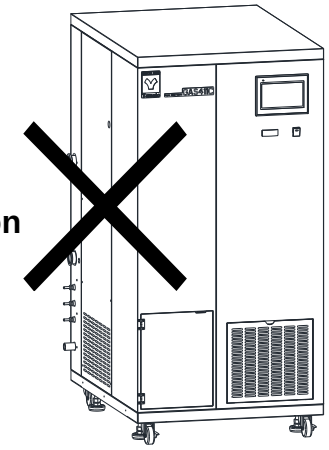
Precautions when installing the unit

⚠ Warning

6. Do not modify

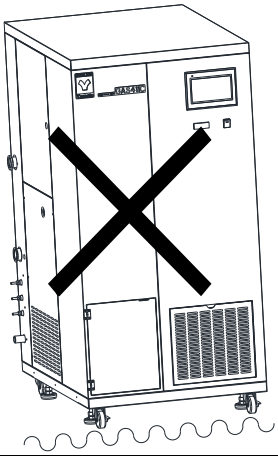
Modification of this unit is strictly prohibited. This could cause a failure.

Modification



7. Do not topple or tilt this unit

Please try to place the unit in a flat place. If the placement is uneven, unexpected accidents may occur.



8. Please use the special socket.

Use a socket that match the electric capacity.

Electric capacity Single phase 200-230V～ 50Hz 5-6A

This unit adopts single-phase 200-230V～ 50Hz 5-6A power supply. Please confirm the voltage and frequency of the power supply and whether the corresponding current value is greater than the requirement of the unit.

There could be the case that the unit does not run even after turning ON the power. Inspect whether the voltage of the main power is lowered than the specified value, or whether other device(s) uses the same power line of this unit. If the phenomena might be found, change the power line of this unit to the other power line.

For connecting of the device to the power source, ask the dealer that you purchased this unit from or an electrical contractor for safe.

9. Handling of power code

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

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

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

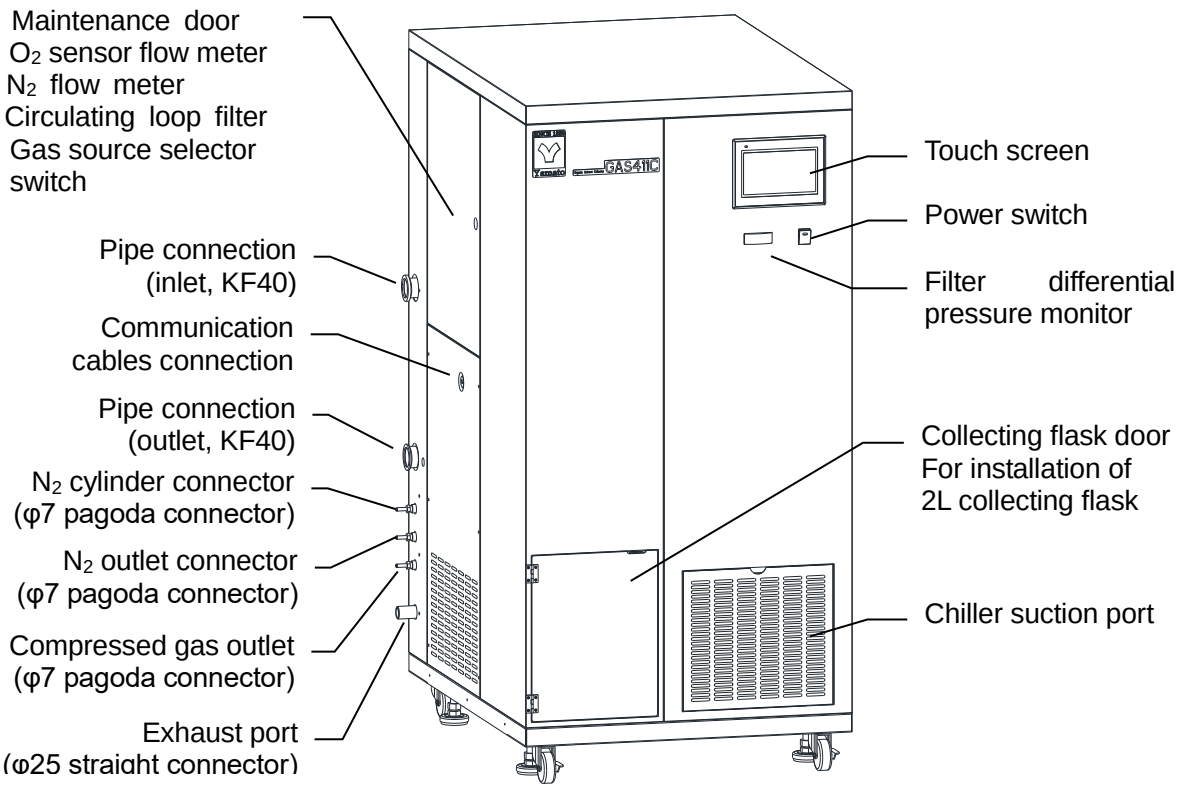
Keep the power cord away from any heating equipment such as a room heater. The cord's insulation may melt and cause a fire or electrical shock.

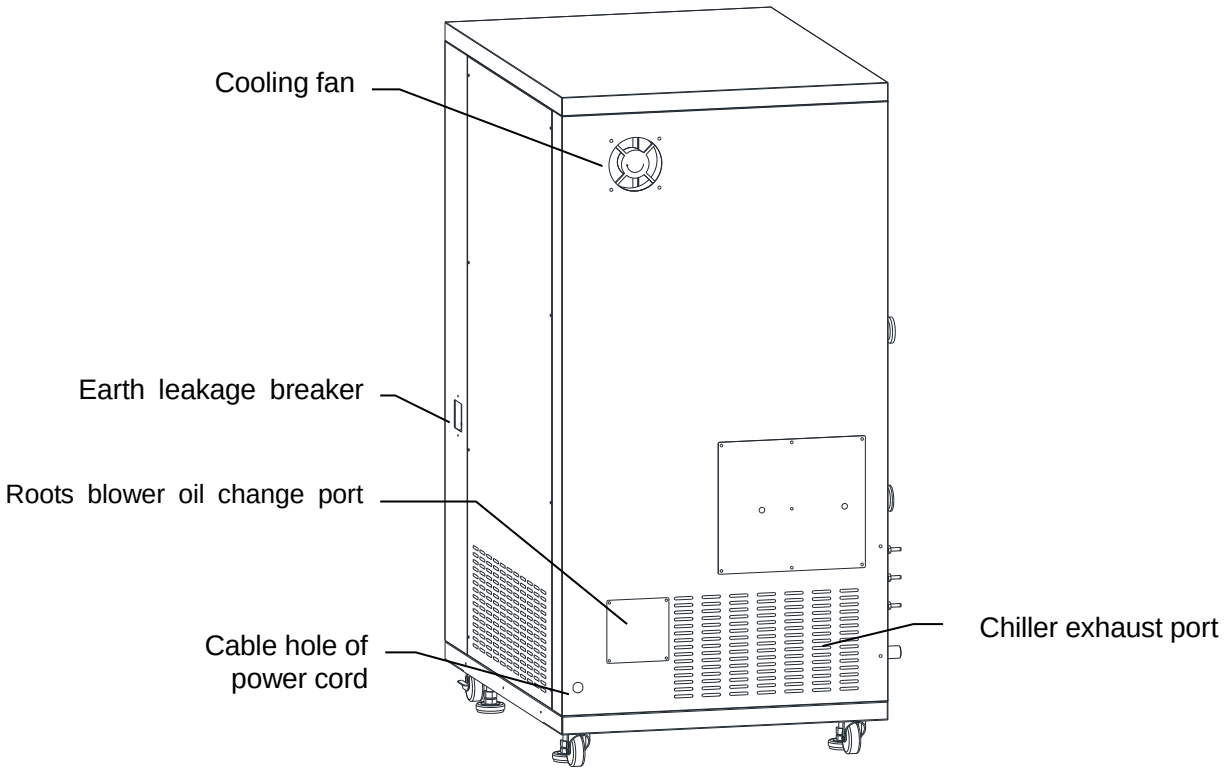
If the power cord becomes damaged (wiring exposed, breakage, etc.), immediately turn off the power at the rear of this unit and shut off the main supply power. Then contact your nearest dealer for replacement of the power cord. Leaving it may cause a fire or electrical shock.

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

3. Names and functions of parts

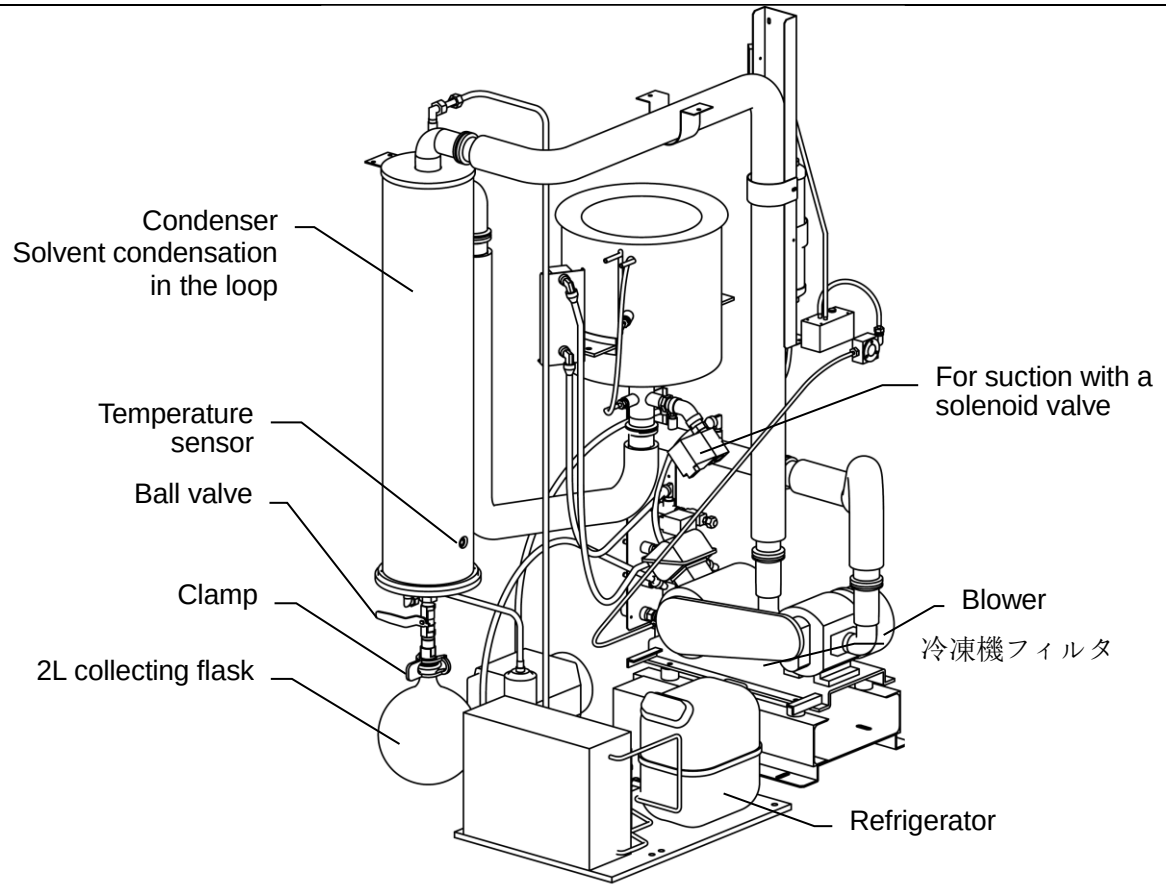
Main unit

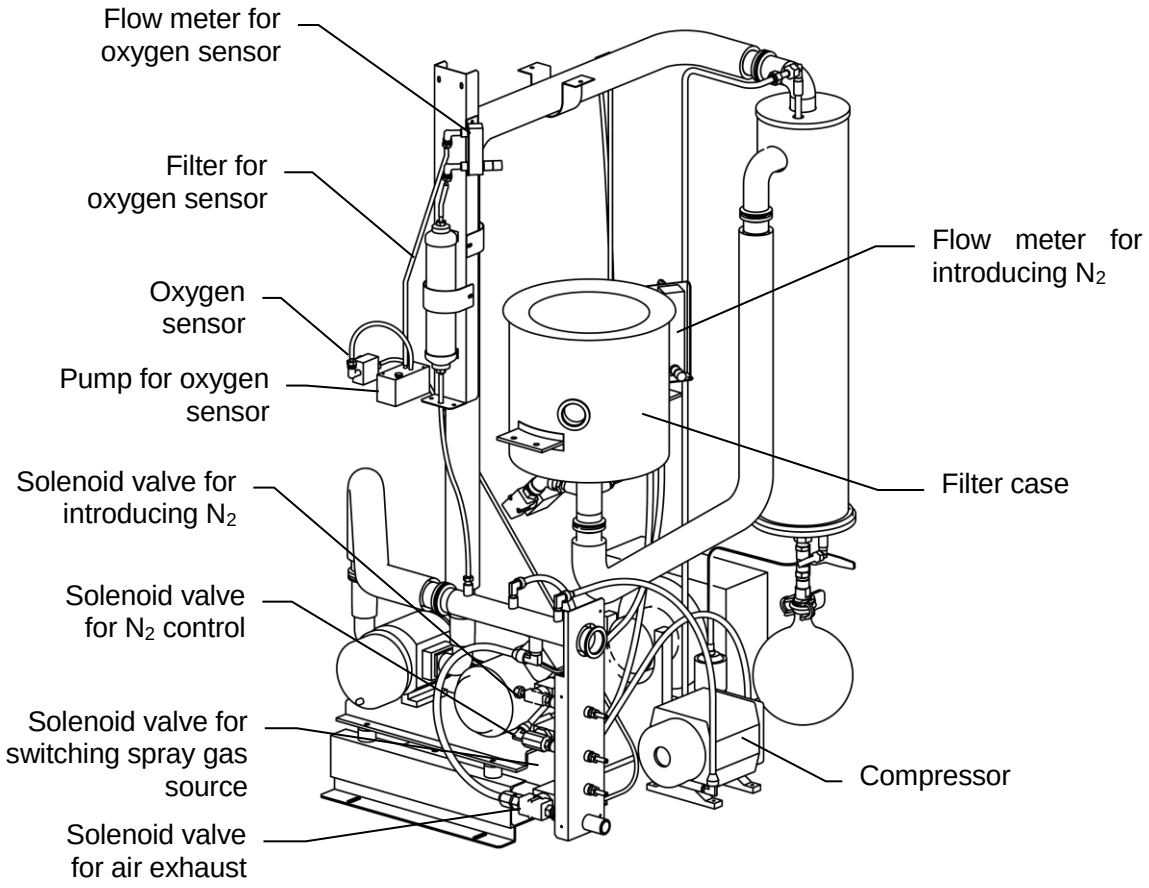




3. Names and functions of parts

Internal mechanism



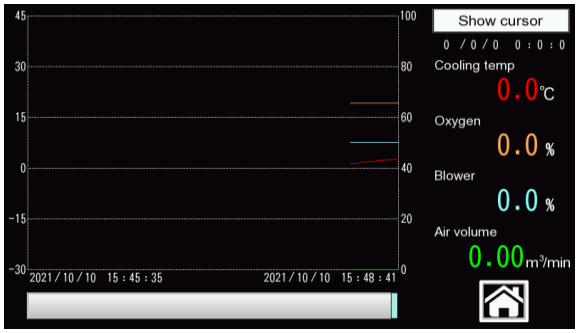


3.Names of parts and their function

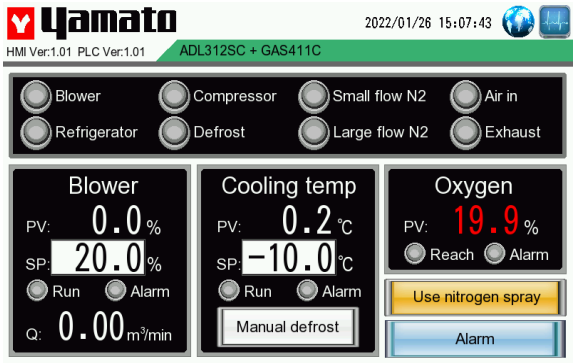
GAS411C Operation interface overview

Preheat waiting interface

Operation curve interface

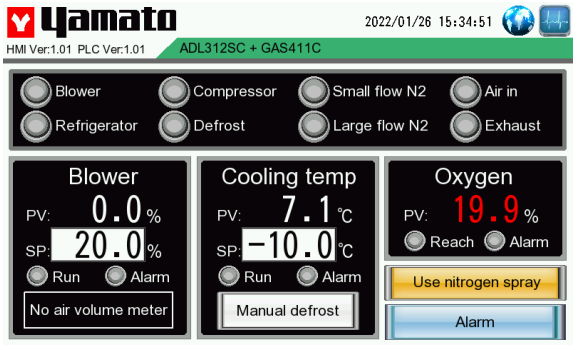


Initial interface (install the air flowmeter)

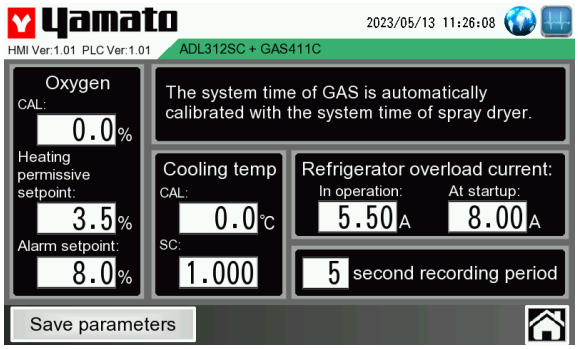


Language selection pop-up interface

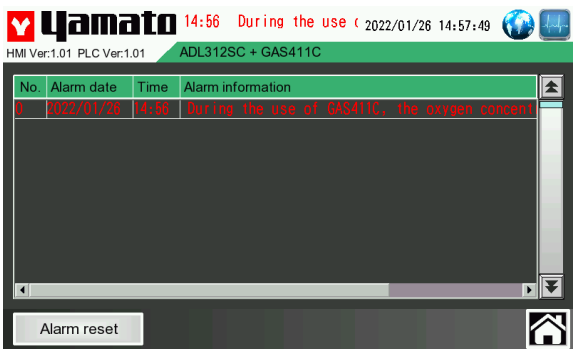
Initial interface (without air flowmeter)



System parameters interface



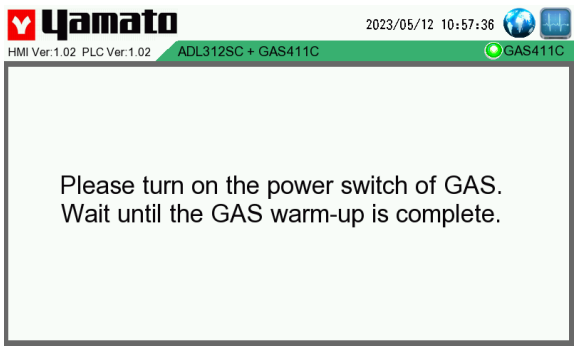
Alarm interface



3.Names of parts and their function

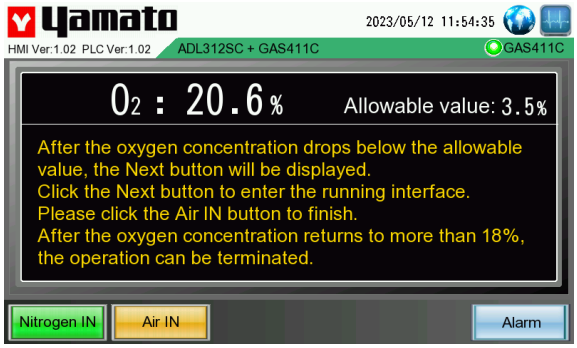
ADL312SC Online operation interface overview

Preheat waiting interface

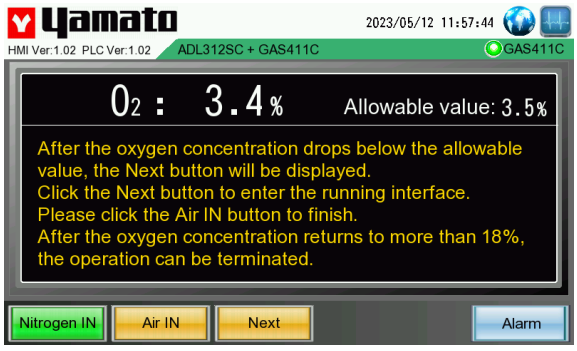


Initial interface

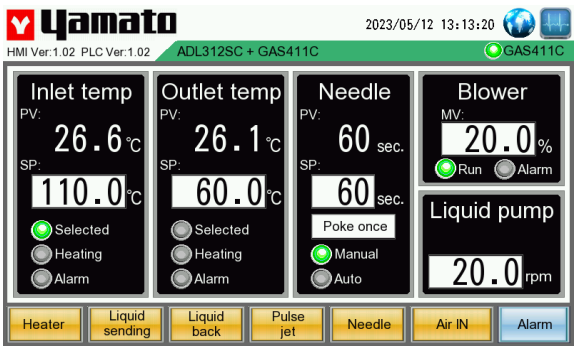
N_2 introducing interface



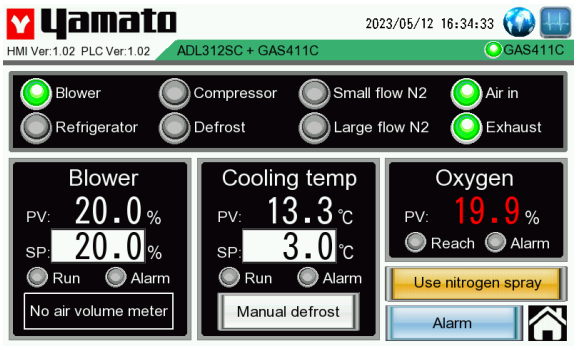
Operation jump interface



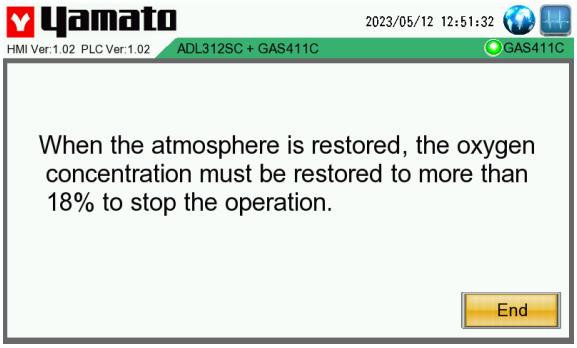
Operation interface



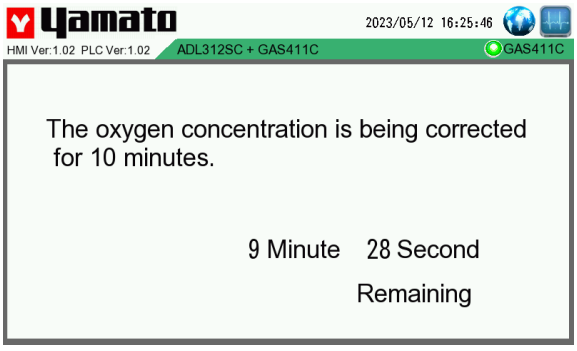
GAS411C remote control interface



The operation is over and the atmosphere is restored



Oxygen concentration calibration interface



3.Names of parts and their functions

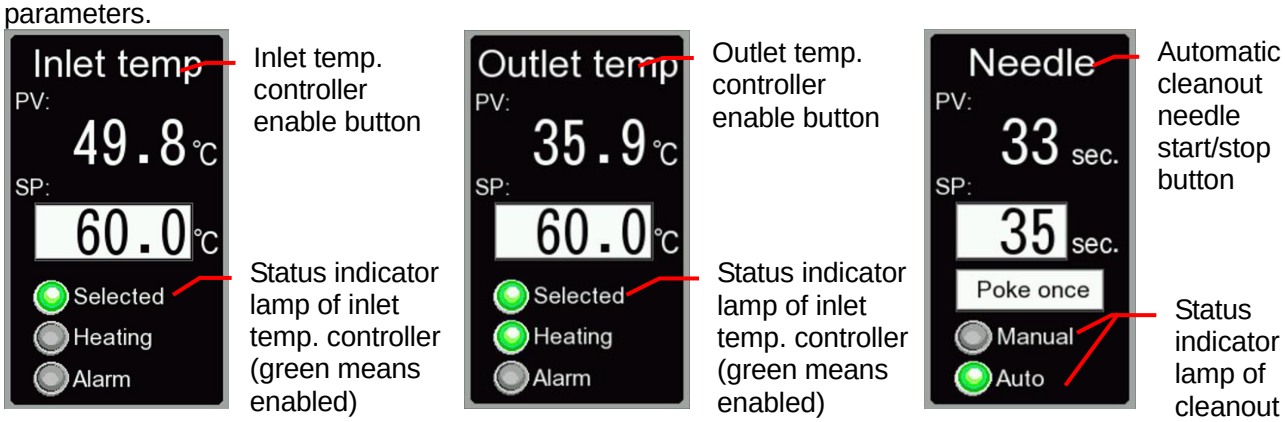
Description of switch and indicator lamp in the interface

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

Type 1: Manual operation buttonThis kind of button is not only a functional switch but also an indicator lamp for the current state of the function. It has only two states of ON/OFF. The operator will switch the state once every time he operates, and the indicator will switch accordingly.
This kind of button has no power-off memory function, and it will be in OFF state after power outage recovery. Its corresponding function can only be activated by the operator.

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

Type 2: Function select button and function enable indicator lamp
This kind of button is only the switch of function, and the usage status of the function is shown by a separate indicator lamp.
This kind of button has power-off memory function, after power outage recovery, will keep the state before power outage. It is characterized by the ability to maintain the last setting of operating parameters.



Type 3: Status indicator lamp
An indicator lamp indicating the current status of each functional unit. This indicator lamp is internal automatic function and has no corresponding switch.
If the indicator lamp is gray or invisible, it indicates that the function is not running. If the indicator lamp is green or visible, it indicates that the function is running. If the indicator lamp is red, it indicates that the function is in the alarm status.

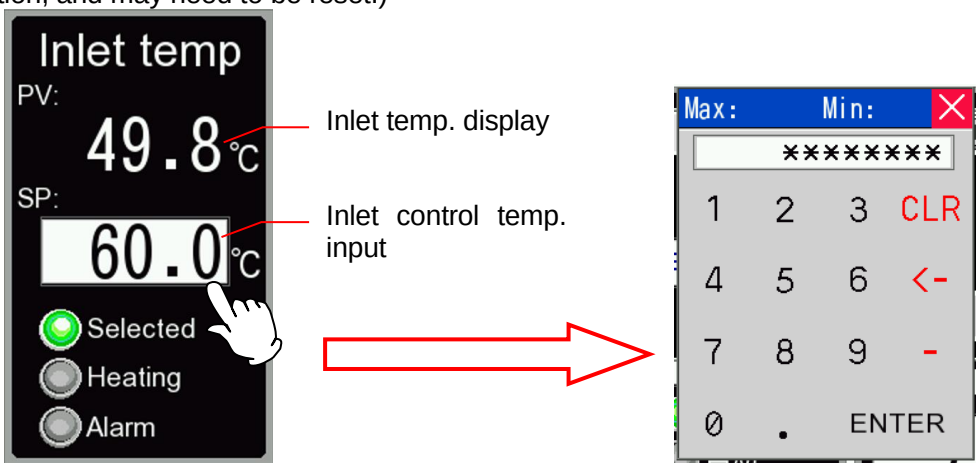
3.Names of parts and their functions

Value display and input description in the interface

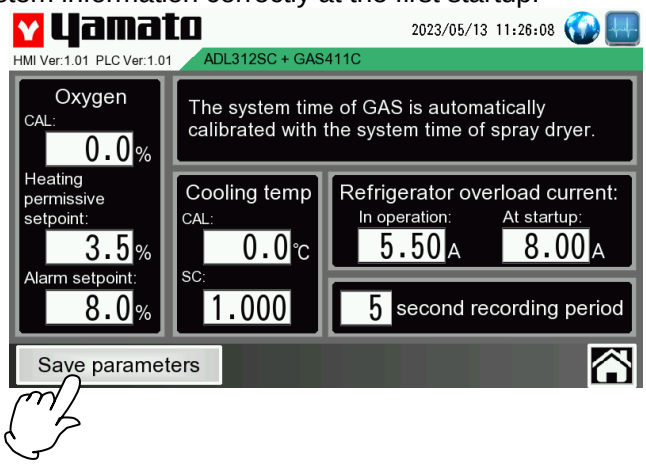
In the operation interface of touch screen, the values can be divided into two types: only display but no input; display and input.

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

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



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



4. Operating procedures

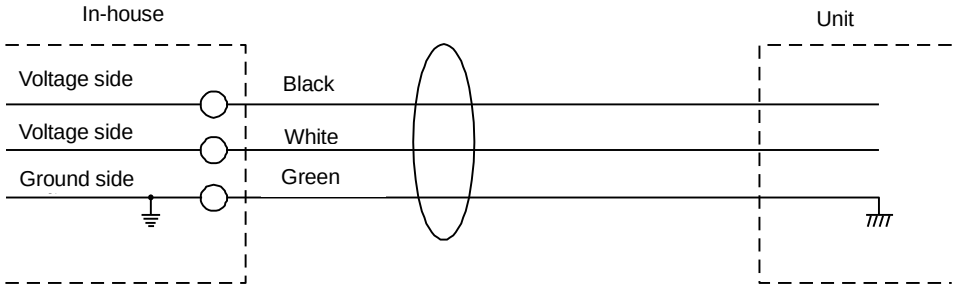
Preparations

(1) Connecting the power cord

First check that the switches of the control assembly and the ELB are OFF and then connect the power cord securely to the power supply meeting the specified voltage and current.

(2) Connecting an earth

The power cord of this unit is earthed 3-core (VCT) including the earth wire, and be sure to ground. The grounding resistance of the standard socket grounding terminal must be less than 4Ω.



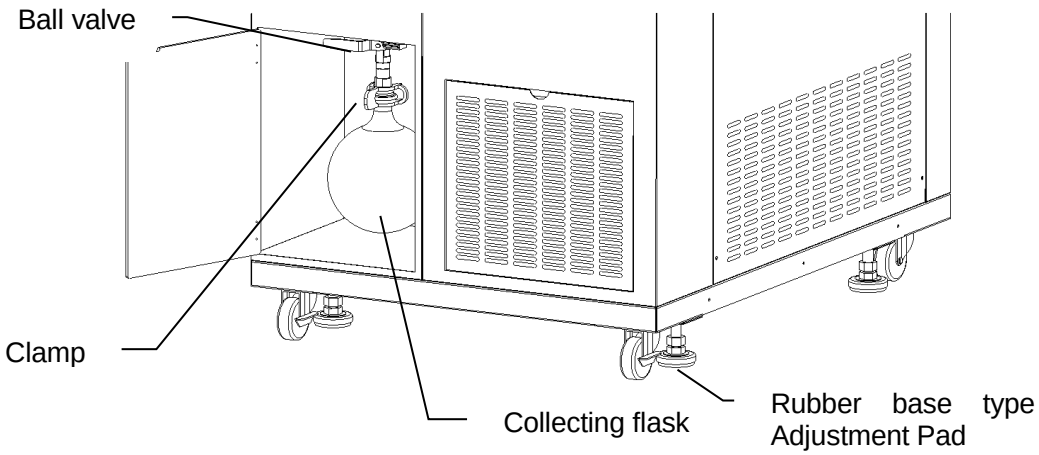
(3) Connecting the exhaust duct

After the operation, the organic solvent, hot air and micro powder in the pipe are discharged through the AIR IN action. Connect the exhaust pipe attached to the exhaust port and exhaust it outside the house using the fume hood. Do not peep into the exhaust port or discharge gas directly into the house, so as to avoid danger. The exhaust port is at the bottom of the left side of the main body.

(4) Connecting the collecting flask

Use a clamp to fix the collecting flask at the connecting port under the ball valve, and then turn on the ball valve after fixing.

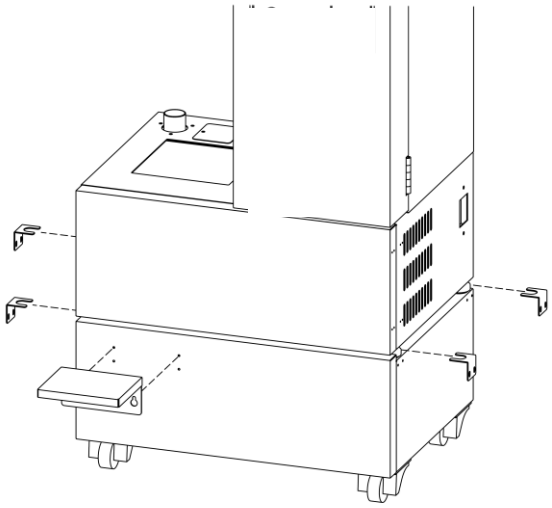
If need to remove the collecting flask, turn off the ball valve, then remove the clamp, and finally remove the collecting flask.



4. Operating procedures

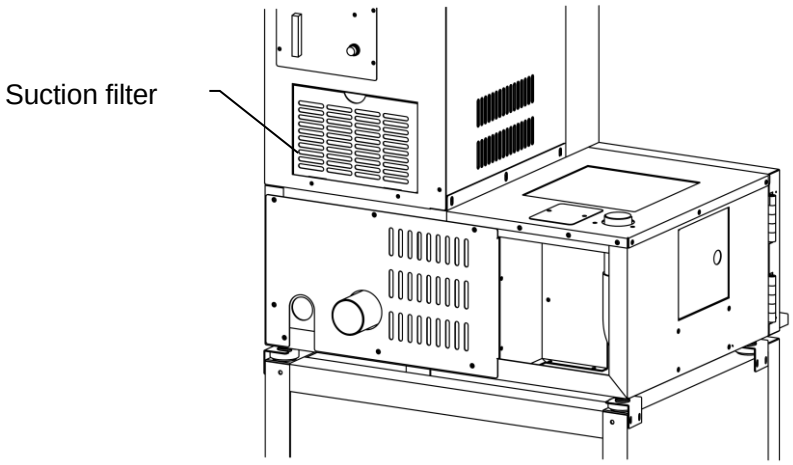
Preparations (ADL312SC+GAS411C)

(1) ADL312SC is used on a table. When connecting with GAS411C, please set the special stand for ADL312SC.

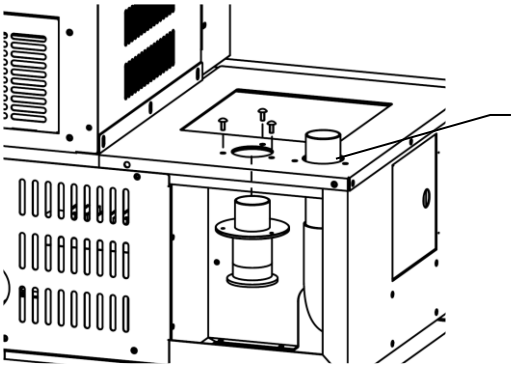


Put the unit body of ADL312SC on the special stand, and use M4×10WS screws to fix the adjusting feet at 4 positions of the fixing plate. Use M4 cross knurled screws to fix the container holder at the front of the special stand.

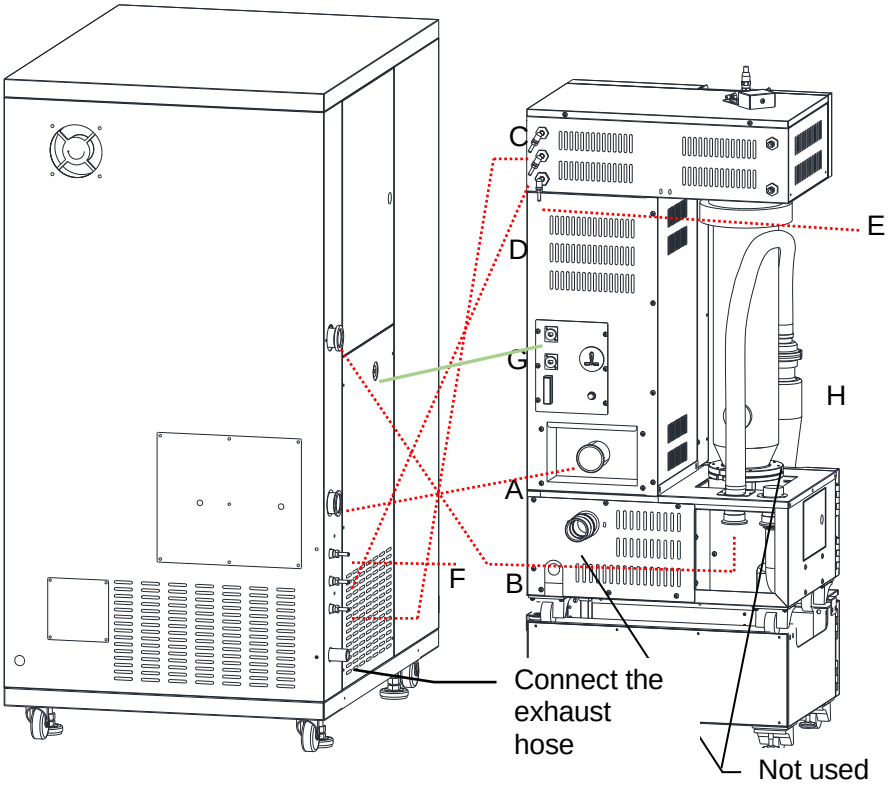
(2) Remove the suction filter and the blind plate.



(3) The attached connecting pipe is installed by M4x10 flat head screws.
The hose from the cyclone outlet is connected to the installed connecting pipe.

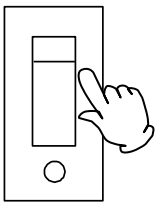


(4) Connect ADL312SC with GAS411C.



A: Connect the hose from the heater inlet to GAS411C.
Put an O-ring and securely fix using a clamp for installation.
B: Connect the hose from the connecting pipe to GAS411C filter hood inlet.
Put an O-ring and securely fix using a clamp for installation.
C: Connect the polyester pipe and fix it with a clamp.
D: Connect the polyester pipe and fix it with a clamp.
E: Connect the polyester pipe to the CDA supply source and fix it with a clamp.
F: Connect the polyester pipe to the N_2 supply source and fix it with a clamp.
G: Connect an interface cable.
H: Set GF300 to the main body according to the ADL312SC instruction manual.

Operating method

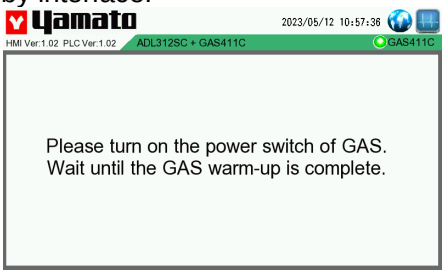


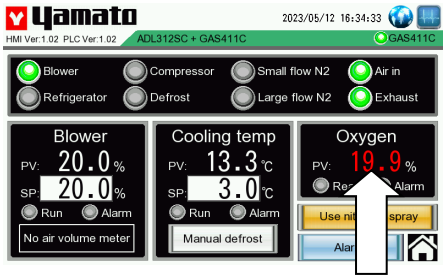
Turn the ELB on the right side of the main body ON and turn the Power switch on the operation panel of the main body ON. Temperature controllers, indicator lamps and the key panel will be displayed.

※The main body of spray dryer is operated with GAS411C.

GAS411C will take 90 seconds to boot (O_2 concentration meter warm-up time). Please wait patiently to switch to the next interface.

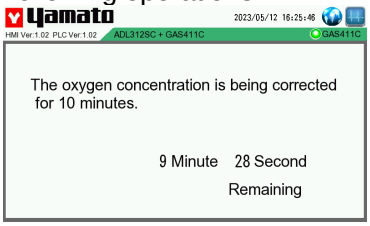
※When GAS411C does not finish booting, the spray dryer is also in the standby interface.





After GAS411C is booted, please observe whether the displayed value of O_2 concentration on GAS411C is above 18% in standby state.

When the O_2 concentration is always lower than 18%, please click the O_2 CAL button on the spray dryer to start the O_2 concentration calibration. After 10-minute calibration, the displayed value of the O_2 concentration should be higher than 18% before proceeding with the following operations.

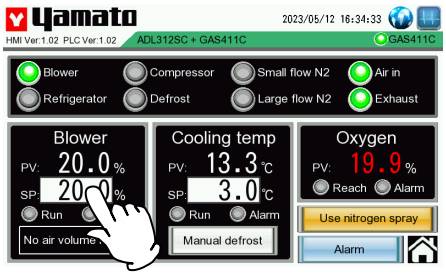


※When calibrating the O_2 concentration, do not perform other operations and do not power off the equipment. Otherwise, the calibration may fail.

※If the O_2 concentration still cannot exceed 18% after the calibration, please refer to P.38 "The displayed value of the O_2 concentration cannot be restored to exceed 18% after the operation".

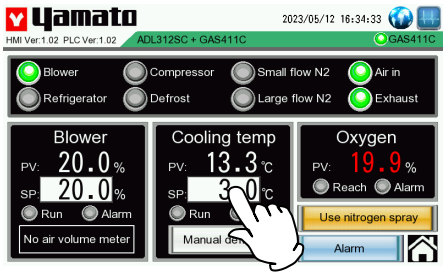
※When the above operations are invalid, considering that the probe of the O_2 concentration meter may have failed, it is forbidden to use this equipment. As for the follow-up treatment, please contact your agent or our customer service.

Operating method



Please set the required blower output power on the touch screen of GAS411C. The setting range is 5.0% ~ 100.0%.

※ If need more accurate air volume display, please select an air volume meter to display the real-time air volume changes.



Please set the required condensation temperature on the touch screen of GAS411C. The setting range is -20.0℃ ~30.0℃.

The refrigerator contains the delay timing circuit. Because it will take 2mins to start after refrigerator stops, the refrigerator may not activate immediately if press BLOWER switch.

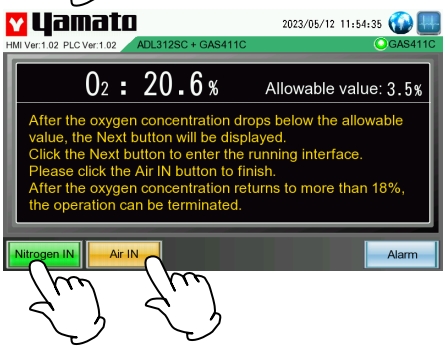
During operation, when the condenser temperature is lower than set temperature, the refrigerator will stop to prevent solvent concretion or sublimation after liquefying when temperature is lower, which may cause pipe blocking. Please according to the characteristics of solvent, set an appropriate control temperature of condenser.

Please set N_2 supply pressure as 0.1MPa.

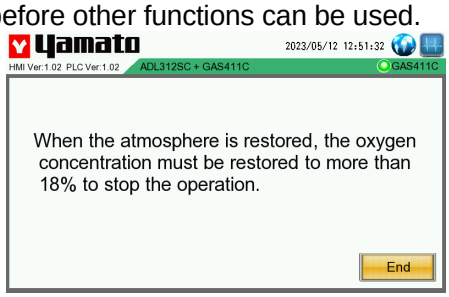
After the above preparations are completed, please complete the experimental operation on the spray dryer. The instruction manual takes the operation of ADL312SC as examples:

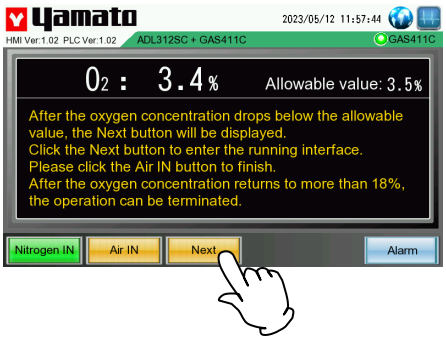
(1) Press the N_2 IN button to enter the nitrogen lead-in interface.

When the oxygen concentration decreases below the allowable value, the NEXT button will appear and click it to enter the running interface.

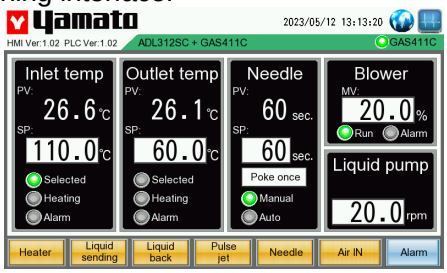


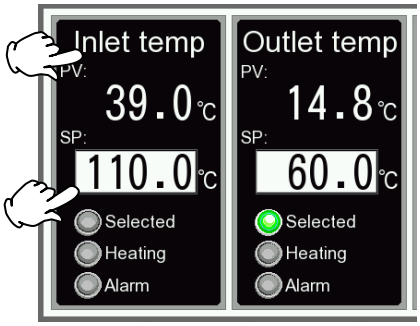
※ When need the reverse operation to restore the atmosphere, please click the N_2 IN button first to turn off the nitrogen lead-in, and then press the AIR IN button to jump to the atmosphere recovery interface. Please note that the atmosphere recovery is an irreversible operation. Once entering the atmosphere recovery stage, the operation must be finished before other functions can be used.





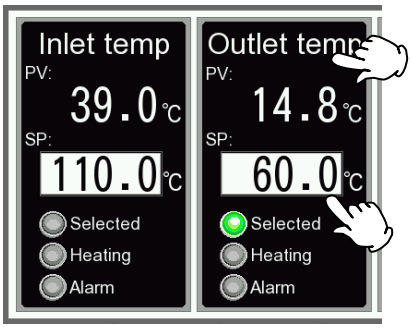
(2) When the oxygen concentration decreases below the allowable value, the NEXT button will appear and click it to enter the running interface.





(3) There are inlet temperature and outlet temperature controllers on the running interface, which can be used for display and temperature setting.

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



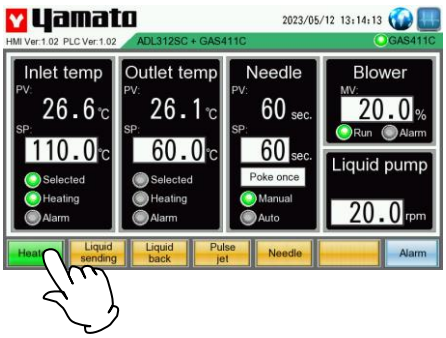
PV value displays the real-time temp. of the temp. sensor, SP value is black characters on white background, click to set the operating temp.

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

Inlet temp. setting range: 0 ～ 240℃

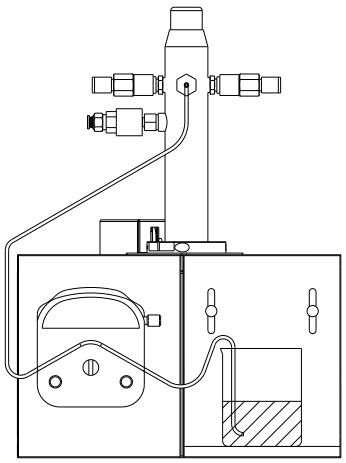
Outlet temp. setting range: 0 ～ 100℃

e.g.: select the inlet control, set the inlet temp. as 110℃.

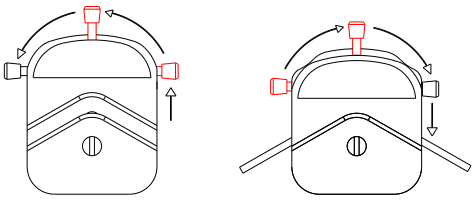


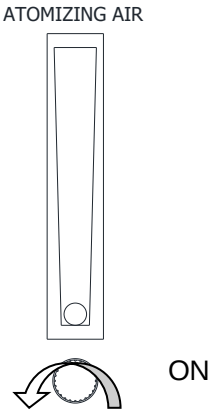
(4) Turn ON the Heater switch.

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



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

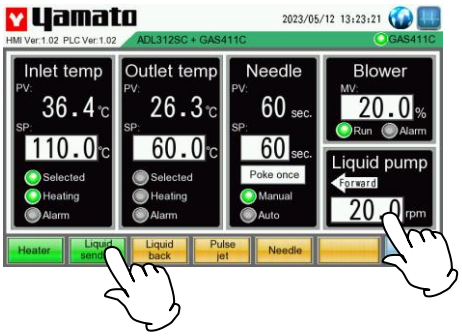




(6) After the inlet and outlet temp. reach the desired temp., set the spray flow and liquid-sending speed, and turn ON the liquid-sending switch to transport the distilled water.

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 10mL/min. (**Please refer to ADL312SC instruction manual**) Adjust the liquid-sending speed to make the outlet temp. be slightly lower than 75℃.

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



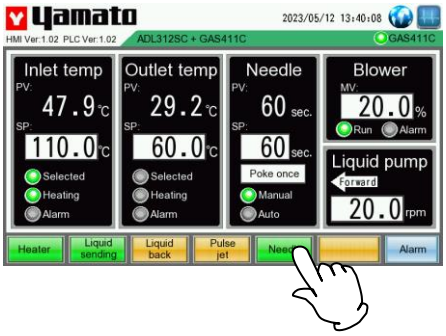
e.g.: Adjust the liquid-sending speed to make the outlet temp. be slightly lower than 75℃.

～ Hint ～

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

(8) 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

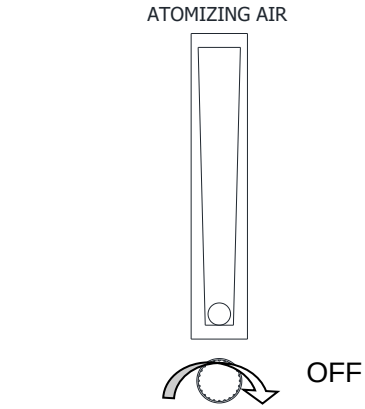


(9) During normal spraying, when the sample cannot be sprayed, the orifice of the spray nozzle may be blocked. Click the needle button to squeeze out the blockage.

※ **Please refer to ADL312SC instruction manual.**

(10) 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 refer to ADL312SC instruction manual.**

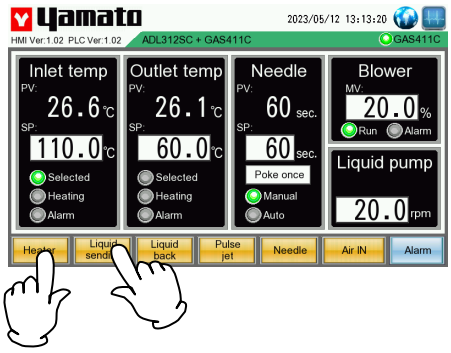


～ End process ～

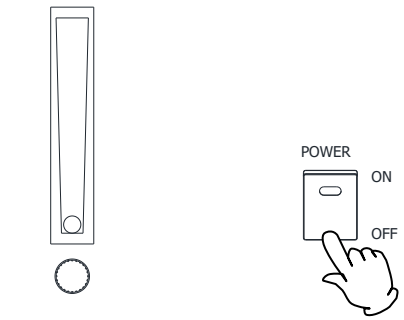
(11) When the sample liquid sending is finished, replace the samples with the distilled water again to clean the nozzle. Clean for about 5mins, turn OFF the liquid-sending switch, and then adjust the spray flow to 0.

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

(12) Turn the Heater button OFF.



(13) When the inlet temp. is lower than 60℃ and the outlet temp. is lower than 50℃, please turn on the AIR IN button. Otherwise, you will be prompted:

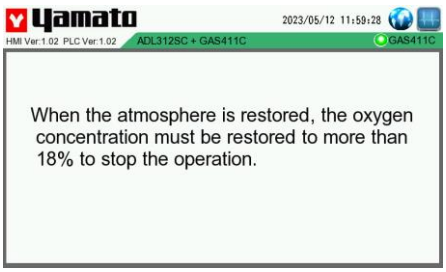


※ When the inlet temperature is above 60℃ or the outlet temperature is above 50℃, do not stop the operation of the blower by forcibly cutting off the power. This may cause a malfunction, or even lead to combustion or explosion.

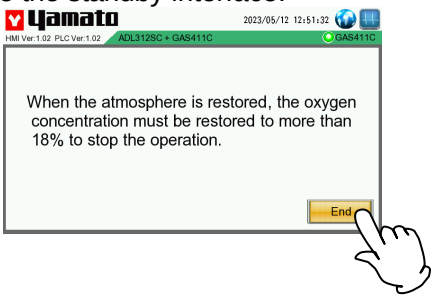
※ At the end of spraying, there is also residual solvent in the pipeline. Please run a little longer to ensure the solvent recovery.

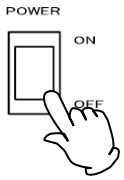
※ When the solvent contains water, there may be frost in the cooling recovery pipe and low solvent recovery. When the solvent recovery in the collecting flask is too low, use the DEFROST switch to stop the refrigerator temporarily and defrost the cooling recovery pipe. The refrigerator will automatically be restored after 5 minutes.

(14) Turn off the valve of N_2 supply source when starting to restore the atmosphere.

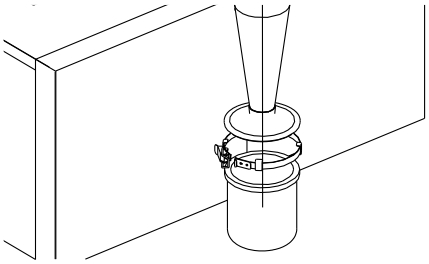


(15) The END button will appear when the oxygen concentration is restored to more than 18%. Click the END button to restore the standby interface.

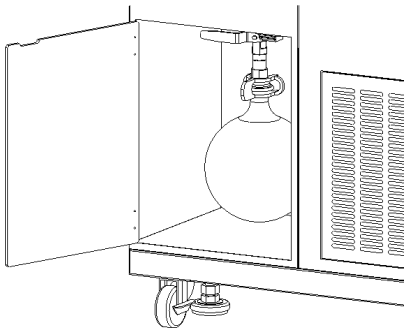




(16) Please turn OFF the power switch of the spray dryer and GAS411C.



(17) 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.

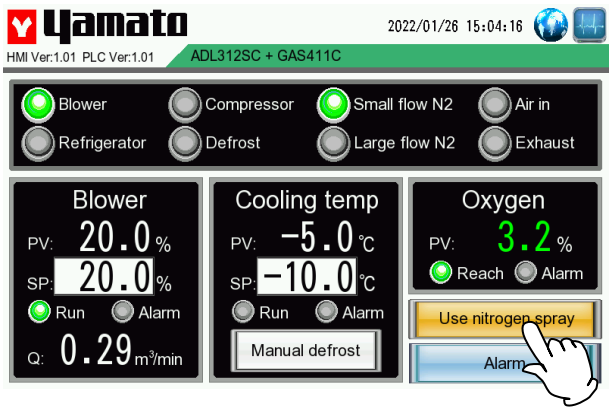


(18) Please turn off the hand valve first, then press the collecting flask with your hand, remove the clamp, and finally remove the flask and recover the solvent.

※ **The hand valve must be turned off before operation. Because there must be liquid solvent remaining on the inner wall of the condenser and condensing cylinder. If do not turn off the hand valve, the liquid solvent will slowly flow down along the inner wall of the pipe, and finally drip down to the bottom of the box. It may cause flammable gas alarm action, or even will cause a fire.**

(19) Wash the containers according to the maintenance method described in the instruction manual of spray dryer.

Gas source selection



The maximum pressure output of GAS411C internal linear reciprocating air compressor is 0.1MPa, and the maximum flow output is 16L/min. (Note that when at the the maximum pressure output, the flow is 0 L/min, and also when at the maximum flow output, the pressure output is 0 MPa. The two cannot be reached at the same time.)

If higher pressure or flow are required, use an external gas source to spray.

Operation procedure: on the touch screen of GAS411C, click the Use nitrogen spray button to adjust the nitrogen gas source to the required pressure.

※ The maximum pressure of the nitrogen gas source cannot exceed 0.3MPa. Otherwise the pipe may be damaged and leak.

4. Operating procedures

The relation between blower and temperature/dry air amount (reference)

The following table is the comparison table of each blower scale value and the average dry air amount, please refer to it when operating. If the filter is blocked, the air amount value corresponding to each blower scale value may be reduced. When the value of the filter differential pressure gauge reaches twice the normal value, it needs to be cleaned.

Blower output power (%)	Avg. dry air amount (m^3/min)
5	0.12
10	0.16
20	0.22
30	0.28
40	0.33
50	0.39
60	0.45
70	0.50
80	0.55
90	0.61
100	0.65

5. Handling Precautions

⚠ Warning

1. Substances that cannot be used

Such substances may cause an explosion or a fire. Whether a solvent may be used or not shall be judged according to “About specified organic solvents” in section 5. Handling precautions.
Always monitor the oxygen concentration during operation to assure safety.
See “13. List of Dangerous Substances” on P.47.

2. If a problem occurs

f smoke or strange odor should come out of this unit for some reason, turn off the power key right away, and then turn off the circuit breaker and the main power. Immediately contact a service technician for inspection. If this procedure is not followed, fire or electrical shock may result. Never perform repair work yourself, since it is dangerous and not recommended.

⚠ Caution

1 Do not put anything on this unit。

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

2. During a thunder storm

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

3. After installing

It may cause injure to a person if this unit falls down or moves by the earthquake and the impact, etc.. To prevent, take measures that the unit cannot fall down.

4. Clean the collecting flask during operation.

When the solvent collected in the collecting flask is about to be filled, because the condensing cylinder has a certain capacity, the collecting flask can be cleaned without stopping operation.
Please turn off the hand valve at the connecting pipe of the collecting flask before removing the collecting flask. Safely dispose the solvent in the collecting flask as soon as possible, then reinstall the collecting flask and turn on the hand valve. The whole operation should be controlled within 5 minutes.
If the solvent is a special reagent, the transfer is hard and the disposal time is long, please order another collecting flask from our company or agent to replace it for safety.

5. It is strictly prohibited to remove the collecting container to collect samples during operation.

It is strictly prohibited to remove the collecting container during operation which will lead to the rapid inhalation of a large amount of air in the sealed pipeline, and there is high temperature in the pipeline, the residual solvent vapor is easy to cause explosion when encountering the oxygen.

Samples should be collected after the end of the operation.

5. Handling precautions

About applicable organic solvents

This unit has been designed to use isopropyl alcohol and ethanol. Note that the following restrictions shall apply when other organic solvents are used.

(1) Restrictions because of explosion limit oxygen concentration

When N_2 gas, organic solvents, and air (oxygen) are mixed, explosion will occur when the oxygen concentration is over the oxygen concentration limit and if there is an ignition source. This means that it is desirable the oxygen concentration limit of a solvent is as high as possible.

The oxygen concentration limit for this unit is 9%. Do not use any organic solvent whose oxygen concentration limit is below 9%. (See “Oxygen concentration limit table” on P.25. Also, calculate limits for organic solvents not shown in the table using the “calculation method of concentration limits”.

(2) Restrictions because of the boiling point

Although the unit recovers solvent by cooling it in the condenser (cooling trap), the outlet temperature of the condenser (TRAP TEMP MONITOR) may become considerably high depending on the outlet temperature, amount of liquid that is sent, environmental temperature, or duration of sending liquid.

〔Example〕

Environmental temperature: 35℃	Amount of liquid to send: 2000mL/H (ethanol)
Air amount: 0.5m^3/min	Liquid sending time: 30 min
Outlet temperature: 100℃	Condenser outlet temperature: 37℃

Thus a solvent with a lower boiling point may not be condensed efficiently. (See “Table of oxygen concentration limit” on P.25.) In fact, you do not need to set inlet and outlet temperature higher when you use a solvent with a low boiling point. For example, you can operate the unit with lower condenser outlet temperature by reducing the air amount and amount of liquid to send for solvents with a low boiling point such as methylene chloride.

〔Example〕

Environmental temperature: 25℃	Amount of liquid to send:1170mL/H (methylene chloride)
Air amount: 0.45m^3/min	Liquid sending time:20 min
Outlet temperature: 38℃	Condenser outlet temperature:14℃

(3) Restrictions because of boiling points

When the solvent contains an organic solvent with a high melting point or water, too low trap temperature might cause it condensate in the condenser. In such a case, raise the trap temperature by increasing air amount, increasing the inlet temperature, or increasing the amount of liquid to send, or stop the freezer once with DEFROST switch and allow condensed solvent or water to solve. (When the trap temperature is lower than the melting point before sending solvent, watch the trap temperature a while because that temperature will rise once sending of solvent is started.)

When you use a water soluble solvent, try to disconnect this unit and operate with ADL312SC or GB211A only.

(4) Restrictions because of corrosion resistance

This unit has been designed to use isopropyl alcohol and ethanol. When other solvents are used, care must be taken because service lives will differ from part to part. See the table of corrosion resistance on P.26 and the piping system drawing that shows parts made of materials other than stainless steel or glass on P.27. In terms of this unit, components other than the liquid sending tube are exposed to thin solvent steam only and will not immediately corrode even if they are exposed to chemicals marked with △ or × in the corrosion resistance table, if any abnormalities such as abnormal increase speed of oxygen concentration or a gas leakage in the pipe path, replace defective parts immediately because service life of some parts may be shortened due to solvents other than ethanol and isopropyl alcohol.

5. Handling precautions

About applicable organic solvents

Chemicals that each type of liquid sending tubes are as follows.

Silicone tube: ethanol, isopropyl alcohol, methanol, acetone, acetic ether

Viton tube: xylene, toluene, benzene, hexane, chloroform, methylene chloride

[Oxygen concentration limit table]

Organic solvent	Boiling point〔℃〕	Melting point〔℃〕	Oxygen concentration limit〔%〕
Xylene	(o) 144 (m) 139.3 (p) 138.5	(o) -25 (m) -47.4 (p) 13.2	(o) 10.5 (m) 11.5 (p) 11.5
Isopropyl alcohol	82.3	-88	9.0
Benzene	80.1	5.5	10.5
Ethanol	78.4	-114.3	9.9
Acetic ether	77.1	-83.6	10.0
Hexane	67.7	-95.3	11.4
Methanol	64.6	-97.4	9.7
Chloroform	61.2	-63.5	Non-combustible
Acetone	56.2	-94.6	10.4
Methylene chloride	40	-97.7	23.9

[How to calculate an oxygen concentration limit]

Molecular formula of flammable gases: $C_a H_b O_c N_d S_e F_f$ (F means halogen) d is not used.

$$v = \frac{100}{1 + 4.773\left[a + e + \frac{b-2c-f}{4}\right]}$$

Oxygen concentration limit

$$= [100-\{L+(1-L/v)\times 100\}]\times 0.209 \ [\%]$$

Example: Toluene

According to the molecular formula $C_6H_5CH_3$, a=7, b=8, c=e=f=0

Lower explosion limit L=1.2

$$v = \frac{100}{1 + 4.773\left[7 + 0 + \frac{8-0-0}{4}\right]} = 2.27$$

Oxygen concentration limit

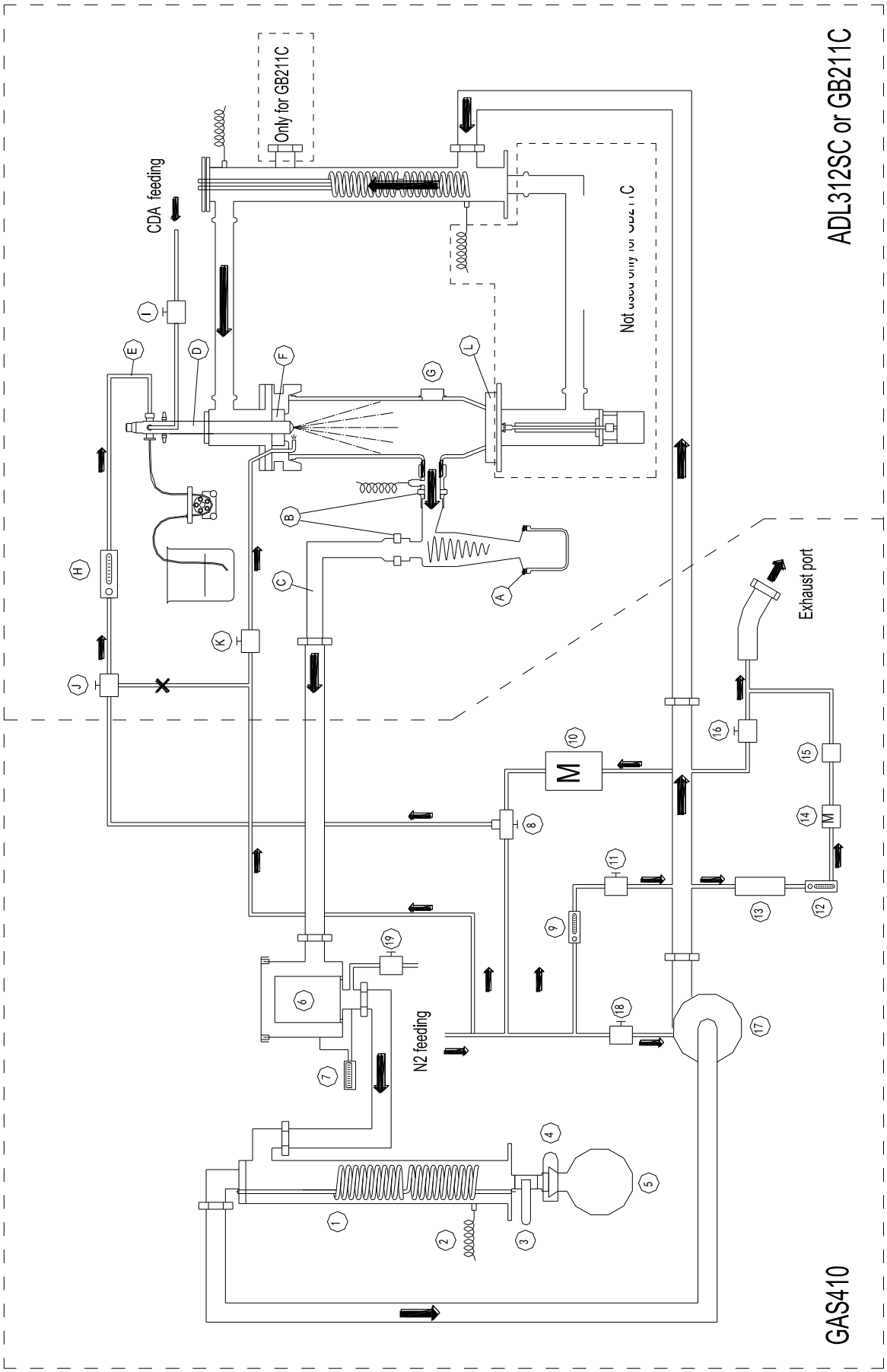
$$= [100-\{1.2+(1-1.2/2.27)\times 100\}]\times 0.209$$
$$= 10.7\%$$

Corrosion resistance table

○: Usable △: Avoid using preferably ×: Unusable for use

Material / Applicable parts	Silicone rubber	Viton (FPM)	Chloroprene rubber (CR)	Nitrile rubber (NBR)	Steel acrylic phthalic acid resin paint	POM	Phenol	Polypropylene (PP)	Vinyl chloride (hard)	Polyacetal (PA)
	Glass connecting packing Liquid sending tube Diaphragm cap for the differential pressure meter Bond to glass	O-ring Solenoid valve seal Liquid sending tube Hoses Packing for installing the oxygen concentration measurement sensor	Filter bottom packing Oxygen concentration meter (pump valve, diaphragm)	Nozzle packing Blower oil seal Pressure meter packing Needle valve packing	Blower air contact part	Needle valve BOX for installing the oxygen concentration measuring sensor	Bonding of aluminum honeycomb Hoses	Compressor cover		Tube coupler
Xylene	×	○	×	△～×	△	○	○	△	×	○
Toluene	×	○	×	△～×	△	○	○	△	×	○
Isopropyl alcohol	○	○	○	○	○	△	○	○	○	○
Benzene	△	○	×	×	△	△	○	△	×	○
Ethanol	○	○	○	○	○	○	○	○	○	○
Acetic ether	△	○	△	△～×	△	○	○	△	×	◎
Hexane	×	○	○	○	△	○	○	△	○	◎
Methanol	○	×	○	○	○	△	△	○	○	△
Chloroform	×	○	×	×	△	×	○	×	×	×
Acetone	○～△	×	○～△	△～×	△	△	○	△	×	○～△
Methylene chloride	×	○	×	×	△	×	○	△	×	×
Ethylene chloride	○～△	○	×	×	△	×	◎	○	×	×

Piping system diagram



5. Handling precautions

List of materials

No.	Part name		Material	No.	Part name	Material
①	Condenser		SUS304	A	O-ring	Viton Adhesive: Silicone
②	Sensor		Stainless steel			
③	Ball valve		Stainless steel		※All O-rings are made of Viton.	
④	Clamp		POM	B	Packing	Silicone
⑤	Collecting flask		Glass	C	Hose	Teflon
⑥	Filter	Filter element	Filtering material : Glass fiber Adhesion: Epoxy Packing: chloroprene	D	Spray nozzle	Label: Hycar (NBR) Teflon
		Filter case	SUS304 Packing: silicone	E	Hose	Teflon
⑦	Differential pressure meter		ABS resin Diaphragm: Silicone Connecting hose: Viton	F	Aluminum honeycomb	Adhesive: phenol
⑧	Needle valve		Label assembly: Teflon Viton	G	Cap	Silicone
⑨	Flow meter (for introducing N_2)		Air contact assembly: Viton、Teflon Connecting hose : Teflon	H	Flowmeter	
⑩	Compressor		Cover case: PP Connecting hose : Teflon	I	Needle valve	Label assembly: Teflon Viton
⑪	Solenoid valve (for N_2 control)		Label assembly: Teflon	J	3-way valve (for switching connection of GAS411C)	Label assembly: Teflon
⑫	Flow meter (for measuring O_2 concentration)		Air contact assembly: Viton, Teflon Connecting hose: Viton	K	Solenoid valve (for pulse jet)	Label assembly: Teflon
⑬	Filter		Connecting hose: Viton	L	Packing	Silicone
⑭	Pump		Valve: Chloroprene Connecting hose: Viton			
⑮	O_2 sensor		Case: POM Packing: Viton Connecting hose: Viton			
⑯	Solenoid valve (for exhaust)		Label assembly: Teflon Connecting hose : Teflon			
⑰	Blower		Oil seal: NBR			
⑱	Solenoid valve (for introducing N_2)		Label assembly : Fluoro-rubber			
⑲	Solenoid valve (for suction)		Label assembly: Fluoro rubber			

5. Handling Precautions

Precautions during operation

(1) Be sure to connect the earth wire when connecting power supply.
(2) Securely connect with ADL312SC.
(3) Using the blower at a low air amount may cause a malfunction. Set it at least 0.2m^3/min or more.
(4) Flow meter for the oxygen sensor (small) and a flow meter for introducing N2 (large) are located inside the left side door. Adjust the flow meter for the oxygen sensor to 0.2L/min at AIR IN during preparations and adjust the flow meter for introducing N_2 to 35～40L/min when performing N2 IN.
(5) According to the connection with the spray dryer, the blower of spray dryer is not used. Please set the air amount on GAS411C.
(6) Make sure that the glass chamber is fixed at the specified position without any play.
Check the connecting assembly when oxygen concentration will not decrease properly or its increase speed has risen.
When a defect at a connection of pipes or at a packing is suspected, repair or replace the relevant part.
(7) The outlet temperature should not exceed 140℃, because the material of the suction/exhaust hose, material of the filter and the performance of the blower may be deteriorated..
(8) Check the glass chambers are fixed to the specified position with no gap, and then turn on the switches of blower and heater.
(9) The unit is not explosion proof. You cannot use this unit in an atmosphere where a flammable gas exists or at a place where a flammable gas may be produced.
(10) If there is a gap between the product collecting container and the bracket at lower of the cyclone, the dried powder may be accumulated at the lower of the cyclone without falling into the product container. Therefore, pay special attention when installing product container.
(11) When the heater is ON, do supply the air to the heater part for at least 0.1 ~ 0.2m^3/min.
(12) If the sample is not fed from the feeding pump, the following causes may be considered; the sample tube is crushed at the roller of the pump, the inner wall of the tube is adhered tightly without restoration, or the inner of the nozzle is blocked. Remove the cause, and reset to the normal status.
(13) Do not perform unattended operation during activating the unit. Since the unit is in idling status and the nozzle is blocked of after the operation using sample, the temperature around outlet is increased and the remaining sample is flown from the sample tube disconnected from the unit, and these failures may cause the indeterminism accident.
(14) There are to types of specimen tubes, those made of silicone and those made of Viton. Take care they might be corroded, swell and break with some solvents during operation.
(15) When the high temperature is set to the temperature around inlet for the operation, supplying too excessive airflow of the blower to the unit may not reach the temperature to the setting one caused by not keeping balance with the heater capacity. To resolve this error, turn down the airflow of the blower, increase the setting temperature, and operate this unit. To avoid a malfunction of the blower, set the air amount below the red zone on the dial scale. When you operate the unit at a higher set temperature, the setting and the actual inlet temperature will not match.

Moreover, the heater will automatically stop when the inlet temperature exceeds 260℃ (320℃ for DL411C) and the outlet temperature exceeds 140℃.

5. Handling Precaution

Caution during operation

(16) If this unit is not operated, turn "OFF" the earth leakage breaker on the back of the unit.

(17) The cyclone may charge easily with static electricity depending on the specific specimen used, or operating environment or conditions. Implement countermeasures against static electricity such as attaching included earth clips at three positions on the clamp at the connection of the cyclone or attaching an antistatic brush to the body of the cyclone.

(18) Depending on the sample to be processed, the static electricity may be occurred at cyclone. Therefore, remove the static electricity with an appropriate method. It is efficient that the wire is wound to the glass portion for grounding, but it is more convenient to use the static electricity remover by setting against the cyclone vertically.

(19) The filter for the oxygen sensor is consumable. Please replace it at least once every six months. The filter is inside the left door of the equipment.

6. Maintenance Method

Daily Inspection and Maintenance

⚠ Warning

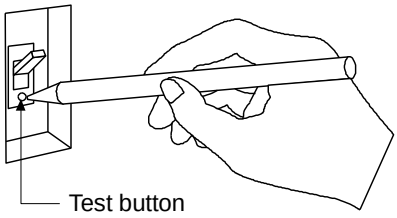
- Disconnect the power cable from the power source when doing an inspection or maintenance unless needed.
- Perform the daily inspection and maintenance after returning the temperature of this unit to the normal one.
- Do not disassemble this unit.

⚠ Caution

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

Monthly maintenance

- Check the earth leakage breaker function.
  - Connect the power cord.
  - 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.



6. Maintenance Method

Daily Inspection and Maintenance

⚠ Caution

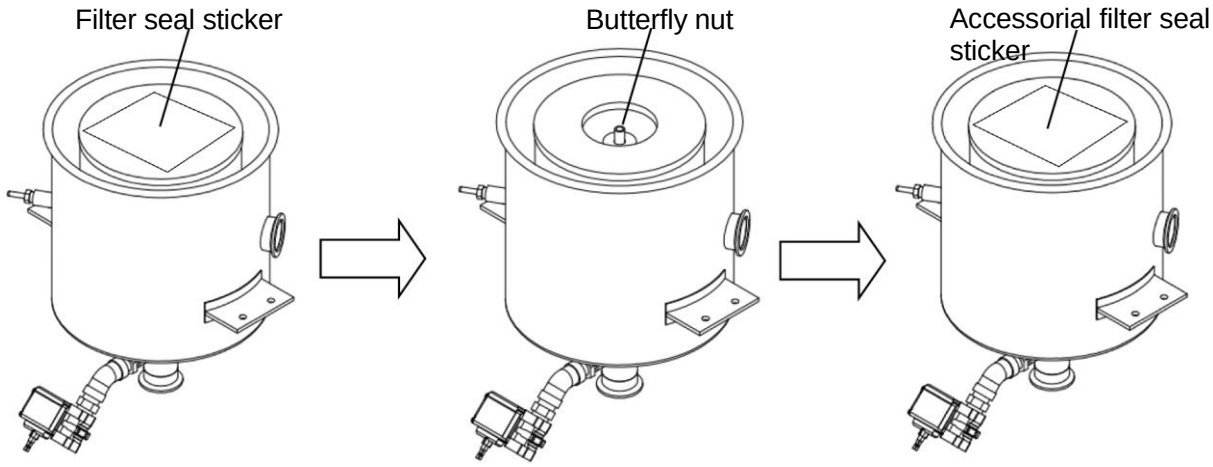
Filter cleaning

- Filter element

  The clogging standard of filter mesh is that the indication on the filter differential pressure gauge is about twice of ordinary indication.

  When the filter is clogged, open the left side door of the unit, open the filter case cover, tear off the filter seal sticker, and then loosen and remove the butterfly nut that fix the filter. When assembling, please paste the accessorial filter seal sticker in the last step, after pasting, the concave of filter will be completely hidden.

  To remove clogging of filter mesh, beat lightly to remove dusts off. (The filter cannot be washed by water.) Replace with a new one if clogging occurs too often after cleaning.



- Filter case

  Remove the filter element and remove dusts attached inside the filter case or on the bottom by suctioning with an electric cleaner or by wiping out with a cloth. During this work, take care so that dusts will not fall on the pipe port on the bottom.

- Refrigerator filter

  There is a filter for the freezer capacitor at the lower right position of the front of the unit. The filter cover is held with magnets. Lightly pull it toward you by hand to remove it and then clean the filter. To clean, gently wash it with water or remove dusts using a cleaner. When capacitor fins at the deep back of the filter are clogged with dusts, remove them with a cleaner.

- Filter (for oxygen)

  Open the door at the left side of the unit and remove the filter fixed to the front pole.

  You can remove the filter holding screws by hand. (See P.9 of the operation manual.)

  Rough replacement interval of the filter shall be about six months.

Supply oil to the blower

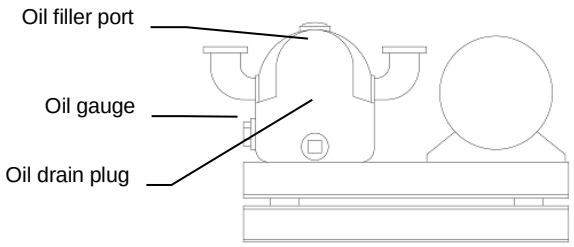
Exchange lubrication oil after 500 hours of operation (about 20 days) of initial operation after installation and each of about 2000 hours of operation (about three months) thereafter.

① Remove the blind plates on the right side plate and at the lower right of the rear side.
② Stop the blower, remove the oil drain plug, and allow all old oil to discharge.
③ Replace the plug, and fill new lubrication oil to the line of the oil gauge taking care dusts will not enter at the upper oil filler port. (Approx.0.3L)

Lubrication oil brands

Appropriate oil is additional turbine oil No.3 (#180) of JIS K2213 or equivalent. Typical brands are as follows.

	Mobil	Esso	Idemitsu	Mitsubishi	Nisseki	Showa Shell	Kyoseki	Cosmo
No. 3	DTE oil heavy medium	Teresso 68	Daphne turbine oil 68	Diamond turbine oil 68	FBK turbine 68	Turbo oil T68 J-H oil68	Kyoseki RIX turbine 68	Cosmo turbine super 68



7. Long storage and disposal

When not using this unit for long term / When disposing

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

Matters to consider when disposing of the unit

Environmental protection should be considered

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

Component Name	Material
Parts of Main Unit	
Exterior	Bonderizing steel plate baked with melamine resin coating, stainless steel
Insulating material	PE foam board, ceramic fiber cotton
Condenser (evaporator) Filter case Pipes and joints	Stainless steel
Label	Polyethylene (PET) resin film
Hose	Silicon rubber, Teflon, Viton
Electrical Parts	
Refrigerator	Stainless steel, iron, copper, aluminum, etc.
Compressor	Iron, PP, etc.
Circuit boards	Composites with board, condenser, resister and transformer
Power cord & wiring materials and others	Synthetic rubber, resins
Sensor	Stainless steel and others

8. When a trouble occurs

Safety unit and error indications

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

[Error indication]

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

Display	Reasons	Solutions
PLC analog module failure	① The wire connection of the PLC analog module is loose ② The PLC analog module is damaged	① Power off and restart ② If it cannot reset after power off and restart, please contact our service department or agent.
Temperature transmitter disconnection	① The wire connection of inlet temperature transmitter is loose ② The inlet temperature transmitter is damaged	① Power off and restart ② If it cannot reset after power off and restart, please contact our service department or agent.
Temperature sensor disconnection	① The wire connection of inlet temperature sensor is loose ② The inlet temperature sensor is damaged	① Power off and restart ② If it cannot reset after power off and restart, please contact our service department or agent.
Roots blower alarm	① The current of Roots blower is too large ② The Roots blower is damaged	① Please set the blower power to 80% and restart after power off (the current is large when the blower starts at low speed). ② If it cannot reset after power off and restart, please contact our service department or agent.
Compressor overload	① The air inlet and outlet of compressor are blocked ② The condensing temperature is maintained at a relatively high temperature for a long time. ③ The compressor is damaged	① Clean the air inlet and outlet ② Reduce the liquid sending amount or reduce the air speed ③ If it cannot reset, please contact our service department or agent.
Flammable gas alarm	① A flammable gas leakage is detected ② The flammable gas detector is damaged	① Immediately stop operation, power off, and ventilate the experimental area. ② If it cannot reset, please contact our service department or agent.

8. When a trouble occurs

Safety unit and error indications

Display	Reasons	Solutions
Evaporation temperature is abnormal	① The condensing temperature exceeds 40℃ ② The temperature sensor is damaged	① Reduce temperature, air speed and liquid sending amount ② If the evaporator cannot be reset after the temperature is reduced, please contact our service department or agent.
Oxygen concentration meter is abnormal	① The oxygen concentration is below 0% or above 25% ② The service life of oxygen concentration probe is exhausted	① Restart after power off ② If it cannot reset, please contact our service department or agent.
Oxygen concentration rises abnormally during operation	① N_2 is exhausted ② There are gaps between glassware and pipes ③ Remove the collecting flask without turning off the hand valve of collecting flask ④ The product collecting container is removed	① Replace with a new gas source ② Power off and reconnect the glassware and pipes ③ Please turn off the valve before removing the collecting flask ④ It is strictly prohibited to collect samples during operation ※ If the spray dryer is used separately, the continuous sample recovery operation can be performed, but once GAS411C is used, such operation must be prohibited, because once the air is mixed into the pipeline, it may cause explosion.

8. In the Event of Failure…

Trouble Shooting

Symptoms	Possible causes	Countermeasures
The POWER does not turn ON	● ELB is turned OFF ● Malfunction of the power supply ● The power cord is disconnected ● Malfunction of power switch	● Turn the ELB ON ● Check the power supply circuit ● Replace the power cord ● Replace the power switch
Although GAS is connected, the operation interface of touch screen does not switch	● Defective wires connection ● Defective wires	● Connect correctly as per the instruction manual ● Replace the wires
Blower does not activate.	● Incorrect connecting of the connector of blower ● Lubricating oil level is low ● Breaking of blower input cord ● Blower switch failure ● Blower or inverter failure ● Blower circuit failure and wiring failure	● Connect correctly. ● Exchange oil periodically ● Replace the cord. ● Replace the touch screen, PLC or temperature controller. ● Replace the blower or inverter ● Maintain or replace the part
The refrigerator does not operate.	● The delay timer is in operation ● Disconnection of the heater ● Touch screen or PLC is defective ● Refrigerator circuit and wiring are defective	● Wait for 5 minutes and check whether the refrigerator operates or not ● Replace the heater ● Replace the touch screen or PLC ● Repair the defective parts or replace the temperature controller
Spray pressure will not increase.	● Dial is set at 0 ● Touch screen or PLC is defective ● Imperfect connection of the hose ● Compressor is defective ● Defective solenoid valve ● Compressor circuit or wiring is defective	● Adjust the dial ● Replace the touch screen or PLC ● Repair or replace the defective points ● Replace ● Replace ● Repair the defective point
Oxygen concentration will not decrease.	● N2 supply source is defective ● Flow meter for introducing N2 is clogged ● Imperfect connection of the hose ● Defective solenoid valve ● Touch screen or PLC is defective	● Adjust appropriately ● Replace the flow meter ● Repair or replace the defective points ● Replace the solenoid valve ● Replace the touch screen or PLC
The value of oxygen concentration monitor cannot go beyond 18%	● High altitude, low oxygen content ● Flowmeter of oxygen sensor is blocked ● Pump failure ● Filter degraded or blocking ● Oxygen sensor failure ● Oxygen sensor board failure	● Use it at proper altitude or use default oxygen concentration ● Replace the flowmeter ● Replace ● Replace the filter ● Replace ● Replace
The value of oxygen concentration monitor does not change	● Flowmeter of oxygen sensor is blocked ● Pump failure ● Filter degraded or blocking ● Oxygen sensor failure ● Oxygen sensor board failure	● Replace the flowmeter ● Replace ● Replace the filter ● Replace ● Replace

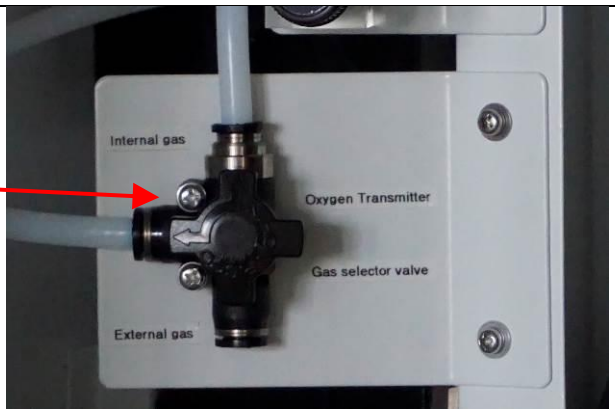
8. In the Event of Failure…

Trouble Shooting

Symptoms	Possible causes	Countermeasures
The value of oxygen concentration monitor cannot recover beyond 18% after operation	● Influenced by active carbon filter, the internal air oxygen concentration cannot recover to atmosphere oxygen concentration ● Flowmeter of oxygen sensor is blocked ● Pump failure ● Filter degraded or blocking ● Oxygen sensor failure ● Oxygen sensor board failure	● Use gas pipe switching valve, connect the test port of oxygen concentration meter to atmosphere directly. See pictures on this page. ● Replace the flowmeter ● Replace ● Replace the filter ● Replace ● Replace
Temperature controller failure	● Defective display function ● Sensor failure	● Maintain the defective points or replace the PLC ● Replace the sensor
Failure of blower power regulation	● Adjusting circuit failure and wiring failure ● Insufficient heater capacity due to excessive dry air flow ● Invalid blower power setting for spray dryer or GAS411C	● Maintain the defective points or replace the PLC ● No error. For operating this unit with high temperature, decrease the flow rate of the dry air or increase the setting value ● When the blower power setting of the spray dryer is invalid, try to use the blower power setting of GAS411C. The converse is equally valid.

◆In case if the error other than listed above occurr, please immediately cut off the power switch of the unit body, unplug the power cord, and contact the sales agent, our company's business office or customer service center.

※ When the value of oxygen concentration monitor cannot recover beyond 18% after operation, it's suspected that it may be influenced by active carbon filter adsorption, operate as per the following pictures. Adjust the gas pipe switching valve to connect to atmosphere (External gas), wait for several minutes, and check if the oxygen concentration display recovers beyond 18%. After confirmation, make reverse operation to recover the working state (Internal gas).

Open the access door at left side	Turn the gas pipe switching valve from ⇧ to ⇩
	

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
- Description of trouble

(as in detail as possible)

See the warranty card or the nameplate on the unit.
See the section “3.Names of parts and their function” on page 8.

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 send it to our customer service center by Facsimile (03-3231-6523). 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.

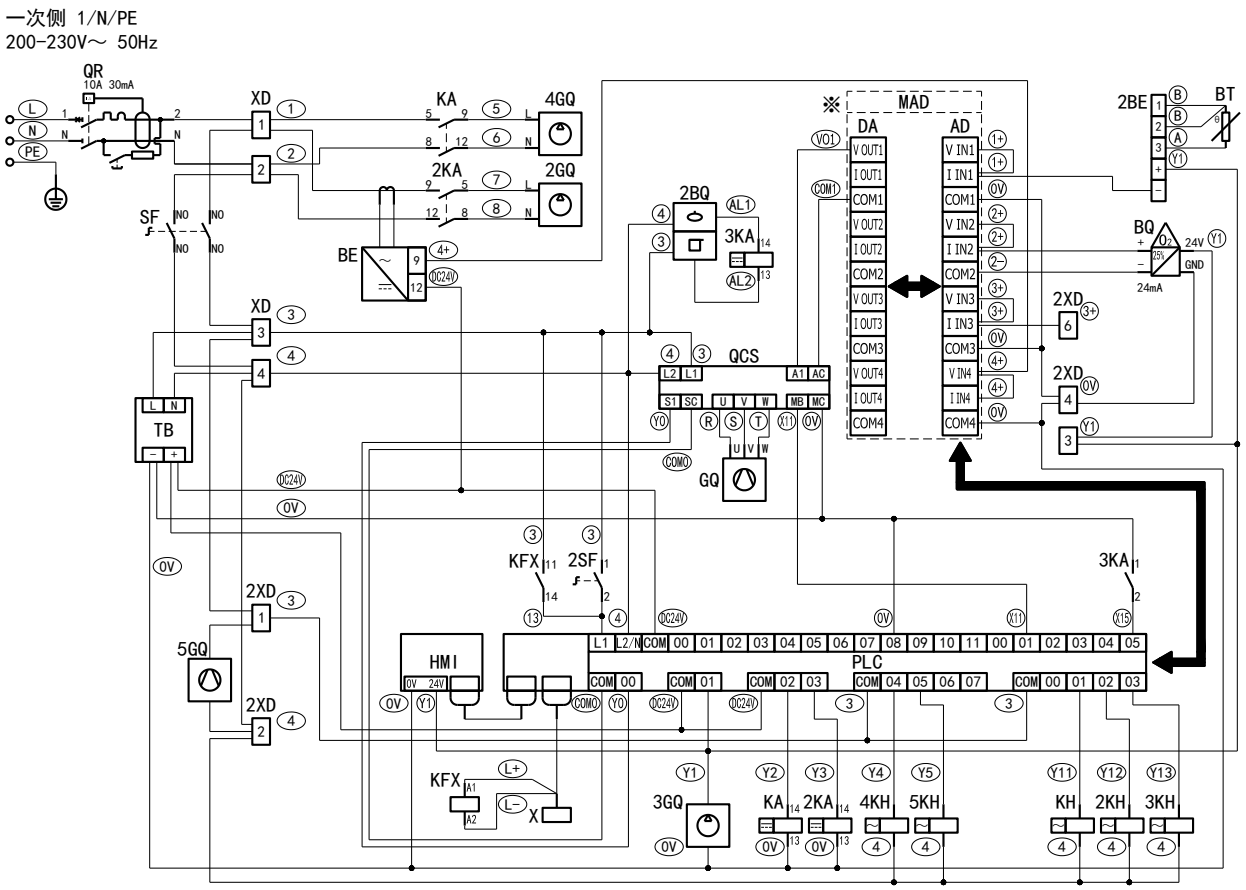
10. Specifications

Specification of the main unit

Model	GAS411C
System	Closed circulation type
Circulating gas	N_2
Circulating amount	0.12～0.65 m^3/min
Solvent recovery system	Condenser (evaporator) + refrigerator
Fine dust collecting system	Cartridge filter
Circulating blower	Roots blower
Refrigerator	Air cooling compressor R404A 800g±10g
Solvent collecting container	2L flask
Indicators	Evaporation temperature, oxygen concentration
Meters	Filter differential pressure meter, flow meters (for introducing N_2, for the oxygen sensor)
Filter	For protecting the O_2 sensor
Pump	For oxygen concentration measuring and circulation
Compressor	For pushing the spray nozzle
Safety device	Oxygen concentration meter, flammable gas alarm, spray nozzle detection switch, overheat prevention device
Power supply	Singal phase 200-230V～ 50Hz 5-6A
External dimensions (mm)※ (W×D×H)	710×950×1450
Weight	Approx. 130kg
Accessories	・ Sample hose Silicone: I.D. 2mm×O.D. 4mm×1m 2 Viton: I.D. 2mm×O.D. 4mm×1m 2 ・ Corrugated pipe 1300mm 1 ・ Corrugated pipe 1000mm 1 ・ Clamp 4 ・ O-ring 4 ・ Duct hose 1 ・ Cable ties 1 ・ Hose 5m 1 ・ Hose 1.5m 1 ・ Fluoro-rubber hose 1.5m 1 ・ Cable ties 6 ・ Interface wires 2 ・ 2L collecting flask 1 ・ Flask clamp 1 ・ Connecting pipe 1 ・ Flat head screws 3 ・ Warranty card 1 ・ Instruction manual 1 ・ Filter seal sticker 2

※ External dimensions do not include protruding parts.

11. Wiring diagram



Symbol	Part Name	Symbol	Part Name
QR	Earth leakage breaker (30mA)	4GQ	Linear reciprocating air compressor
XD	Terminal block (switchboard)	5GQ	Cooling fan
2XD	Terminal block (back of unit body)	BQ	Oxygen concentration meter
SF	Panel power switch	2BQ	Flammable gas alarm
2SF	Debug switch	BT	Temperature sensor
TB	Switching power	PLC	Programmable logic controller
KFX	Solid state relay (remote start)	HMI	Touch screen
KA	DC relay (reciprocating air compressor)	MAD	Analog quantity control module
2KA	DC relay (refrigeration compressor)	X	Network connector for spray dryer on-line
QCS	Roots blower controller (converter)	KH	AIR-IN solenoid valve
BE	Compressor current transmitter	2KH	Large flow N2 solenoid valve
2BE	Temperature transmitter	3KH	N2 normal open solenoid valve (small flow)
GQ	Roots blower	4KH	Spray gas source switching solenoid valve
2GQ	Compressor unit	5KH	Exhaust solenoid valve
3GQ	Vacuum pump for oxygen concentration detection		

12. Replacement parts table

	Part name	Specification	Manufacturer	Code №
※	Fliter	GAS41-40040 for refrigerator	YSC	B040300003
	Flammable gas detector	TJ-PLT119-EX	YSJ	A020299002
	ELB	BV-DN IP+N 10A 30mA	YSJ	A010410007
	Axial flow fan	SJ1238HA2BAL for thermal discharge	YSJ	A080104012
	Air cooled condensing unit	CAJ2428ZBR	YSJ	A030101001
	Temperature sensor	GAS410C_03_01-02	YSJ	H100101028
	Roots blower	IRS-32A	YSJ	B040201001
	Miniature vacuum pump	D35S-41J-0000 for oxygen sensor	YSJ	A041700055
※	Activated carbon filter set	GAS41-40570 for oxygen sensor	YSC	B081601001
	Flow meter for introducing N2	LZB-07A10MT 5-50L/min	YSJ	A040409005
	Flow meter for oxygen sensor	LZM-6T 0.1-1.5L/min	YSJ	A040499023
	Solenoid valve	CKD AB41-04-8-M-AC100V for air suction	YSJ	A040403015
	Solenoid valve	CKD AB41-03-7-F-AC100V for air exhaust	YSJ	A040403014
	Solenoid valve	CKD AB31-01-2-M-AC100V for introducing N2	YSJ	A040403013
	Solenoid valve	CKD AB41-02-5-F-AC100V for controlling N2	YSJ	A040403004
	Linear compressor	AC0910 AC230V	YSC	A040201007
	Differential pressure meter	DG87-641-1C 0～1kPa	YSC	B042300001
※	Filter element	RE-205-90-FB 0.3μ	YSC	B040300001
※	Fluoro rubber hose	φ4×φ6 specify length	YSC	B080807049
※	Teflon hose	φ6×φ8 specify length	YSJ	A080807007
※	Teflon hose	φ10×φ12 specify length	YSJ	A080807006
	Corrugated pipe	40KF L=160	YSJ	A041500019
	Corrugated pipe	40KF L=1500	YSJ	A041500006
	Corrugated pipe	40KF L=1000	YSJ	A041500003
	Corrugated pipe	40KF L=500	YSJ	A041500008
	Corrugated pipe	40KF L=1300 for external connection	YSJ	A041500004
	Corrugated pipe	40KF L=1000 for external connection	YSJ	A041500003
	Clamp	40KF	YSJ	A041500078
※	Center ring	40KF	YSJ	A041500077
	Duct hose	φ25×2m	YSC	B080807030
※	Hose	Φ6×Φ11×5m	YSC	B080807050

12. Replacement parts table

	Part name	Specification	Manufacturer	Code №
	Liquid sending hose	Φ2×φ4(PTFE)	YSJ	B080913005
※	Liquid sending hose	Φ2×φ4×1m	YSJ	A020300067
	PLC	CP2E-N30DR-A	YSJ	A020300069
	Analog input/output unit	CP1W-MAD44	YSJ	A020399053
	Touch screen	NB7W-TW11B	YSJ	A020400014
	CAT6 gigabit network cable	2m	YSJ	A120102034
	CAT6 gigabit network cable	1m	YSJ	A120102032
	CAT6 gigabit network cable	0.5m	YSJ	A120102031
	Switching power	LRS-100-24	YSJ	A010801045
	Intelligent temperature transmitter	NHR-213	YSJ	A010599023
	Frequency converter	3G3JZ-AB007	YSJ	A020501001
	Stationary oxygen detector	HT-FX100	YSJ	A020799033
	DC relay	HF13F/0242Z1D	YSJ	A011001011
※	Filter seal sticker	130*130*0.5 (thickness)	YSJ	A089900040

Note: Parts marked with ※ are consumable parts.

13. List of Dangerous Substances

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

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.

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

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
Solvent Recovery Unit
GAS411C
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