

GLOVE BOX OPERATION MANUAL

Declaration

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Glove boxes may be updated by software or hardware upgrade, all of which will be included in the new version of the instruction manual without notice.

We strive for comprehensive and simple, from which you can get knowledge of the use of products, precautions, technical indicators, and operation methods.

We have tried our best to avoid people's mistakes to ensure that this maintenance procedure is correct and reliable, but not fully guaranteed before and after printing, please considedr it.

Before the new instructions were published, the use of the glove box should be based on this, and other materials are only referenced. If you find problems in use, please feedback in time to study modifications.

Before using, please confirm the main person in charge. If the person in charge off, the person in charge is responsible for guiding the next person in charge to use the equipment correctly. After confirming that the new people can use and maintain equipment correctly after handover.

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1 PRESENCE

1.1 Welcome

Thank you for purchasing the AOT-VGB-2 glove box system of XIAMEN AOT ELEC Co., Ltd.. If you are using this product for the first time, please read this instruction manual carefully before installing, please read this manual, "Danger", "Warning", "Note", to ensure you and the surrounding staff Safety and equipment security.

1.2 Company Profile

AOT is one of the manufacturers of lab equipment in Asia, and is also a high-tech enterprise and high-tech enterprise in Xiamen City, China.

• Product

AOTELEC provides a complete set of glove boxes to domestic and foreign customers, including: inert gas protective glove boxess, anaerobic glove boxes, vacuum glove boxes, biochemical experimental glove boxes, vacuum coating machines, OLED R & D equipment, lithium battery glove boxes, special lamp production glove boxes, laser welding glove boxes, solvent purification system, gas purification system, soot adsorption system, vacuum heating system, etc.

• Quality

A O T strictly basis in accordance with the ISO9001 quality control system, and strictly control the products in its materials, processing, machine, and shipment, ensuring the performance and quality of products.

• Service

AOTELEC specially establishes a marketing management center, setting up eight offices across China, and setup more than ten branches overseas, resident technical service personnel, providing customers with comprehensive pre-sale, sale, after-sales support and services .

2 OVERVIEW OF PRODUCTS

2.1 Review

The glove box is a laboratory apparatus that charges the high purity inert gas into the chamber and circulates the laboratory equipment of the active substance in which it is filtered out. Also known as a vacuum glove box, an inert gas protection system, etc. It is a fully enclosed system that can effectively remove moisture, oxygen, and organic gases, the main function is the correctness of the organic gas. Widely used in anhydrous, aerobic, dust-free ultrapureal environment.

2.2 Product Features

Simple: humanized design operation window, intelligent HMI man-machine interface, easy to operate;

Safety: High-sealing property protects the safety of personal and sample;

Efficient: integrated design to improve equipment efficiency;

Energy Saving: Variable Frequency Adjustment Control.

2.3 Main uses and scope of application

- 1. MOCVD technology in the semiconductor industry
- 2. special lamp (HID) development and production
- 3. microelectronics, laser and plasma soldering
- 4. OLED / PLED development and production
- 5. lithium ion battery development and production
- 6. inorganic / organic chemistry research
- 7. metal halide / metal powder / ceramic powder research
- 8. nanomaterial research
- 9. catalyst research
- 10. YAG laser welding
- 11. food microbiological test
- 12. Medical and health clinical specimen test

2.4 Using environmental conditions

Room temperature: minimum + 15 °C to maximum + 30 °C (install air conditioner if necessary);

Ground: Sturdy, flat;

The distance from the non-working surface from the wall or other objects is 600 mm;

The work surface area of the device needs to reserve 800mm width to ensure sufficient operating space.

2.5 Influence on environmental and energy

Danger:

The glove box uses gas as a high-purity inert gas such as argon, nitrogen, helium; people are in high purity inert gas, which will affect people's health. Before use, make sure the device and gas source sealing. Please be careful when you operate your device.

AOTELEC Company reminds you to pay attention to the following:

- 1. Put the ventilation pipe to the outdoor or ventilated pipeline;
- 2. Vacuum pump rustic ports are in the outdoor or ventilated pipeline;
- 3. The room is in a dry and ventilated state;
- 4. Take care of gas usage and avoid leakage.

2.6 Product Structure and Working Principles

2.6.1 Overall structure and its working principle

AOTELEC glove box cycle is a closed cycle. Under the driving of the fan, the gas in the chamber is passed through the purification column in the purification system, and then flows back to the chamber. After a long cycle, the trace moisture and oxygen is gradually absorbed by purified

column.



2.6.2 Main components

The glove box system mainly consists of the following parts:

- a) Main chamber
- b) Purification system
- c) Solvent system
- d) Main antechamber
- e) Mini antechamber
- f) Control system

3 SAFETY INSTRUCTIONS AND PRECAUTIONS

3.1 Review

This chapter mainly introduces the relevant safety operations of the glove box system and preventive measures to avoid unnecessary injuries.

Warning:

Any personnel responsible for the operation, maintenance and service of the system for transportation, storage, installation, and commissioning must be familiar with all the contents of this manual. Ensure that the equipment operates in a safe environment. If you need help, you can contact the **AOTELEC** after-sales department.

3.2 Safety notice

Please ensure that all pipeline connections are accurate and firm, and there is no safety hazard such as leakage of the working gas source. Observe the gas usage regularly and keep a record. If there is any abnormality, timely leak detection and troubleshooting. The initial installation of the equipment must be done by **AOTELEC** service personnel.

3.3 Safety protection

Please properly deal with chemicals, corrosives and solvents.

Note:

The standard system is not suitable for handling toxic or radioactive materials. If processing is required, special components and methods are required to connect the system, and safety precautions must be observed. This manual does not elaborate on this. If necessary, **AOTELEC** after-sales service department will provide relevant information.

If the sample is flammable, explosive, and toxic, some guidelines for chemical materials are provided below (for reference only)

a) Comply with relevant safety regulations and material safety handling principles and suggestions provided by other suppliers;

b) Wear appropriate protective safety masks and gloves to handle chemicals, corrosives or solvents;

c) All chemical substances in containers and containers containing waste products shall be affixed with appropriate labels and warning signs;

d) Ensure that there are ventilation facilities indoors;

e) Have proper respiratory equipment protection to prevent inhalation of harmful gases to avoid the danger of suffocation;

f) Do not ingest food or drink when handling chemicals to avoid the risk of poisoning.

3.4 Fire protection

- 1) Keep away from fire;
- 2) Smoking is prohibited in the laboratory;
- 3) Equipped with fire fighting equipment.

3.5 Electrical safety

The equipment is operated under AC 220V 50Hz power supply requirements. Please ensure the safety and stability of the power supply. You should try to be cautious or avoid direct or indirect contact with the wire connection part to avoid possible electric shock events;

Note:

The equipment needs to be grounded effectively, and it is prohibited to cut off the grounding wire device.

3.6 Protective measures for equipment

a) The normal condition of the glove box requires a 7×24h cycle operation;

- b) Avoid frequent start and stop of circulating fans and vacuum pumps;
- c) The circulation fan should stop the circulation immediately when there is noise in the circulation fan, and check the reason;
- d) The water and oxygen content remains high, it is recommended to shut down for maintenance;
- e) Use it sparingly, and don't knock it hard.

3.7 Use common sense

It is generally not recommended for two or more than two to operate the system at the same time. There may be some improper operations or lack of communication with each other, leaving potential safety hazards. If two or more people operate at the same time, please confirm each person's respective tasks and not affect each other.

3.8 Safe handling of emergencies

Suggestions for emergency handling in case of emergencies:

- a) Immediately turn off the main power supply and unplug the plug;
- b) Close the main valve of the working air source;
- c) Handle the experimental samples in the glove box carefully;
- d) Handle the materials according to the principle of safe handling of materials, or contact the corresponding emergency personnel in the area;
- e) Before restarting, a comprehensive inspection must be carried out to ensure safety, and contact AOTELEC after-sales service department to guide the service.

4 INSTALLATION

4.1 Installation requirements

The removal of equipment needs to be carried out under the guidance of AOTELEC

engineers; Room temperature: minimum $+15^{\circ}$ C to maximum $+30^{\circ}$ C (please install air

conditioning if Ground surface: firm and flat;

The minimum distance between the non-working surface of the equipment and the wall or other objects is 600mm;

The working surface area of the equipment needs to reserve at least 800mm width to ensure that there is enough operating space.

Note:

The selected use environment should have enough space to place the glove box, and the workplace must have good ventilation, especially when quickly cleaning or opening an already operating glove box;

Before disassembling and repairing the glove box, make sure that the gas in the box is standard air.

4.2 Electrical connection

Power requirements: AC220V $\pm 10\%$, 50HZ $\pm 2\%$

Total power: 1.5KW (standard single-station glove box equipment)

5 OPERATION AND USE

5.1 Review

AOTELEC standard glove box system is not suitable for handling toxic or radioactive materials. If processing is required, special components and methods should be selected to connect the system, and safety precautions must be observed. This manual does not elaborate on this. If required, **AOTELEC**'s after-sales service department will provide relevant information.

Note: Incorrect system operation may cause threats. The connection of the system should be done by professionals.

5.2 Preparation and inspection before use

- Prepare sufficient high-purity working gas (please refer to Table 1 for gas specifications)
- Prepare sufficient regeneration gas (refer to Table 2 for gas specifications)
- Two decompression meters (for working gas and regeneration gas respectively)

Use	Purging chamber, balance pressure, working gas			
Gas type	Nitrogen, Argon or Helium			
Purity	≥99.999% ; H2O≤5ppm ; O2≤5ppm or better			
Decompression meter range	Main gauge pressure range>15MPa; auxiliary gauge pressure range \leq 1MPa			
Need pressure	0.4-0.6MPa			
Connecting pipe	Material: PU; Outer diameter: \emptyset 10mm; Inner diameter: \emptyset 6.5mm;			

Table 1 Working gas

Use	Reduction purification column H2O absorption and oxygen absorption purification capacity
Gas type	When nitrogen is used as the working gas, use a nitrogen/hydrogen mixed gas (H2 accounts for 5-10%);
	When argon is used as the working gas, use argon/hydrogen mixed gas (H2 accounts for 5-10%);
	When helium is used as the working gas, use helium/hydrogen mixed gas (H2 accounts for 5-10%);
Purity	99.999% $H_{2O} \leq 5ppm$; $O_2 \leq 5ppm$ or better

Need pressure	About 0.02-0.04MPa
Decompres sion meter range	Main gauge pressure range> 10MPa; auxiliary gauge pressure range <0.5MPa
Connecting pipe	Material: PU; Outer diameter:

Table 2 regeneration gas

Note:

Set the pressure correctly as required Too high pressure will destroy the system, and too low pressure will not work.

Danger:

Since the equipment uses inert gas, there is a risk of suffocation. The exhaust gas used for purging and regeneration must be discharged outdoors! If toxic or radioactive materials are used, exhaust gas is prohibited from being discharged indoors and must be treated and discharged. Please strictly observe, the manufacturer is not responsible for this.

5.3 Precautions before operation

The glove box equipment is a sophisticated laboratory equipment. You must read and understand this instruction completely before performing the operation experiment.

All the dangers, warnings and cautions in this manual will cause different degrees of personal injury, please refer to them in detail.

5.4 Operation guidance

This operation guide is only applicable to the operation of this system. The following are installation inspection items:

1. The working gas connection is normal, adjust the decompression gauge 0.4-0.6Mpa;

2. The regeneration gas pipeline is connected properly;

3. The water cooler is connected and the inlet and outlet pipes are connected correctly;

4. The vacuum pump is installed;

5. The exhaust gas of cleaning exhaust and the exhaust gas of vacuum pump have been connected;

6. The voltage is correct and connected;

7. The gloves have been installed and the sealing ring has been properly fixed;

8. Tighten the clamp and screws.

Operation precautions:

• Untrained personnel are not allowed to use the glove box alone;

• It is forbidden to use items that can poison the regenerated catalyst, such as sulfhydryl compounds;

• Do not use volatile solvents that can damage Plexiglas, such as acetone, without permission;

• Before using volatile solvents, contact the person in charge to remove the H2O analyzer;

 \bullet When using volatile solvents, the activated carbon circulation system needs to be opened;

• When using the glove box, do not have long nails, and it is forbidden to wear sharp objects (such as watches, rings, etc.).

5.5 Pressure control system

The glove box is equipped with a high-precision pressure sensor. Please install the pressure sensor correctly before powering on the system.

There is a wire marked with a pressure sensor on the purification system, plug the connector into the pressure sensor of the glove box and tighten it with a screwdriver; the sequence is as shown in the figure:

Connect in sequence



Danger:

If the pressure sensor is not installed and energized, it will cause continuous air supply to the equipment. In severe cases, it will cause the gloves to swell and burst and damage the equipment. Please observe if there is any abnormality after power-on, and immediately turn off the power if there is any abnormality.

5.6 Turn on and turn off

The power switch is located on the right side of the control cabinet; turn it clockwise to turn on the device.

As shown in the figure "0 OFF" and "1 ON".



5.7 Touch screen operation

The touch screen is the control unit of the glove box and also the display unit. The operating information of the equipment can be intuitively understood through the touch screen. The following is the definition of different keys:

Cycle: start/stop cycle purification function;

Vacuum pump: start/stop the vacuum pump;

Lighting: turn on/off the lighting;

Analyzer: control H2O and oxygen analyzer;

Cleaning: configure purging parameters;

Setting: enter the system setting;

Default value: restore the default value set by the system;

Alarm setting: set the H2O and oxygen alarm prompt;

System settings: configure system parameters;

Regeneration: start/stop system regeneration function;

Time setting: set the display time;

Company information: manufacturer information;

Record viewing: query system operation records;

Language: Chinese/English dual language selection.

5.8 Quick cleaning

This purging system is suitable for glove box systems equipped with automatic purging functions.

Conditions: The equipment is installed for the first time, the atmosphere in the chamber is exposed to air, the H2O and oxygen content exceeds the range, and other conditions that damage the atmosphere of the glove box.

Preparation: Pre-configured \geq 3 bottles of 40L steel cylinder gas (standard single-station glove box configuration), the gas is \geq 99.999%.

Purpose: To replace the air or other unqualified gases in the glove box so that the H2O and oxygen content in the chamber is less than 200 ppm.

Steps: Click the "Purge" button on the touch screen to enter the purging setting interface, set the time and pressure in turn, and then confirm to start the purging. The program will automatically run the purging operation, and the purging will automatically stop after the purging time is over.

Note:

The set pressure needs to be positive pressure. It is recommended to use the default value of 5-8mbar. The purging time can be extended or shortened according to the purging effect.

The vacuum pump needs to be turned on during the purging process, otherwise it will not be able to be purged.

5.9 Circle

AOTELEC glove box cycle is a closed cycle. Driven by the fan, the gas in the chamber flows through the purification system and then returns to the chamber. After continuous circulation, the purification column gradually absorbs the trace amount of H2O and oxygen in the chamber, so that the circulation ensures the stability of the system and purifies the gas economically and effectively.

Note:

Use working gas to purge the atmosphere H2O and oxygen in the chamber and start the cycle after the oxygen is less than 200ppm, because too high H2O and oxygen content will destroy the purification system.

Normally, the circulation mode needs to be kept on at all times, so as to better maintain the H2O and oxygen in the chamber at <1ppm.

Precautions:

✓ The working gas has been connected to meet the required pressure of 0.4-0.6MPa for circulation;

- ✓ All antechambers have been closed;
- ✓ The glove box has been purged;
- The purification system has been regenerated;
- ✓ No leakage in the glove box;
- ✓ The H2O and oxygen content in the glove box < 200 ppm.

Etel	ux	[GP20]控	制和呈	示系统	<u> </u>	Gł	31	Red Fan stop state
GR1 .	水含量< 氧含量<	000.0	ppm ppm			GE	31	Red Fan start state
	VPC							_
新马	5 真空脈	照明 5	计标仪	清武	说定		_>	Cycle

The following provides you with several troubleshooting solutions that cause the cycle to fail to start:

a) The working gas supply pressure is insufficient, the high vacuum baffle valve is not opened, and the normal working pressure is 0.4-0.6MPa;

b) The power switch of the circulating fan is off;

c) The inverter is in the protection state in case of failure, try to restart it and see if it can be resolved;

d) The magnetic switch on the high vacuum flapper valve does not light up, and there is no feedback signal.

5.10 Regeneration

After the glove box has been running for a period of time, the purification material will become saturated, and the ability to adsorb H2O and oxygen will decrease, resulting in failure to meet the requirements. At this time, the purification column needs to be regenerated and reduced to restore the adsorption capacity of the purification material.

Conditions met before regeneration:

- ✓ The purification column that needs regeneration has stopped circulating;
- ✓ Turn on the vacuum pump;
- ✓ Confirm whether a password is required;
- ✓ The chamber pressure is set to "default value"
- ✓ The H2O and oxygen content in the chamber < 200ppm

Steps: Click "Set" from the main interface to enter the system setting page, and select the "Regenerate" button

GI1 (GI1 (GI1) (GI	点击		Regeneration is not open (Red)
新年 真空泵 照明 分析仪	精洗 設定		Regeneration is open (Yellow)
telux 系統 上店設定点 000 単世 下店設定点 000 単世 規算設置 系統 単世	2000-00-00-00-00-00-00-00-00-00-00-00-00	再生	Regeneration is not open (Light color)
· · · · · · · · · · · · · · · · · · ·	请我 返回	再生/开	Regeneration is open (Dark color)

Tip: If there is an abnormal situation, click on the "Regeneration / Open" (Dark) button again to appear, select "YES" to close the regeneration;

	1	
YES	80	

Steps	Time	Activity
1	0-2 minutes	Try the ventilation
2	5-285 minutes	Purification column heating
3	180-330 minutes	Connect regeneration gas
4	332-600 minutes	Vacuum purification column
5	660-960 minutes	Add gas to purification column

Table 3 Regeneration Run Time Reference Table

Warning:

The trying ventilation process: Confirm that the decompression meter is in pressure, gas flow cannot be too large, and can be referred to the flow rate of 15-20L / min (the drift is in this range);

An abnormal phenomenon during the regeneration process, please interrupt.

Precautions:

- a) Connect the regenerative exhaust gas to the outdoor, if it is contaminated gas, it must be discharged to the air after processing;
- b) The glove box can not be powered off when regeneration, can not disconnect the working gas;
- c) For single purification column systems, the regeneration and cycling can not be opened at the sametime;
- d) For security, the direct contact purification column is prohibited during regeneration, prevent burns;
- e) Before regenerating, confirm that the gas in the glove box is an oxygen content of <200 ppm.

Danger:

After the regeneration goes half an hour, once regeneration stops unexpectedly. It is forbidden to restart and circle within 6 hours, otherwise the device will be damaged.

After the regeneration is completed, you need to adjust the upper "gas valve" of the vacuum pump. Keep the knob to "1" or "2" for 15-20 minutes. And turn to "0", which is to release the air pump oil.



5.11 Solvent filtration system



① KF40 butterfly valve; ②Feeding port; ③Discharging port

Specific replacement process:

- a) Close the "Cycle" button on the display, and then close the KF40 butterfly valve on the solvent column(1);
- b) Open (2) (feeding port) and (3) (discharging port);
- c) Activated carbon flows out from (3) (discharge port); after cleaning, seal (3) with a clamp;
- d) Pour clean and dry activated carbon from ② (feeding port). After it is full, tighten the clamp;
- e) Click the "Purge" button on the touch screen, enter the purge parameter setting, and set the purge time to 15min, the purge pressure to 8mbar up and 5mbar down, and then click "Start purge", and then immediately open the KF40 butterfly valve(1). (The purpose of this process is to purge the air that enters the column when the activated carbon is filled in the solvent column)

f) After purging, restore the pressure range of the chamber to the normal working pressure range, and click the "Cycle" button on the display screen.

Note: After replacing the activated carbon and purging the solvent column, you must open the ① KF40 butterfly valve before you can click the "Cycle" button on the display.

5.12 Antechamber Operation

The antechmabers are divided into main antechamber and mini antechamber, which is designed to deliver items within the glove box. The standard size of the main antechamber is $\notin 360 \times 600$ mm ($\notin 390 \times 600$ mm), mini antechamber $\notin 150 \times 300$ mm; generally main antechmaber transfer big items, mini antechamber transfers smallitems.

Important:

Remember not to open the inner and outer doors of the antechambers at the same time;

It is very difficult to open the antechamber door in the vacuum state, please be careful when opening the door;

Attempting to open the antechamber door in a vacuum state will damage the mechanical locking structure of the door. When the antechamber is filled with outside air, remember not to open the inner door. If you open it, it will destroy the atmosphere in the chamber and may damage the analytical instrument and the inside material in the chamber;

The mechanical parts and sealing rings should be checked regularly to avoid contamination;

When using inert gas, please follow the relevant national regulations.

5.12.1 Operation interface for vacuuming and replenishing gas in main and mini antechambers

When you need to perform air extraction and replenishment operations for the main and mini antechambers, you need to click the "antechamber" button on the main interface of the touch screen to enter the control interface as shown in the figure below, and perform the specific operations of the corresponding antechamber according to the button name instructions.

SIEMENS	SMART LINE
AOTELEC Vac	cuum Time
Vacuum Time Set/min Time Control Defau	0 ult Time
Cycle Pump Light ch	Ante- amber Purge Return





5.12.2 Transfer articles into the chamber

Precautions:

1. To transfer items into the chamber, pump three times and replenish three times must be performed on the antechamber, otherwise it will destroy the atmosphere in the glove box (vacuum to -1bar is one pumping, and the air supply to 0 bar is one replenish);

- 2. When the delivered items are cotton or paper items, please ensure that the items are dry, and if necessary, please dry them in an oven before putting them in;
- 3. When transferring plastic bags and small items, they must be handled properly to avoid blocking the air intake of the antechamber;
- 4. When the delivery items are bottles or cans, they need to be delivered open to avoid rupture due to excessive pressure difference between the internal and external bottles and cans and the chamber pressure;

5. When the delivery items are bottles, cans, and containers that cannot be opened, please do not pump to -1bar when vacuuming. It is recommended to pump to about -0.5bar, and the corresponding purging times should be increased to 4-5 times.



5.12.3 Remove items from the chamber

1) Make sure that the atmosphere in the antechamber is the same as the atmosphere in the glove box

Precautions:

When transferring plastic bags and small items, they must be handled properly to avoid blocking the air intake of the antechamber.



2) The atmosphere of the antechamber is uncertain

Precautions:

- 1. When you are not sure about the gas atmosphere in the antechamber, you must perform three extractions and three supplements of gas for the antechamber before opening the antechamber door, otherwise it will destroy the atmosphere in the glove box (evacuating to -1bar is one extraction and supplementation) To 0bar is a supplementary gas);
- 2. When transferring plastic bags and small items, they must be handled properly to avoid blocking the air intake of the antechamber.

5.12.4 Outer door of main antechamber



- ① Turn the door handle until the door is loose;
- ② Open the door;
- ③ Pullout the tray slowly.

The steps for closing the door are reversed.

Warning:

It is strictly forbidden to open the antechamber door when the antechamber is in vacuum state! Otherwise it will cause damage to the chamber!

5.12.5 Main antechamber inner door





Warning:

It is strictly forbidden to open the antechamber door when the antechamber is in vacuum state! Otherwise it will cause damage to the chamber!

It is strictly forbidden to open when the atmosphere in the antechamber is uncertain, and the antechamber must be purged first.

5.12.6 Mini antechamber door



Warning:

It is strictly forbidden to open the antechamber door when the antechamber is in vacuum state! Otherwise it will cause damage to the chamber!

5.12.7 Antechamber structure



1. Support frame;

- 2. Pneumatic spring;
- 3. Main antechamber cover;
- 4. Main antechamber shaft;
- 5. Antechamber beam;
- 6. Handle;
- 7. Lead screw;
- 8. Main antechamber hook;
- 9. Pressure gauge;
- 10. Mini antechamber cover;
- 11. Mini antechamber door handle;

5.13 Maintenance and installation of gloves

Please refer to the figure below to install the glove box for the first time



If the gloves are found to be damaged during use, they should be replaced in time. The steps are as follows:

- 1. Push the gloves to be replaced into the chamber;
- 2. Remove the outer O-ring, and then move the inner O-ring to the outer groove of the glove port;
- 3. Roll the gloves to the outer edge of the O-ring, taking care not to let the gloves fall from the glove port;
- 4. Compress the new gloves as much as possible to drive out the air inside;
- 5. Install the new glove on the glove port and put it on the old glove;
- 6. Install an O-ring on the groove inside the glove port outside the new glove;
- 7. From the glove box, use another glove to take the old gloves into the chamber;

8. On the outside of the new glove, install an O-ring on the groove outside the glove port;

9. Take out the old gloves through the antechamber and dispose of them properly.

5.14 Installation of clamp



Note:

Before installing the clamp, ensure that the sealing ring and flange surface are clean and free of damage!

- 5.15 About vacuum pump
- 5.15.1 Vacuum pump details



- 1. Exhaust connector
- 2. Oil mist filter
- 3. Vacuum pump exhaust port

- 4. Vacuum pump body
- 5. Tray
- 6. Connect the chamber
- 7. Vacuum pump inlet
- 8. Vacuum pump power plug

5.15.2 Routine maintenance

- 1. Check that the oil level of the vacuum pump is at 2/3, if it is insufficient, add it in time;
- 2. Check whether the vacuum pump oil is contaminated, if so, please replace it immediately;
- 3. Whether there is noise in the vacuum pump.

Note:

Check the oil filter every six months to ensure that the oil filter is not blocked. The oil of the vacuum pump is changed every six months. To change the oil of the pump, please use the special vacuum pump oil.

5.15.3 Oil change steps

- a) Operate and start the pump, let it run for about ten minutes to allow the oil to heat up, and then turn off the pump (this can reduce the viscosity of the vacuum pump oil and make it easier to drain from the pump);
- b) Close the glove box;
- c) Cut off the power of the vacuum pump and disconnect the vacuum pump from the glove box vacuum system;
- d) Remove one of the fuel filler ports;
- e) Place a block under the pump motor so that the pump can be tilted to one side (no upside-down). At the sametime, place a suitable container (a container not less than 1L) under the drain port, open the oil drain plug, and let the oil drain into the container;
- f) Reinstall the oil drain bolt cover and remove the cushion block;
- g) Inject new pump oil from the oil filling hole and add it to the two-thirds position of the oil level observation window;
- h) After changing the oil, wipe off the oil stains, and reconnect the pump to the glove box;
- i) If the oil discharged from the pump is contaminated, please use the clean oil and repeat the above steps from a to i until the oil in the pump is clean.

Note:

When refueling, it is necessary to clean the refueling port to ensure that no dust and debris enter the vacuum pump.

When installing the oil plug, please pay attention to the O-ring to ensure tightness.

5.16 Analyzer

5.16.1 Trace moisture analyzer

1 Summary

The trace moisture analyzer is used to monitor the moisture content in the glove box system. The range is 0-500ppm, and it is linear from 0-100ppm, and more than 100ppm is an estimated value.

The probe is a "double helix" platinum wire wound on a special insulating material. The surface of the probe is coated with completely dehydrated phosphoric acid. The moisture molecules in the gas pass through the phosphoric acid membrane to electrolyze H+ and OH- to generate H2 and O2 to generate current. The current generated by H2O molecules reaching the probe surface depends on the content of H2O molecules in the gas. The original signal is temperature compensated and amplified to monitor the H2O content.

2 Composition

The trace moisture analyzer is composed of a probe and a special circuit, the interface is KF40 flange sealing, and the probe is protected by a protective cover to prevent physical damage. The signal connection port is RJ45 interface.

The power supply voltage of the analyzer is 24VDC. The output signal is 4-20mA or 0-10VDC.

The circuit and probe components have been uniformly tested and approved by the manufacturer before leaving the factory. (Note: If you have special requirements, you can consider providing a calibration method, allowing trained technicians to recalibrate the accuracy of the probe below 100ppm.)

3 Interface

Wire order	Interface	Color (reference)	Wiring connection	Corresponding to RJ45
1	Grounded	Orange &	24M	1
		white		
2	Switch 24V	Orange	24L	2
3	Signal	Green &		
	ground	white		
4	Output 24L	Blue		
5	4-20mA	Blue & white	4-20mA	5
			signal	
6	0-10V	Green	0-10V signal	
	signal			
7	+24 power	Brown &	24L	7
		white		
8	Grounded	Brown	24M	8



RJ45 The color sequence of the above picture: orange & white, orange, green & white, blue, blue & white, green, brown & white, brown

4	Technical parameters Mechanical Dimensions Probe part Flange Weight	L 205mm W 80mm H 58mm L45mm diameter 26mm NW 40 KF
	weight	0./Kg
	Electronic Power supply	24VDC +/- 10%
	Environment	
	Environment temperature	$+15^{\circ}$ C to $+35^{\circ}$ C
	Pressure	800 to 1200 mbar (Maximum pressure difference of electronic components +/- 100 mbar)
	Measure	
	Range	0-500ppm
	Sensitivity	10mV/ppm
	Response time (0-90%)	About 10 seconds (0-90%)
	Preheat time	10 minutes (<10ppm about 6 hours)
	Accuracy*	Within 100ppm is 2% of the displayed value ± 1 ppm
	10ppm is the amount of drift	10% /year
	•	

5 Installation

The H2O analyzer is fixed by the KF40 flange vacuum seal interface, usually connected to the KF40 flange interface. Please do not energize the analyzer before the chamber is fully purged with inert gas.

- 6 Maintenance & Clean the analyzer
 - 1. Before maintaining the H2O analyzer, the analysis should be closed;
 - 2. Routine maintenance includes cleaning and regeneration;
 - 3. The following parts are required fordisassembly and maintenance of the H2O analyzer;
 - 4. Soft, absorbent, fiber-free cloth;
 - 5.A small amount of phosphoric acid cleaning solution;
 - 6. Protective equipments includes gloves and goggles;

Note:

When cleaning the H2O analyzer, pay attention to prevent the outside air from polluting the atmosphere in the chamber. It is recommended to set the pressure in the chamber at ± 1.0 mbar

To +5.0mbar and close the loop.

Danger:

Be careful when using cleaning solutions, and you need to wear protective gloves and goggles. If you accidentally drip the cleansing solution onto your skin, you should immediately wash it off with running water. If you accidentally drip into your eyes, you should immediately wash it off with running water; then contact a doctor immediately.

5.16.2 Trace oxygen analyzer

1 Summary

The trace oxygen analyzer is used to measure the oxygen content in the glove box system. The range is 0-1000ppm, and it is linear from 0-100ppm, and more than 100ppm is an estimated value.

This analyzer is made of zirconium oxide, which is sensitive to oxygen. When the oxygen content is >1000ppm (for example, air), turning on the analyzer will not cause irreversible damage to the analyzer, but it should be avoided as much as possible. After being exposed to the air, it takes several hours to accurately measure the oxygen content in the inert gas.

Note:

Because of the high temperature of the analyzer and the reaction of the platinum surface, there will be a slight cross-reaction to hydrogen and other sensitive gases. This will shorten the life of the analyzer.

2 Composition

The trace oxygen analyzer is composed of a probe and a special circuit, and the interface is KF40 flange sealing. The probe is protected from physical damage by a protective cover. The signal connection port is RJ45 interface.

The power supply voltage of the analyzer is 24VDC. The output signal is 4-20mA or 0-10VDC.

The circuit and probe components have been uniformly tested and approved by the manufacturer before leaving the factory.

3 Interface

Wire order	Interface	Color (reference)	Wiring	Corresponding to RJ45
1	Grounded	Orange, white	24M	1
2	Switch 24V	Orange	24L	2
3	Signal ground	Green, white		
4	Output 24L	Blue		
5	4-20mA	Blue, white	4-20mA Signal	5
6	0-10V Signal	Green	0-10V Signal	
7	+24 power supply	Brown, white	24L	7
8	Grounded	Brown	24M	8



RJ45 color sequence in the picture above: orange & white, orange, green & white, blue, blue & white, green, brown & white, brown

4 Technical parameters

Mechanical

Dimensions Probe part Flange Weight

L190mm W 80mm H 58mm L 45mm Diameter 26mm NW 40 KF 0.7kg

Electronic power supply

24VDC +/- 10%

Environment			
Environment temperature	+15°C to +35 °C		
Pressure	800 to 1200 mbar (The maximum pressure difference of electronic components is +/- 100 mbar)		
Measuring			
Range	0-1000ppm oxygen		
Sensitivity	10mV/ppm		
Response time (0-90%)	About 10 seconds (0-90%)		
Preheat time	10 mins (<10ppm About 6 hours)		
Accuracy*	Within 100ppm is 2% of the displayed value ± 1 ppm		
10ppm is the amount of drift	10% /year		

* In a pure argon atmosphere, there is no gas like H2O or CO2 ** In an atmosphere that does not contain the reduced lifetime of the platinum surface of the probe like PH3 or SO2

5 Installation

The trace oxygen analyzer is fixed by the KF40 flange vacuum sealed interface. It is usually connected to the flange interface of KF40. Please do not energize the probe before the chamber is fully purged with inert gas.

6 Questions and answers

The trace oxygen analyzer does not contain user-repairable parts. If there is any problem, please send the entire probe back to the manufacturer for repair.

Fault description	Handle ways
When the measured value is below 10 ppm, although the actual value is very low, the display value will change very slowly (please confirm whether it is the actual atmosphere value of the chamber).	The probe will be affected by previous high levels of oxygen or prolonged exposure to the air. Therefore, it takes a few hours to work in an inert atmosphere before the value drops. The probe has a very stable zero point, so the possible influencing factors must be eliminated.

6 MAINTENANCE AND TROUBLESHOOTING

6.1 Overview

This chapter provides some problems that may be encountered during operation for troubleshooting. For components provided by other suppliers, please refer to the user manual provided by the supplier.

AOTELEC glove box include the following third-party accessories: Vacuum pump

Siemens PLC control components

Siemens touch screen

GE H2O Analyzer / MICHELL H2O Analyzer (optional)

GE Oxygen Analyzer (optional)

Note:

Please observe the maintenance and repair requirements of third-party accessories!

6.2 Daily maintenance

- 1. Before and after each work, first clean the environment to make the ground dry and clean. Then clean the equipment, including the inner and outer surfaces of the glove box, the observation system, and the work surface to be free of debris and clean.
- 2. Carefully record the H2O and oxygen content of the glove box and the gas consumption of the equipment every day to avoid insufficient gas pressure, which may cause the equipment to stop running.
- 3. Pay attention to the gas volume in the working gas cylinder at any time and replace it in time.
- 4. In case of power failure, press the "Vacuum Pump" button on the panel to run the vacuum pump after power on.
- 5. After powering on, if the vacuum pump fails to start, the first possibility is that the vacuum pump power cord is loosely connected, and the second reason is that the vacuum pump itself is not turned on.
- 6. When putting the sample in the glove box, try to use a mini antechamber. Before opening the antechamber door, pay attention to whether the pointer of the pressure gauge on the valve is at the zero position. If yes, you can open it directly; if not, you need to first turn the switch under the valve cavity to the "filling" position, so that the gas enters the glove box antechamber, and then turn the switch back to the middle position, then you can open the antechmaber. Put the sample in the antechamber, and then close the door. When placing the sample, be careful not to touch the inner wall of the antechamber with your hands. Please wear gloves to pick and place the sample.

- 7. Before taking out the sample in the antechamber, you must first turn the switch on the antechamber to the "vacuum" position to extract the air in the antechamber, and then transfer it to "fill" to make a dry and clean inert gas. After repeating three times, you can open the antechamber door from the glove box and take out the sample.
- 8. When using the equipment, it is forbidden to wear things that may pierce gloves, such as watches and rings. If you use sharp objects, pay special attention to avoid piercing the gloves.
- 9. Check the oil level of the vacuum pump every week in the glove box. Pay attention to adding it when it is less than two-thirds. In order to ensure the operation of the vacuum pump and prolong the service life of the vacuum pump, it is recommended to replace the vacuum pump oil every six months.
- 10. The cabinet and glass can be cleaned with detergent (outside the equipment); use a soft, lint-free cloth; if possible, use a vacuum cleaner with a brush or a sticker roller.
- 11. Check whether the gloves are damaged, especially on the fingers. Please wear gloves when working to avoid moisture in the gloves. In addition, after finishing the work, please point the 5 finger cots on each glove outward to prevent the finger cots from sticking to the sweat for a long time. If the gloves are found to be damaged, they must be replaced immediately, and any repairs to the gloves are prohibited.
- 12. Check whether the sealing ring of the antechamber is damaged, and the damaged sealing ring should be replaced in time. If the antechamber door is difficult to open or close, t is a mechanical problem, please consult us and solve it. If there is a problem with the sealing strip, you can try it with less grease or lubricating oil.
- 13. The accessories are carried out in accordance with the maintenance instructions of the accessories, for example: vacuum pump. Follow the third-party maintenance instructions.

Maintenance	Operation hours	Handle ways	Operation hours	Handle ways
	nouis		nouis	
Chamber leak	6 months	Holding	Every year	Perform a major
detection		pressure test		maintenance
Purification	6-10 months	Regeneration	Accumulative	Replace
material			lyregenerate	purification
			5 times	materials
Fan	One year	One check	Over 5 years	Recommend to

6.3 Maintenance cycle

				replace
Gloves	6 months	Holding	/	/
		pressure test		
Antechambers	Every month	Clean	Half a year	leakage detection

6.4 Maintenance and maintenance during operation

- 1. Untrained personnel are not allowed to use the glove box without authorization;
- 2. It is forbidden to use items that can poison the regenerated catalyst, such as sulfhydryl compounds, etc.;
- 3. Without permission, do not use volatile solvents that can damage Plexiglas, such as acetone, etc.;
- 4. Before using volatile solvents, contact the person in charge to remove the H2O analyzer;
- 5. When using volatile solvents, open the activated carbon circulation system;
- 6. When using the glove box, it is forbidden to leave long fingernails and to wear sharp objects (such as watches, rings, etc.).

6.5 Maintenance and maintenance during long-term parking

If you do not use it for a long time, please follow the steps below:

- a) Take out the items that are not easy to store for a long time in the glove box;
- b) Turn off the power of the glove box and unplug the power plug;
- c) Clean the interior of the glove box and antechambers to avoid evaporation of residual samples;
- d) Close all access valves;
- e) Tuck the gloves into the glove box and wrap them in a bag at the port of the glove box to prevent the gloves from being scratched outside;
- f) Drain the vacuum pump oil;
- g) Affix unused, safety attention and other eye-catching reminders labels.

6.6 Failure analysis and troubleshooting methods

6.6.1 Fan trip

- 1. Check whether the equipment has a solvent filtration system, and observe whether the butterfly valve related to the solvent filtration system is opened correctly;
- 2. Is the fan not turned on but the equipment has started to work? This shows that the feedback position of the flapper valve on the purification column is incorrect;
- 3. It may also cause the circuit breaker to trip or the inverter to protect itself because the load is too large.

6.6.2 Noise from the fan

- 1. The bearing is short of oil, and professionals need to disassemble the fan and refuel for maintenance;
- 2. If a foreign object falls in, it needs to be disassembled for inspection.

6.6.3 The glove box constantly replenishes air

- 1. There is a problem with the sealing of the equipment itself, and the pressure is maintained for leak detection;
- 2. The door of the antechamber is not closed tightly;
- 3. Whether the pedal is pressed by something;
- 4. The solenoid valve of the purification system pipeline is clamped by impurities.

6.6.4 The glove box keeps vacuuming

- 1. The door of the antechamber is not closed tightly;
- 2. Whether the pedal is pressed by something;
- 3. Whether the <purification column air extraction valve> on the solenoid valve block is clamped by impurities;
- 4. Whether the <chamber exhaust valve> on the solenoid valve block is clamped by impurities.

6.6.5 Increased gas consumption of the glove box

- 1. There is a leak in the pipeline from the working gas source to the equipment, the cylinder port at the gas source leaks, and the inlet pipe interface on the valve block leaks;
- 2. High vacuum baffle valve gas leakage;
- 3. The pressure pipe of the high vacuum baffle valve is leaking. Check in turn.

6.6.6 Excessive H2O and oxygen content

- 1. Whether the method of using the equipment is correct, do not put too many samples in the chamber during debugging, if you need to put it in, it is recommended to dry it;
- 2. The airtightness of the chamber, including the use of main and mini antechambers and whether the gloves are used incorrectly to cause air leakage;
- 3. Temperature has a certain effect on H2O content, and the H2O content decreases slowly when the temperature is too high;
- 4. Incomplete baking of activated carbon will also have a certain impact on the H2O;
- 5. Whether the regeneration effect is normal, focus on the vacuuming link in the regeneration process of the purification column, and the vacuum should be maintained for more than 2 hours.

6.6.7 The oxygen content rises slowly during circulation

- 1. There is a small amount of leakage between the chamber and the air inlet of the fan, and the problem can be eliminated through the sectional pressure maintaining method;
- 2. The bellows may leak;
- 3. The joint may leak;
- 4. The purge column or solvent column may leak.

6.6.8 The cycle cannot be started

- 1. Whether the working gas pressure is between 0.4-0.6MPa;
- 2. Whether the feedback switch of the high vacuum baffle valve is normal;
- 3. Whether the display of the pressure sensor is normal;
- 4. Whether the fan circuit breaker has tripped;

5. Whether the fan inverter is normal.

6.6.9 The regeneration button does not work

- 1.A password is required;
- 2. The vacuum pump is not turned on;
- 3. The purification column is circulating (regeneration and circulation cannot be on the same purification column at the sametime).

6.6.10 Buttons cannot be operated

- 1. Whether the pressure of the glove box is normal;
- 2. Check whether the communication line of the PLC is loose;
- 3. The wiring of the common terminal 24M, M, COM, etc. is loose.

6.6.11 Vacuum pump cannot be operated

- 1. Please check whether the button switch on the vacuum pump body is turned on, "0 OFF", "1 ON";
- 2. Check whether the circuit breaker of the vacuum pump has tripped.

6.6.12 The vacuum flapper valve cannot be opened

- 1. The working air pressure is too low, the pressure range should be between 0.4-0.6MPa;
- 2. The flapper valve is not energized.

6.6.13 Working air pressure is too low

- 1. Check whether the working gas is sufficient;
- 2. Whether the decompression gauge is damaged.

6.6.14 Cycle automatic stop

1. If the chamber pressure is too low, the circulation will stop automatically. Check whether the door in the antechamber is tightly closed; check if it is possible that it is connected to the vacuum pump because it is not tightly closed;

- 2. Check whether the pressure sensor is damaged;
- 3. Check whether the air source pressure is 0.4-0.6MPa.

7 TRANSPORTATION, SHIPPING AND STORAGE

7.1 Packaging

Use wooden packaging.

7.2 Methods and precautions for transportation and shipment

In the process of transporting the equipment, please pay attention to the following to avoid accidents:

- Hoisting, it is forbidden to deflect or turn the machine upside down during transportation;
- Hoisting, the pipeline may be affected during transportation, and it needs to be re-debugged and tested before use;
- When the machine is not used for a long time, disconnect all external electrical connections of the machine and keep the parts clean;
- During long-distance transportation, it shall not be installed in open cabins and vehicles, shall not be stored in open warehouses, shall not be shipped with flammable, explosive, and corrosive items, shall not be subjected to rain, snow, or other liquid wetness.
- In the process of loading and unloading, forklifts, cranes, straps, etc. that can carry at least 1000kg are required;
- For safety reasons, workers need to wear helmets, gloves, and safety shoes;
- During transportation, the casters need to be completely stowed.

7.3 Storage conditions, storage period and precautions

- The equipment should be stored in the original packaging box. The ambient temperature of the warehouse where the equipment is stored is: $0^{\circ}C^{\sim}40^{\circ}C$, and the relative humidity is $45\% \sim 80\%$;
- It is forbidden to store the equipment together with harmful gases, flammable and explosive materials and corrosive materials; the storage place should be free from strong mechanical vibration, shock and strong magnetic field;
- The packing box should be at least 20cm away from the ground. If there are no other

regulations, the storage period should not exceed three months.