Glove Box with Gas Purification System and Digital Control

VGB-6



MTI Corporation

860 S 19th Street, Richmond, CA 94804, USA Tel: 510-525-3070 Fax: 510-525-4705 E-mail: <u>info@mtixtl.com</u> Web site: <u>www.mtixtl.com</u>

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Features

- Siemens PLC control system with 6" touch screen display for easy accessing all functions.
- Recirculation system: closed-loop gas circulation, oil free and vacuum tight. ų m
- Automatically pressure control: working pressure can be set in the range of +/-12mbar.
- Automatically purging for convenient operation and saving gas as well as safe for operating solvent.
- Equipped with 9 3/4" butyl gloves for immediate use.
- Pressure can be regulated via foots witch.
- Automatically log system's data.

Specifications

Glove-box Housing:	3mm thickness stainless steel (SS304) with removable back panel
Chamber Size:	1220mm L x 900mm H x 760mm W
Total dimension:	3600mm L x 900mm H x 1000mm W
Leak rate:	<0.05 vol%/hour
Bellows Tube:	Stainless Steel 304, KF40 and KF25
Glove Ports:	9" aluminum glove port
Lighting :	Fluorescent lamp at the top of the front window.
Main Air-lock Chamber:	Diameter 360mm x length 600mm, made of 3mm thick SS304
Small Air-lock Chamber:	Diameter 100mm x length 300mm, made of 3mm thick SS304
Gas Purification System:	Made of SS 304 and automatically regenerated
-	One H2O/O2 purifier column designed to maintain O2 & H2O < 1 ppm
	Lindy Molecular Sieve and BASF R3-11 Copper Catalyst.
	Capacity of 30 liters of O2 & 1.3kg of moisture before regeneration
Pressure control:	Automatically controlled by PLC, Working pressure can be set in the range of +/-12mbar.
Circulation system:	Oil free & Vacuum tighten (0-60 CFM continuously variable blower).
Regeneration:	Automatically programmed regeneration
Vacuum pump:	RV-8 Edwards Vacuum Pump and oil mist fitter included (Vacuum Rate: 8m ³ h).
Power:	Single phase, Standard 204- 240VAC (50/60Hz), 110V is available by MTI's transformer
Warranty:	One year
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Note: Working and regeneration gas are not included in the package, please order from local gas supplier.

Preparation

1. Operation Environment

Temperature: 15-25 °C (air conditioner required if out of this range) Operation Room: Good ventilation and dry

2. Gas Requirement

Working Gas

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Gas Type	Nitrogen, Argon, Helium
Purity	\leq 5ppm H ₂ O , \leq 5ppm O ₂
Gas Amount Requirement	Continuous supply
Gas Regulator (Figure 10)	Input: >150bar (>2175 PSI);
	Output (to controller inlet): 0~10bar (Atmosphere to 145 PSI)
	Table 1
Regeneration Gas	
Gas Type	If N_2 as working gas, please apply mixing gas 90-95% N_2 and 5-10% H_2
	If Ar ₂ as working gas, please apply mixing gas 90-95% Ar ₂ and 5-10% H_2
	If He as working gas, please apply mixing gas 90-95% He and 5-10% $\rm H_2$
Purity	\leq 5ppm H ₂ O; \leq 5ppm O ₂
Gas Amount Requirement	Approximately 5000 Liter (in gas not liquid) per Regeneration Cycle
Gas Regulator (Figure 10)	Input: >150bar (>2175 PSI);
	Output (to controller inlet): 0~10bar (Atmosphere to 145 PSI)
	Table 2
Purge Gas	
Gas Type	Same as working gas

Purity	\leq 5ppm H ₂ O; \leq 5ppm O ₂
Gas Amount Requirement	2.5 bottle of gas with pressure 2400 PSI (read from gas regulator's input)
Gas Regulator (Figure 10)	Input: >150bar (>2175 PSI);
	Output (to controller inlet): 0~10bar (Atmosphere to 145 PSI)

Table 3

3. Gas pressure requirement

3-a. Working gas needs 4-5 bar (<70 PSI) input pressure with respect to atmosphere

3-b. Regeneration gas needs 0.5-0.6 bar (<7 PSI) input pressure with respect to atmosphere

Note: Higher than above may damage the glove box system !!!

4. Safety

4-a. MTI does not suggest customer use radioactive or toxic material.

4-b. The device should be well grounded.

4-c. Customer must have fume hood or other waste gas disposal system connecting to the outlet of the regeneration gas.

5. Gloves Installation

5-a. One o-ring is wrapped inside the end of the glove; please put it to the o-ring groove closest to the window:



Figure A

5-b. Install another two o-rings onto the outer grooves.



Figure B

Note: Put the gas into glove box and wait for 20-24 hours to check if any leaks (the glove would have little change in inflation status if no leaks, how to put gas will be discussed in Operation Chapter from 1-a to 1-h):



Figure C

6. Connection



Figure D

7. Power Cable

MTI leaves the naked power cable for customer because different countries have different power setup requirement, please ask a local licensed electrician to do the power setup for you, here, two power cables requires AC220V plug:



Figure E Power Extension on the back



Figure F Power Cable for Controller

8. Sample Preparation

Put the sample into the glove box via big or small transition chamber, if the sample or other equipment is much larger than the big transition chamber, please loosen the screws around front window to put it/them in and then reinstall the windows back.

Note: You need at least 2 persons to remove the frond window glass and the frame; it is very heavy and fragile!!!

Installation

1. Follow below picture to finish the tube connection:





Figure 1-b



To Regenerating Gas Inlet

legenerating Gas Outlet

To Water Cooling Outlet

To Water Cooling Inlet

b Working Gas

Note:

Figure 2

- Working gas should be connected all the time when you are using the glove box, and its purity should be over 99.999% if you need the H_2O and O_2 content lower than 1ppm. Water cooling is optional if your room temperature under 25C but a must when doing circulation, because it is used for
- цш cooling down the fan which is the impetus of circulation. цш.
- Regenerating gas should be closed when working but a must when regeneration. Customer must have fume hood or other waste gas disposal system connecting to the outlet of the regeneration gas. վա

Inside the controller



Figure 3-a



Right Side View Figure 3-b



Figure 3-c Left Side View



Attention:

Proper use and storage of Oxygen Analyzer

- Please seal the Oxygen Sensor head by the blank flange and quick clamp after the completion of each experiment, the Oxygen Sensor head should not expose in the air for a long period of time, otherwise its lifespan would be affected.
- Working pressure range is 550~950torr, pressure beyond this range is not allowed. Please use proper valve to reduce pressure when pressure is too high
- Please disconnect the Oxygen Analyzer from Vacuum devices to avoid Oxygen sensor broken
- The use of acidic gas such as CO2 and HCl is prohibited
- If gas contain plenty of oily cent or impurity particles, please filter the gas before using
- Avoid big vibration when using

Transition Chamber (One is big and one is small)



Figure 4



Left side of controller





Figure 6-b

Power Input



Figure 7

Note: A 1500W transformer is in standard packing to convert AC110V to AC220V for power input if you only have AC110V power supply.

How to assemble KF40 fitting (Similar to the Bellows Tube)









Figure 8-1

The same way to install the valve on the spare port:



Figure 8-2

Note: Keep the pump "power button" on 1, and the controller will automatically control its on/off via power cable.



Figure 9-1

Operation

1. Purge the glove box

1-a. Make sure the gas source is well connected, for your reference, MTI use a gas regulator as below:



Figure 10

1-b. Adjust the working gas pressure around 25~40 PSI.

1-c. Adjust the power knob to the right to power on the controller.



Figure 11 1-d. You will see the controller self-testing for a few seconds and enter the main menu:

This devi see OP pr for detai	ce contains Free So operties in the Con Is.	ftware trol Pánel
in 1776		
	Figure 12	
Loade	r V01.04.00.04_01.01	

Figure 13 (Do not touch these buttons; they are for factory setting only!!!)



Figure 14 Main Menu

Cycle: Slightly press once to do circulation (should enable after purge!!! Otherwise, may damage the circulation system) Pump: Slightly press once to manually power on the pump; press again to stop it. Light: Slightly press once to power on the light on the front top of the glove box. Set: Slightly press once to enter the setting menu.

1-e. Press "Set" to enter the setting menu:

		default
	-1	OK
Regeneration/off		
		Alarm Set

Figure 15 Setting Menu

1-f. Press the number after "up pressure" to enter the key pad:



Figure 16 Key Pad

ESC: Exit BSP: Backspace +/-: Positive or negative the number

Enter (Confirm)

I Move the curse to left or right

1-g. Please set "up pressure" to 6 and press "Enter" to confirm, and then "down pressure" to 4 (Unit is mbar, these two numbers are very important for purging!!!).

1-h. Press "OK" in setting menu and you will hear the solenoid valve inside the controller enables and the pressure in the glove box will increase until to 5mbar (by the progress bar) and the two gloves are put out by inside positive pressure, then, the solenoid valve will disable to balance the pressure there.

Note: Wait for at least a few minutes to see if there is any gas leak; if yes, the pressure solenoid valve will anyhow open again to let gas in, check any possible points (for example by suds) where may leak such as KF40 fittings, doors of big/small chamber both inside and outside....

If no leak,

- a. Close the gas source
- b. Shut down the controller power
- c. Open the valve to release the gas inside glove box to atmosphere.
- d. Put the all the research stuff into the glove box.
- e. Close the valve.



Figure 17 Gas Valve

1-i. Repeat 1-g and 1-h and then, half open the valve above to purge the glove box. You will hear solenoid valve inside the controller keeping on and off (It will be on to let gas in when pressure goes below 4 mbar and be off when new gas filling in until 5 mbar). With the on and off, the H2O and O2 will be driven out through the half-open valve.

1-j. Wait until $H_2O < 50$ ppm and $O_2 < 200$ ppm and start the circulation.

Circulation

- 1. Make sure $H_2O < 50$ ppm and $O_2 < 200$ ppm by the display in the main menu.
- 2. Close the gas valve on the back of the glove box (in figure 17).
- 3. Go to setting menu (figure 15) and set back to default (up is 3 and down is -1 mbar).
- 4. Press "Cycle" to do circulation.
- 5. Wait for 8-12 hours, both O_2 and H_2O will reach <1ppm even lower.

Note:

I

1. Never close the working gas though no fresh working gas will go into the glove box from the gas source, keep the gas pressure there to enable the circulation fan, otherwise, the circulation fan will not work if pressure is 0. 2. See blow circulation schematic:



Figure 18

Operation

1. Big Transition Chamber: Customer may need to put some big samples in the main chamber via big transition chamber while not disturbs the operation in the glove box.

1-a. Make sure the inner door of the big transition chamber in the glove box is well tighten.



1-b. Open the outer door of the big transition chamber:



Figure 20

1-b. Put the sample on the holder and close the door then tighten the screws by the handle.

1-c. Keep the "Gas Filling Valve" closed as shown in figure 5-a. Open the "ball valve" (Figure 5-b) under the big chamber and press "pump" on the main menu (Figure 14) to vacuum the big chamber until the meter to -1, then close the ball valve and stop the pump by another press on main menu.

Please note: If open valve, always power on pump first and then open valve. If close valve, always close valve first and then stop the pump.



Figure 21 Pressure Gauge

1-d. Slowly open the "gas filling valve" (figure 5-a) to let the gas inside the glove box be sucked into the big transition chamber. Please note that the reason why you should not fast open the valve is that the gloves may get blown out.

1-e. Close the valve until the gloves like in figure C (page 5) and then, wait until the new working gas goes into the glove box to meet the gas range you set (remember, -1 to 3 mbar you set in Step 3 in Circulation).

1-f. Repeat 2-3 times from step 1-c to 1-e.

1-g. Open the inner door of the big transition chamber and pull out the sample holder to get the sample.

2. Small Transition Chamber: Customer may need to put some small samples in the main chamber via small transition chamber while not disturbs the job in the glove box.

2-a. Open the outer door of the small transition chamber and put the sample in.



Figure 22-a

Figure 22-b

2-b. Close the door.

2-c. Adjust the T-valve (Figure 23-a) under the small transition chamber to "Vacuum" and then enable pump to vacuum the chamber to -1 by the pressure gauge.

- 2-d. Adjust the T-valve to close.
- 2-e. Adjust the T-valve to "Gas Open" to flow gas into the small transition chamber to 0 by the pressure gauge.
- 2-f. Repeat 1-2 times from step 2-c to 2-e.
- 2-g. Open the inner door to get the sample out.



Figure 23-a



Figure 23-b

Figure 23-c

Regeneration/Reactivation

1. The purification system which is used in circulation (Figure 18) needs to be reactivated when you find circulation time to your target PPM becomes much longer than usual, we suggest an empirical value as blow: 1-a. Go to "Record View" from "System Set" (figure 15) and get the value in third row T (Distance last time: Hour).



- 1-b. Then the empirical interval between two regenerations is T-10 in hours.
- 2. Regeneration Gas

2-a. Choose proper regeneration gas by following the table 2.

2-b. Connect the regeneration gas source to Regeneration Gas Inlet (in Figure 2) and outlet to gas disposal system (MTI do not provide disposal machine/system, please dispose the gas according to your local gas disposal regulation)

2-c. Adjust input pressure to 0.04-0.06 Mpa (5-8 PSI) and set pressure range, up to 3mbar and down to 1mbar in main menu. 2-d. Make sure the circulation is off and turn gas ballast on vacuum pump to "0" and then press the "pump" in main menu to enable the pump.



Figure 24

2-e. Press Regeneration/Off in setting menu and it will become Regeneration/On which means the regeneration is on. 2-f. The program will give customer 2 minutes to adjust the input gas pressure to let the gas flow between 15-20L/min by floating flow meter:





Note: Please check the gas source if flow meter has no response within 2 minutes after you enable regeneration. 2-g. The system will enable first section of regeneration program after the 2-minute adjustment and at the same time, stop the

gas flowing.

2-h. Every 2-3 hours, the gas will flow for a few minutes and then stop to enable new section of regeneration and the whole

regeneration will last for 15 hours, as below:



Around 15 hours

Figure 26

2-i. When the whole regeneration stops, please go to vacuum pump and turn gas ballast on vacuum pump to "1" to release the vapor in the pump, turn back to "0" after 15 minutes.

During the regeneration procedure, please be kindly advised:

Make sure the gas source is enough for 15-hour regeneration; check the gas supply amount every 1-2 hours.

Adjust the pressure as in step 2-f every time when gas flowing enables shown in figure 26.

- It is OK to leave the machine auto-run when in section of regeneration.
- Do not enable the new circulation within 6 hours after a whole regeneration finishes.
- Do not attempt to resume regeneration within 6 hours if the regeneration stops abnormally, which means you could take a break for 6 hours and then restart the regeneration from step 2-d; otherwise, it may damage the controller.
- Keep the pump on during the regeneration.
- Do not touch the controller during the regeneration in case any burn.

Maintenance

1. Glove Box

1-a. Make sure there is enough gas source.

1-b. If power failure during the process, you must press "pump" on main menu to enable the pump again after power recovery. Note: If above still can not start the pump, please disassemble the KF25 clamps to let air go into the vacuum hose, then reassemble it to enable the pump.

1-c. Use small transition chamber as possible as you can for sample delivery when working.

1-d. Do not wear watch, rings or any other sharp items to keep gloves from any penetration or worn-out.

1-e. Regularly check the oil level of the pump, refill the oil if the level lower than 2/3 of full scale.

2. Vacuum Pump Oil Change

2-a. Keep the pump running for 10 minutes to decrease the viscosity of the pump oil which will help it be poured out more easily.

2-b. Close the ball valve between the pump and big transition chamber.

Exhaust Used from Oil Outlet

2-c. Unplug the power cable from the pump and disassemble the KF25 clamp.

2-d. Remove either of the two caps of oil inlet and incline the pump body to pour the oil from the oil outlet (remove the cap) to a proper container underneath.



Fill New form Oil Inlet



2-e. Close the outlet and fill new oil from the inlet until the oil level to the 2/3 of the full scale and fill more if the oil goes lower than the 2/3 after a few minutes.

Note 1: If you find the oil from the pump is too dirty, fill the new oil from the inlet to flush away the contamination stuff inside the pump to the container, repeat this purge process for a few times by refill the oil poured in the container, and then, fill new oil.

2-f. Close the inlet and reinstall the pump back to the glove box.

Any other questions, please feel free to call us at 1-510-525-3070 or email info@ mtixtl.com.

Packing List for VGB-6		
Item	Quantity	Image
Glove Box Main Chamber	1 pcs (with power extension but without gloves)	
Gas Controller	1 pcs (with pedals, gas tubes, oxygen analyzer Ethernet port, pump power cable and controller power cable, light power cable)	
Pump	1 pcs	
Vacuum Pump Exhaust Filter	1 pcs	
Vacuum Pump Oil	1 bottle	
Glove	1 pair 31" L x 9-3/4" Diam.	
O-ring for Sealing Gloves	4 pcs	
O-ring for Big Transition Chamber	3 Pcs (2 has been installed on the big transition chamber for immediate us)	
O-ring for Small Transition Chamber	3 pcs (2 has been installed on the small transition chamber for immediate us)	O
KF40 Fitting Vacuum Bellows with 2 Clamps and Sealing O-ring	2 pcs	
KF25 Fitting Vacuum Bellows with 2 Clamps and Sealing O-ring	1 pcs	1
Oxygen Analyzer Sensor	1 pcs	
1" O.D. Vacuum Tube	1 pcs	
5/16" O.D. Gas Pipe	1 pcs	

3/8" O.D. Gas Pipe with Swagelok Fitting	1 pcs	
Teflon for sealing the gas pipe (if applicable)	1 roll	