# OMNI-LAB SYSTEM

# USER GUIDE

## System Part Numbers
## 101965, 102282, 106424 (110 VAC)
## 101975, 102283, 108092 (220 VAC)

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# 1 INTRODUCTION

## 1.1 GENERAL

The OMNI-Lab inert atmosphere glovebox and gas purification system has been designed with a revolutionary architecture, with no sacrifice in performance. With the OMNI-Lab, we've integrated the gas purifier, valves and electronics together on the top of the glovebox. The system is provided with a sturdy stand, or it may be mounted on top of a bench. The OMNI-Lab is exceptionally simple to set up, operate, and maintain, which allows the operator to concentrate on the important stuff – the processes in the glovebox. As with all Vacuum Atmospheres Company glovebox systems, the ability to reach and maintain sub 1-ppm levels of oxygen and moisture is a standard feature.

This manual is intended for use with part numbers 101965 and 101975 (2 glove port systems) and part numbers 102282 and 102283 (4 glove port systems). The manual includes operational information on the gas purifier, glovebox, antechamber and control system. There is additional information on the optional oxygen and moisture analyzers.

The gas purifier removes oxygen and trace moisture contamination in the hermetically sealed glovebox environment. The OMNI-Lab is equipped with a single gas purifier and manual circulation valves used to isolate the glovebox atmosphere from the purifier.

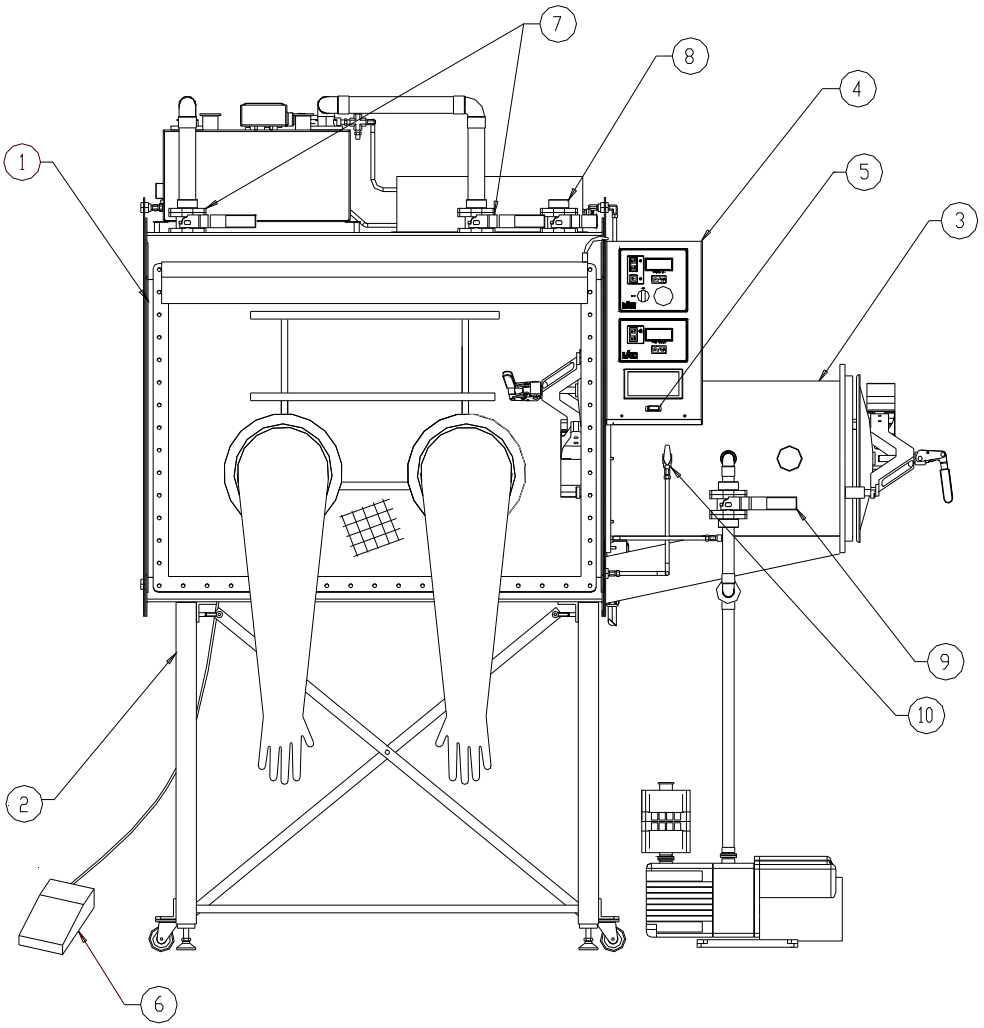
The glovebox is a hermetically sealed, stainless steel enclosure with a full-view window and 2 glove ports. A right-side installed 15" diameter antechamber is standard.

The instrumentation system features a touchscreen for easy monitoring and control of glovebox pressure, glovebox purge, circulation blower, and purifier regeneration. The simplicity and ease of operation of the touchscreen allows new users to quickly come up to speed.

The optional oxygen analyzer and display uses an electrolytic fuel cell to measure glovebox oxygen to below 1 part per million. The optional trace moisture analyzer display is supplied with an aluminum oxide probe for measurement of moisture levels down to less than 1 part per million. Both analyzers are available with optional user selectable alarm setpoints and audio alarms.

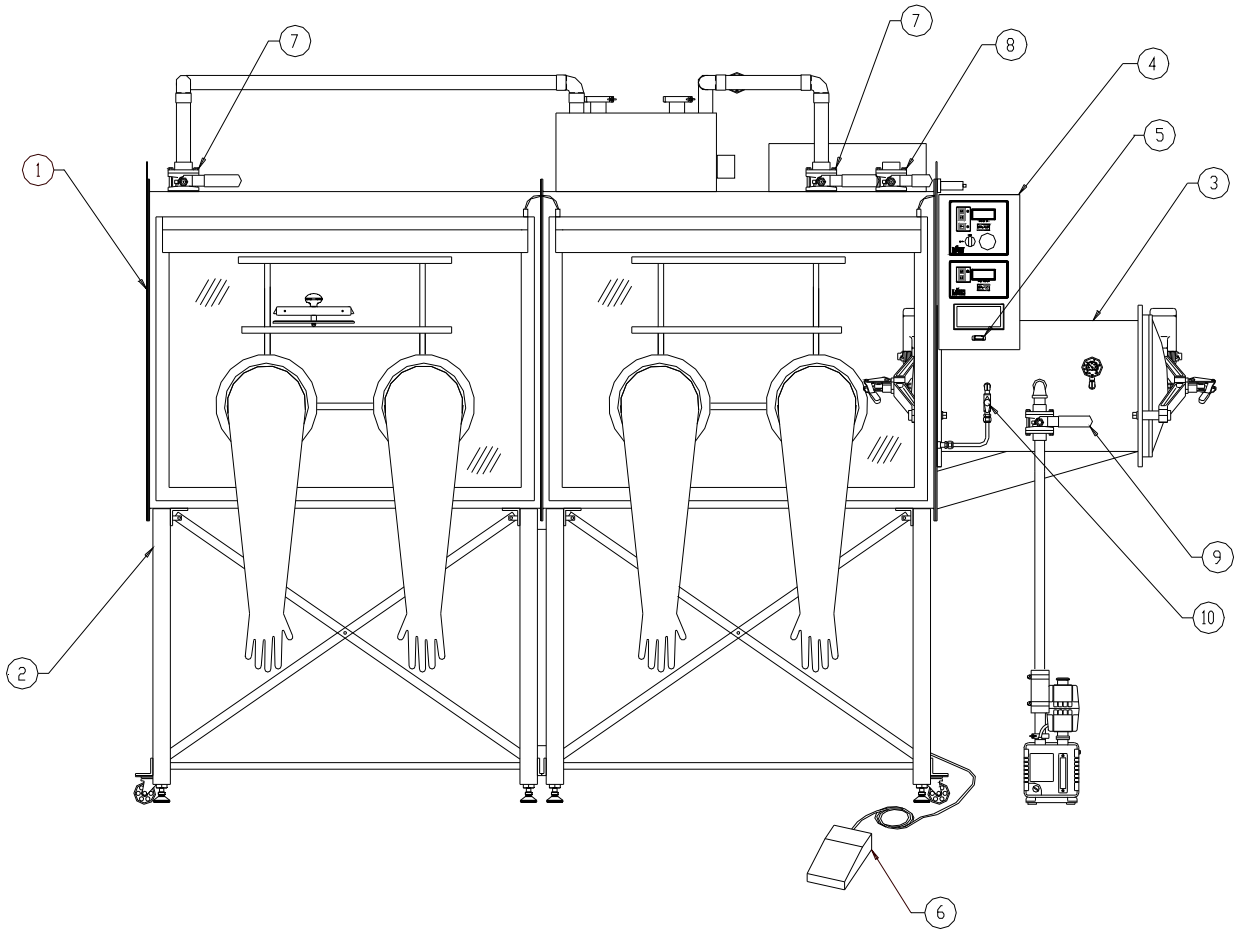
## 1.2 SYSTEM CONFIGURATION

The following figures display the general system configuration of the OMNI-Lab.



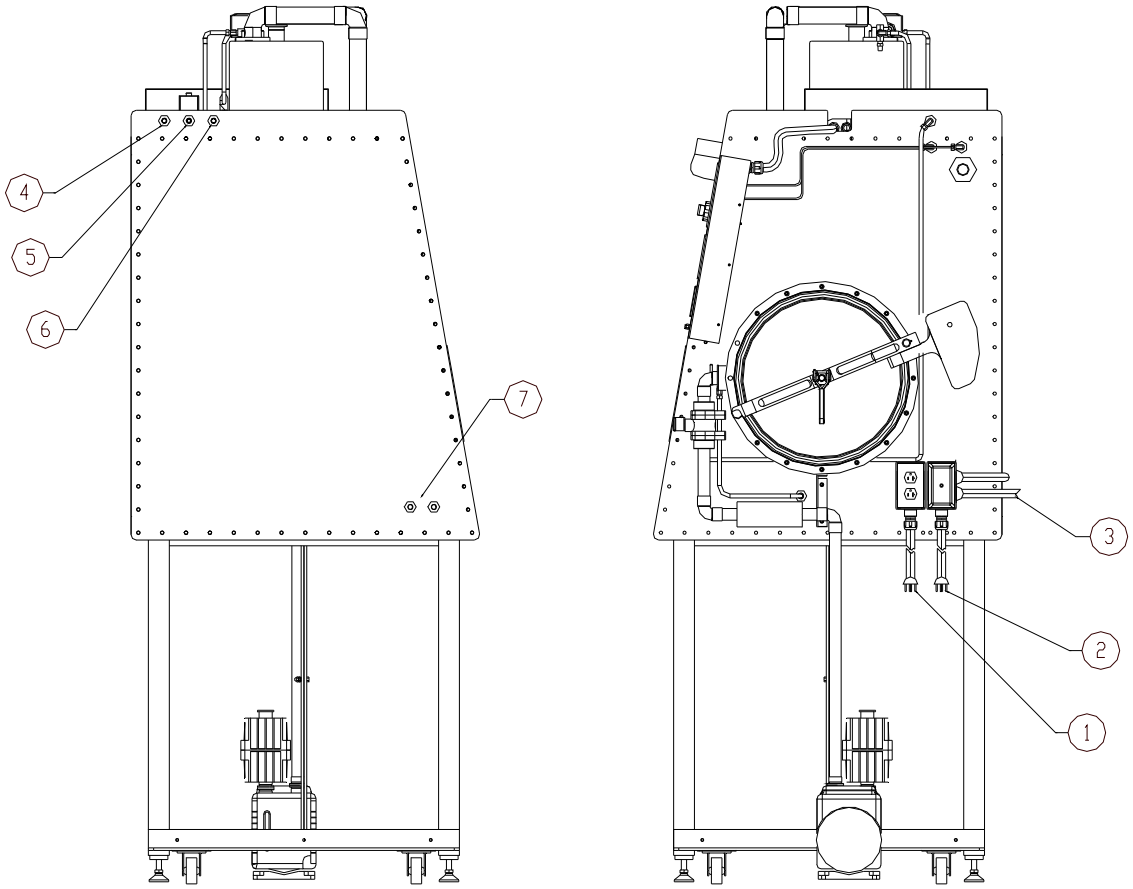

1) Stainless Steel Glovebox
2) Glovebox Stand
3) Antechamber (15” diameter X 24” long)
4) Control Panel (with touchscreen and optional oxygen and moisture analyzers)
5) System Power Switch
6) Pressure Control Footswitch
7) Glovebox Circulation Valves
8) Glovebox Purge Valve
9) Antechamber Evacuation Valve
10) Antechamber Refill Valve

**Figure 1-1**
**Front View, OMNI-Lab 2 Glove Port Models,**
**Part Numbers 101965, 101975**




1) Stainless Steel Glovebox
2) Glovebox Stand (collapsible)
3) Antechamber (15” diameter)
4) Control Panel (with touchscreen and optional oxygen and moisture analyzers)
5) System Power Switch
6) Pressure Control Footswitch
7) Glovebox Circulation Valves
8) Glovebox Purge Valve
9) Antechamber Evacuation Valve
10) Antechamber Refill Valve

**Figure 1-2**
**Front View, OMNI-Lab 4 Glove Port Models,**
**Part Numbers 102282, 102283**




Left Side View

Right Side View

1) Power Cord for Glovebox Internal Duplex Receptacle
2) System Main Power Cord
3) Vacuum Pump Power Cord
4) Regeneration Purge Vent Port
5) Regeneration Gas In Port
6) Inert Gas In Port
7) Customer Interface Ports (to Glovebox)

**Figure 1-3a**
**OMNI-Lab Side Views**
**(All Single Side Models)**

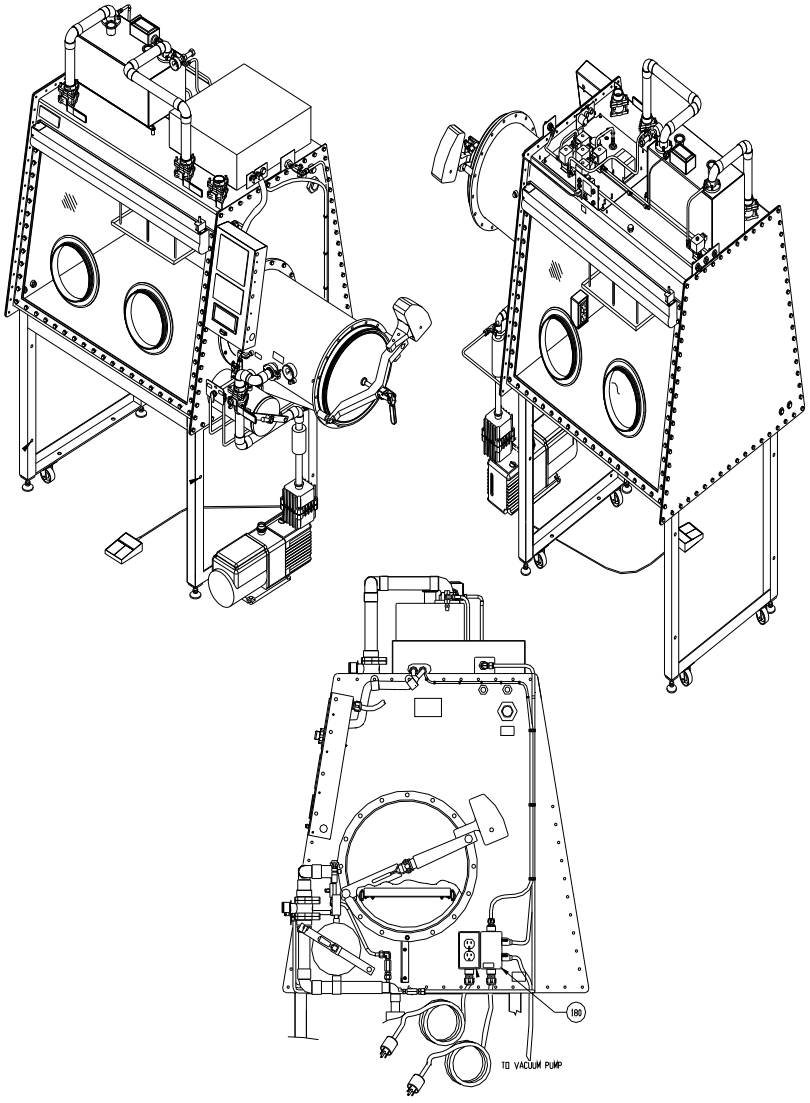
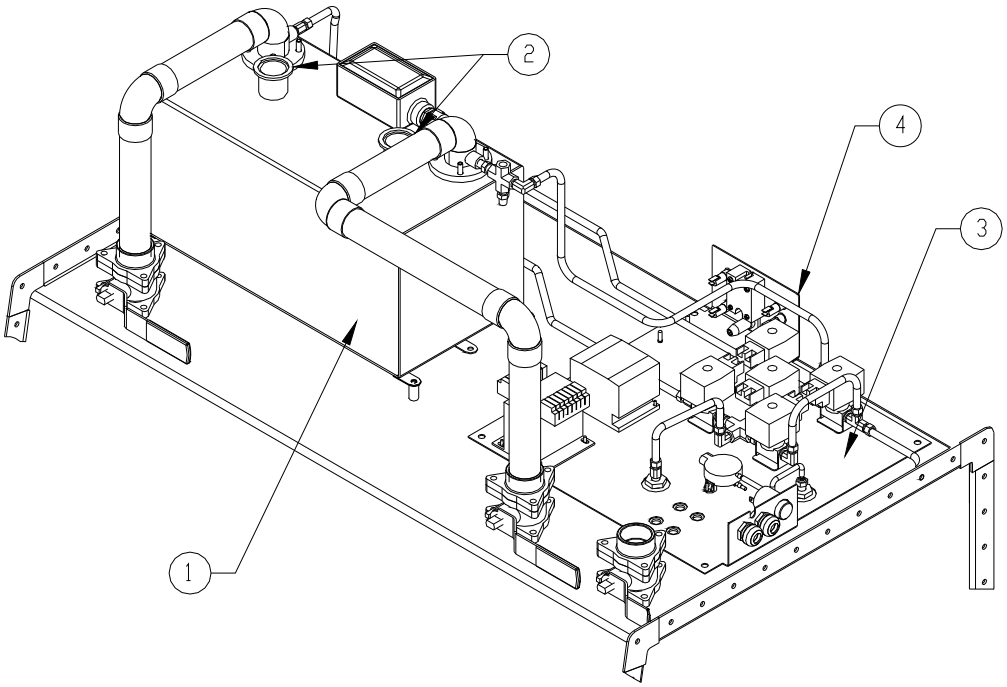



**Figure 1-3b**
**OMNI-Lab Dual Sided Views**
**Part Numbers 106424 (110VAC), 108092 (220 VAC)**




1) Gas Purifier
2) Purifier Fill Ports (KF Flanges)
3) Pneumatic/Electrical Panel (cover removed for clarity)
4) Fuse Panel

**Figure 1-4**
**OMNI-Lab Top View**

## 1.3 THEORY OF OPERATION

### 1.3.1 Moisture and Oxygen Removal

The OMNI-Lab system is designed to remove moisture (vapor) and oxygen from argon, helium or nitrogen gas contained in a glovebox. The system does this by circulating, in a closed loop, the glovebox atmosphere through an activated bed of molecular sieve and copper catalyst (Figure 1-5). The molecular sieve is hydroscopic and will remove up to approximately 2.6 pounds of moisture. The catalyst, by oxidizing, will remove up to approximately 20 liters of oxygen. The system will remove the oxygen and moisture and establish an equilibrium point of 1 ppm or less (depending upon conditions such as inert gas purity and glovebox integrity). As the system operates, the purifier bed will gradually "saturate". As the bed saturates, the efficiency (moisture and oxygen absorbed per pound of molecular sieve and copper catalyst) will diminish. Assuming a normally fixed rate of moisture and oxygen entry into the glovebox due to diffusion, leakage, and material processing, the levels will eventually begin to rise. At this point the purifier must be regenerated.

A saturated purifier can be regenerated by applying a combination of heat, reduction gas, and vacuum to remove the moisture from the molecular sieve and the oxygen from the catalyst. The regeneration cycle is manually initiated by the user. See Section 5.2 for details on purifier regeneration.

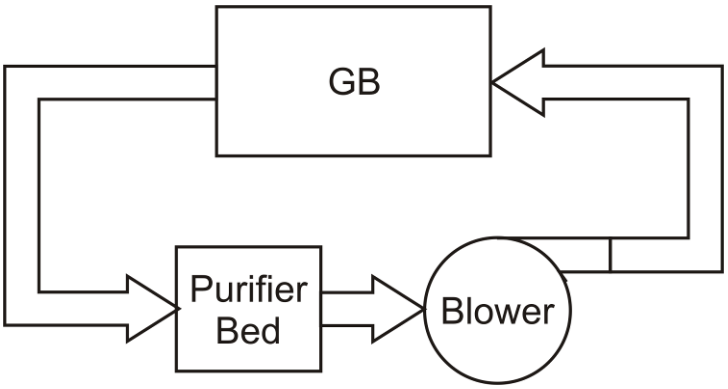



**Figure 1-5**
**Purifier and Circulation Blower Configuration**

### 1.3.2 Pressure Control

The OMNI-Lab system is designed to regulate the pressure in a glovebox enclosure within user selected limits. The control system monitors the pressure using a solid state pressure transducer and displays it on the screen. When the pressure drops below the low set limit, the V1 (inert gas supply) solenoid valve is energized, which admits gas into the glovebox to raise the pressure. When the pressure rises above the high set limit, the V2 (vacuum supply) solenoid valve is energized, opening the glovebox to the vacuum pump and lowering the pressure in the glovebox.

Additionally, the pressure can be manually controlled using a footswitch to make fine pressure adjustments within the preset limits. This makes it easier for the operator to work in the glovebox. See Section 4.1 for more details.

### 1.3.3 Glovebox Purge

The system is designed to allow the user to purge the glovebox with inert gas to displace the existing atmosphere. This is useful for establishing a relatively inert atmosphere during initial start-up, or to clean up after a repair or unintentional exposure to air. See Sections 3.3 and 6.2 for additional information on glovebox purge.

# 2 INSTALLATION

## 2.1 GENERAL

Installation specifications including suggested work area for your OMNI-Lab are provided in a separate document.

## 2.2 UNPACKING AND INSPECTION

Remove all the plastic wrapping from the unit. Carefully inspect for any sign of shipping damage. Call VAC immediately if any damage is noted.

**NOTE: Be careful NOT to open the circulation valves at this point (ref. Figure 1-1 or 1-2, item 7). These valves should remain closed until an initial purge process has been completed. As a reminder, there is a warning tag attached to the valves when the unit is shipped. Follow the instructions on the warning tag!**

The system has been shipped from the factory after a complete regeneration of the gas purifier. Opening the circulation valves before purging the glovebox with an inert gas will contaminate the purifier charge with air and will necessitate another regeneration cycle.

**NOTE: If the system has an oxygen analyzer installed, leave the SAMPLE/AIR CAL gas selector valve in the AIR CAL position. There is red tape on this valve as a reminder.**

Rotating the oxygen analyzer SAMPLE/AIR CAL gas selector to the SAMPLE position will expose the sensor cell to air, which will quickly destroy its ability to detect trace oxygen levels later.

To avoid damage, the gloves are not installed on the system. Install them now using the Initial Glove Installation Procedure on the following page.

## 2.3 INITIAL GLOVE INSTALLATION PROCEDURE

1) Remove stainless steel clamp over the outer O-ring.
2) Remove O-ring and plastic sheet from glove port.
3) Install new glove by folding glove cuff inside out approximately 2 inches.
4) Place glove into glove port/glovebox and stretch cuff onto glove port flange. The bead in the cuff should be positioned in the inner groove closest to the glovebox.
5) Adjust glove so that thumb is pointed in the correct direction (up for ambidextrous, horizontal for formed L/R gloves).
6) Stretch O-ring over glove and into the outer groove. Make sure there are no wrinkles, especially under the O-ring.
7) Cover O-ring with black plastic electrical tape.
8) Install clamp over O-ring.

A. Glove port ring
B. Glove
C. O-ring
D. Black plastic tape (electrical tape)
E. Clamp

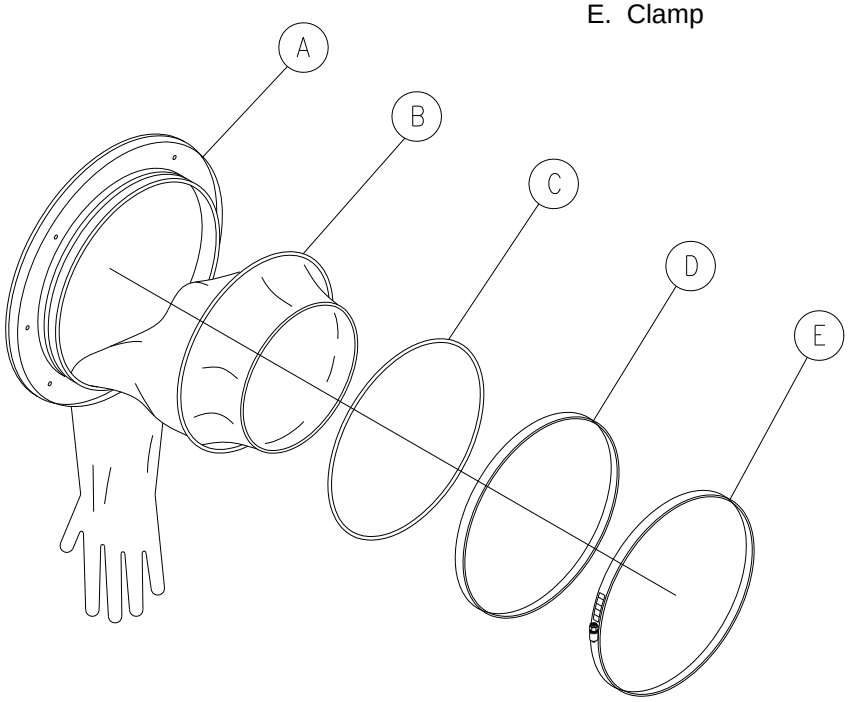



**Figure 2-1**
**Glove Assembly, Exploded View**

## 2.4 UTILITY CONNECTIONS

1) Before proceeding to the next step, be sure that the power switch on the bottom of the control panel is in the OFF position (ref. Figure 1-1 or 1-2, item 5).

2) Verify your electric utility service voltage matches the listing on the specification plate, normally found on the side of the glovebox behind the control panel. The unit requires a minimum 15 amp circuit for 110 volt systems and a minimum 8 amp circuit for 220 volt systems. There is a single electrical utility connection for the system, and a separate connection for the duplex receptacle located in the glovebox.

3) Prepare an inert gas source and a regeneration gas source for connection to the customer service connections. These sources may be bottles, cylinders or dedicated connections. Typical inert gas sources include argon or nitrogen. The regeneration gas must be nitrogen or argon with 3-5% hydrogen content. Install a dual stage inert gas regulator and a dual stage regeneration gas regulator set to 35 psi on each source. **Note: Dual stage pressure regulators are required for proper system operation.** Now connect a 3/8" inert gas line from the regulator to the inert gas connection (1/4" NPT). Connect a 3/8" line from the regeneration gas regulator to the regeneration gas connection (1/4" NPT). Figure 1-3a shows the location of these connections.

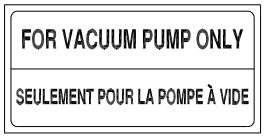
4) Connect exhaust lines to fume hood or exhaust duct as required. The vacuum pump exhaust (NW25 connection) is located on top of the vacuum pump. If connected, use a 1" exhaust line. The purge outlet from the purifier (1/4" NPT) is found next to the inert gas and regeneration gas connections (ref. Figure 1-3a, item 4). If used, this should be a 3/8" line. The glovebox purge outlet (1-1/2" I.D., 1-5/8" O.D. sweat flange) is located on top of the glovebox on the right side. If used, a 1" line is sufficient.

## 2.5 MARKINGS

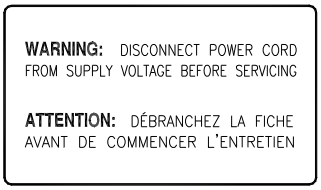
Fuse Labels – There is a fuse panel adjacent to the pneumatic/electrical panel on the top rear of the OMNI-Lab (ref. Figure 1-4, item 4). There are 3 fuse labels corresponding to the (2) mains supply fuses, the 24 V transformer secondary fuse, and the gas purifier heater fuse. A sample for the mains supply fuses is shown below:

| FUSE RATINGS | CAUTION: DISCONNECT POWER BEFORE SERVICING. FOR CONTINUED PROTECTION AGAINST RISK OF FIRE, REPLACE WITH ONLY SAME TYPE AND RATING FUSE.<br>ATTENTION: COUPER LE COURANT AVANT L'ENTRETIEN. AFIN D'ASSURER UNE PROTECTION PERMANENTE CONTRE LES RISQUES D'INCENDIE, REMPLACER UNIQUEMENT PAR UN FUSIBLE DU MÊME TYPE ET MÊME CALIBER. |
|---|---|
| SIZE: 3AG | |
| TYPE: TIME-DELAY | |
| T250V, FOR 115V~: 10 A | |
| T250V, FOR 230V~: | |

Vacuum Pump AC Receptacle – Use only for vacuum pump. The following labels are found next to this receptacle:




The following label appears on the right side adjacent to the system power cord:




**WARNING: Do not attempt to access any components on the OMNI-Lab without disconnecting the power cord.**

# 3 START-UP

## 3.1 START-UP PROCEDURE

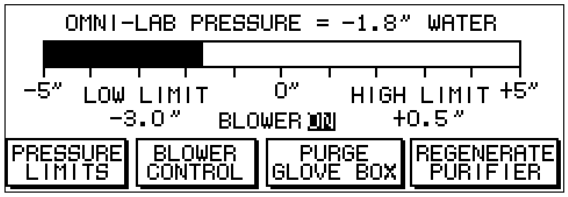
The following section describes how to properly start-up your OMNI-Lab. Closely follow the procedures to ensure safe operation and to avoid damaging the unit. Basic operation of the system is straightforward with the touchscreen interface.

**WARNING: If the equipment is used in a manner not specified by VAC, the protection provided by the equipment may be impaired.**

The following procedure brings the system on line. After step 3 below, the screen should display the actual pressure in the lab on the pressure graphic. All utility connections should be in place at this point.

**NOTE: The glovebox circulation valves should still be closed, and the oxygen analyzer, if present, should be in the AIR CAL mode. This will prevent contamination of the purifier charge and the oxygen sensor cell.**

1) Turn ON the system power switch (located at the bottom of the control panel). Turn ON the vacuum pump.
2) The touchscreen will initialize and after a few seconds the main screen will appear.

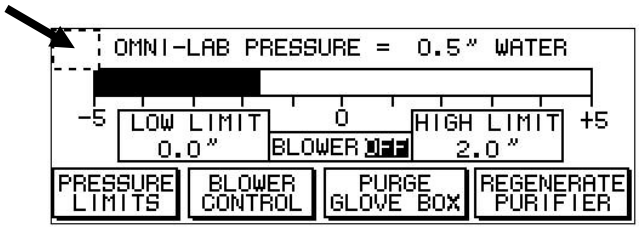



Unlike this sample screen, the pressure should read approximately ambient and the circulation blower will default to OFF when the system comes on line. Don't turn the blower on yet.

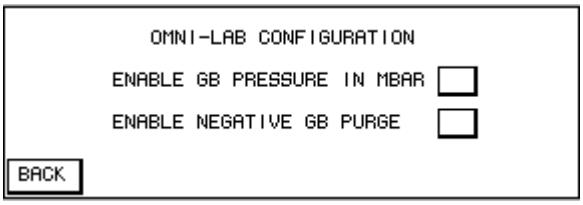
## 3.2 CONFIGURATION OPTIONS

The default pressure display units are inches of water column. If pressure in mbar is desired, it may be enabled using the Configuration screen. The default glovebox purge is at positive pressure, however this may be changed to a negative pressure purge using the Configuration screen. Follow these instructions to configure the pressure units and the glovebox purge type.

1) Press the upper left corner of the main screen.



2) The Configuration screen will appear.




3) Select the desired option(s), then press the BACK button to save this configuration and return to the main screen.

## 3.3 ESTABLISHING AN INERT ATMOSPHERE

### 3.3.1 Positive Pressure Glovebox Purge

A glovebox purge must be initially performed. To do this, press PURGE GLOVEBOX. At the following screen, press START GLOVEBOX PURGE. The glovebox pressure limits will automatically be reset to a low limit of 3" water column and high limit of 5" water column. Assuming the glovebox was at approximately 0" water column to start, the inert gas valve will open and the pressure will increase in the glovebox. Open the glovebox purge valve when the pressure is approximately 3" water column Adjust the valve so the glovebox pressure reaches equilibrium at approximately 1.5" water column Purge the glovebox with about 10 volume changes of inert gas, which usually requires at least one K-type cylinder per workstation (pair of gloves). If using house gas, purge for approximately 45 minutes per workstation. The glovebox atmosphere should contain less than 200 ppm oxygen after completing this purge, which the purifier system can then remove down to below 1 ppm.

### 3.3.2 Negative Pressure Glovebox Purge (Optional)

If the negative pressure purge option has been chosen (ref. Section 3.2), the OMNI-Lab glovebox purge vent must be connected to negative pressure ventilation system. The ventilation system pressure must be less than -1" water column. Press PURGE GLOVEBOX, and at the following screen press START GLOVEBOX PURGE. The glovebox pressure limits will automatically be reset to a low limit of -0.5" water column and a high limit of 0" water column. When the glovebox purge vent is opened and the glovebox pressure decreases to a level below -0.5" water column, the OMNI-Lab inert gas valve will energize, allowing purge gas to flow. Adjust the purge vent valve so the pressure reaches equilibrium at a level of approximately -1" water column. Purge the glovebox with about 10 volume changes of inert gas, which usually requires at least one K-type cylinder per workstation (pair of gloves). If using house gas, purge for approximately 45 minutes per workstation. The glovebox atmosphere should contain less than 200 ppm oxygen after completing this purge, which the purifier system can then remove down to below 1 ppm.

## 3.4 START-UP CONCLUSION

The last step involves bringing the purifier system on line.

The glovebox circulation valves should still be closed. The purifier leaves the factory regenerated and is ready to begin removing moisture and oxygen from the glovebox. When the glovebox has been sufficiently purged, press STOP PURGE. The screen prompts you to first close the purge valve and then press STOP PURGE again. The pressure limits are then returned to their pre-purge values. You may adjust the pressure limits as necessary by pressing PRESSURE CONTROL.

**The glovebox circulation valves may now be opened**. Turn on the circulation blower by pressing BLOWER CONTROL. The oxygen analyzer, if present, can now be put in the SAMPLE mode by turning the knob counter-clockwise.

As the glovebox atmosphere begins to circulate through the purifier, the oxygen and moisture levels will decrease quickly. The oxygen level should drop to below 1 ppm within one hour. The moisture will take longer initially to reach this level, as it will typically take several days for the circulation process to scrub the moisture from the interior surfaces of the glovebox.

# 4 GLOVEBOX PRESSURE CONTROL

## 4.1 SETTING THE PRESSURE CONTROL LIMITS

The touchscreen displays the pressure in a horizontal bar graphic with the operating pressure limits displayed below. The PRESSURE CONTROL touch key brings up another screen that allows the user to set the high and low pressure limits for the glovebox. The low pressure limits are adjustable from –5" water column to +4.5" water column, and the high pressure limits are adjustable from –4.5" water column to +5" water column. The limits are set by pressing the DEC or INC touch keys for either limit. The minimum pressure window size is 0.5" water column.

If the pressure limits do not encompass the actual pressure in the glovebox, the inert gas valve or the vacuum valve will be actuated to bring the pressure within the limits. The pressure can be adjusted within the pressure limits by use of the footswitch. Press the right or left side of the footswitch to increase or decrease the glovebox pressure, respectively. The footswitch is overridden when the pressure is outside the limits.

## 4.2 GLOVEBOX SAFETY CONTROL PRESSURE LIMITS

The pressure safety limits are set at ±10" water column. If the glovebox pressure for some reason exceeds one of these limits, all valves are inactivated, the vacuum pump is shut down and an alarm sounds. If the system is in process of purifier regeneration, it is aborted. A warning screen appears, and the user is prompted to find the source of the over/under pressure situation.

One example of a situation like this is when the inert gas source is absent (disconnected or depleted) and there is an unchecked vacuum source which continues to pull the glovebox pressure in the negative direction. If the OMNI-Lab vacuum pump is the source, at –10" water column it will automatically be turned off. At this point the observant user might note that the antechamber evacuation valve is open, as well as the inner antechamber door, and the user would then 1) close the door and 2) restore the inert gas connection. Upon pressing the CONTINUE touch key at the warning screen, the system would then be able to bring the pressure back into the normal range.

# 5 PURIFIER SYSTEM OPERATION

The OMNI-Lab provides consistent, dependable moisture and oxygen removal to levels below 1 ppm. The circulation flow has been optimized for fast removal without the need for glovebox or circulation blower cooling. The purifier uses copper catalyst for oxygen removal and molecular sieve for moisture removal.

**WARNING: Sulfur and sulfur compounds such as $H_2S$, RSH, COS, $SO_2$, $SO_3$, etc., poison (deactivate) the reactant material in the purifier. Large quantities of halides, chlorides, halogen (Freon), alcohol, hydrazine, phosphene, arsine, arsenate, mercury, and saturation with water may also deactivate the oxygen reactant. The system should have a suitable trap if any of these chemicals are present.**

## 5.1 CIRCULATION BLOWER CONTROL

Pressing the BLOWER CONTROL key turns the blower on or off. The OMNI-Lab blower is automatically turned off during purifier regeneration. At the end of a regeneration, the user is prompted to open the circulation valves and turn the blower back on. These steps have been taken to maximize the life of the blower.

### 5.1.1 Power Interruption During Circulation

The system stores the blower control state in non-volatile memory. When power is restored, the circulation blower will come up in the same state as it was when the power was interrupted.

## 5.2 REGENERATION

The purifiers have a specific oxygen and moisture removal capacity that is dependent on the quantity of catalyst material. The regeneration cycle restores the purifier's ability to remove contaminates. The glovebox must have an inert atmosphere of less than approximately 200 ppm before purifier regeneration or contamination may occur during the cycle.

All regeneration sequencing is automatic. The standard regeneration routine takes 12 hours. Additionally, there is a selectable 3 hour solvent removal routine that may be started before the standard regeneration. At the end of the solvent removal routine, the standard regeneration automatically begins. The user may abort a regeneration cycle using the menu instructions on the display. The display allows the user to view the current mode of the regeneration and the remaining time of the cycle.

The cycle requires regeneration gas with 3-5% hydrogen at approximately 35 psig. A typical cycle for the OMNI-Lab uses approximately 40 cubic feet of regeneration gas.

The standard 12 hour regeneration cycle is as follows:

| Function | Solenoid Valve Energized |
|---|---|
| 1) Vacuum Test | V5, then V6 |
| 2) Heat | - |
| 3) Heat, Purge with Regeneration Gas | V3, V4 |
| 4) Evacuate | V5 |
| 5) Refill (from Glovebox) | V6 (Intermittent) |

### 5.2.1 Beginning a Regeneration Cycle

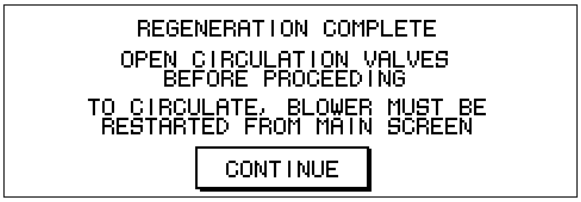
**ALWAYS close the circulation valves before starting the regeneration cycle. The screen reminds the user to do this at the beginning of the cycle. Do not forget to open these valves after completing a regeneration.**

You may begin a regeneration while purging the glovebox, or you may purge the glovebox at any time during the regeneration. However, it is recommended that the glovebox be purged down to below 200 ppm oxygen BEFORE the regeneration is started. This is because the OMNI-Lab oxygen analyzer uses the differential pressure across the circulation blower to sample the glovebox atmosphere, and the blower is off during regeneration. So, if you purge during the cycle, the oxygen analyzer will not give an accurate reading due to lack of flow.

1) After verifying a sufficient supply of regeneration gas, press START REGENERATION from the main screen.
2) You are prompted to close the circulation valves. Close them now.
3) Press START STANDARD REGENERATION or START REGENERATION WITH SOLVENT REMOVAL.
4) There is an initial 20 second vacuum test to assure the circulation valves are closed. If they are not, the alarm will sound and the regeneration will be aborted. If the valves were closed and the alarm sounded, it is possible that operator movement in the gloves caused a false alarm triggering. If this is the case, remove your hands from the gloves for at least the first 10 seconds and start the regeneration again.
5) Status of the regeneration can be viewed by pressing the REGEN STATUS key.
6) The time remaining for the regeneration is displayed at the bottom of the main screen.

### 5.2.2 The End of a Regeneration Cycle

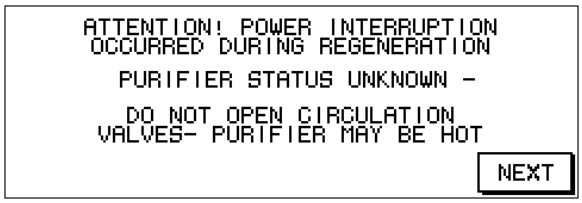
If the regeneration has completed successfully, a message will appear:




To begin circulating through the regenerated purifier, open the circulation valves, press CONTINUE and restart the blower by pressing BLOWER CONTROL from the main screen.

### 5.2.3 Power Interruption During Regeneration

The purifier will typically be regenerated while the system is unattended. A power outage will abort the regeneration and the system will display the following messages when power is restored:





Depending on where the regeneration cycle was when the power went off, the purifier may be hot or under vacuum. It also may be filled with regeneration gas if the outage happened during the purge portion of the regeneration cycle. Keep the circulation valves closed to avoid contaminating the glovebox or introducing heat or leftover regeneration gas into the glove box.

The safest thing to do is to restart the regeneration after allowing the purifier to cool. You can get a general idea by feeling the purifier insulation blanket. If it is cool or lukewarm to the touch, restart the regeneration, otherwise wait a few hours. This will prevent any damage to the purifier charge.

# 6 GLOVEBOX AND ANTECHAMBER OPERATION

## 6.1 GENERAL

The OMNI-Lab's glovebox provides a working volume of inert atmosphere nearly free of moisture and oxygen. The glovebox is a hermetically sealed, stainless steel enclosure with a full-view window. Installed is a right side mounted 15" inside diameter antechamber with an interior and exterior entry/exit airlock door, used for passing materials in and out without disturbing the glovebox atmosphere. All materials are passed in and out of the glovebox on a sliding tray installed in the antechamber.

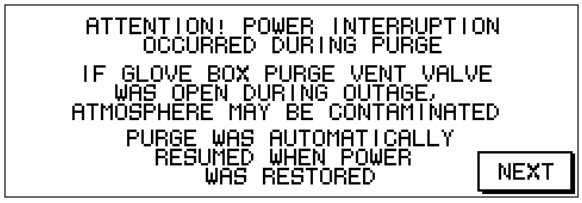
9" diameter glove ports and butyl rubber gloves, mounted in the full-view window, provide easy access to all areas of the glovebox. Two standard customer interface connections are located on the left side of the glovebox. Electrical connections inside the glovebox are provided with a standard duplex receptacle box on the lower right side.

## 6.2 GLOVEBOX PURGE PROCEDURE

Follow the instructions in Section 3.3, **Start Up Procedure**, **Establishing an Inert Atmosphere** , with a couple of exceptions. If a purge is being done to bring oxygen and moisture levels down quickly after a glovebox contamination, it is obviously not necessary to use as much gas as is described in the initial establishment of the atmosphere. Also, in this case the circulation valves can be left open.

### 6.2.1 Power Interruption During Glovebox Purge

If the power goes off during the purge mode, the system will remember and return to the purge mode when power is restored. The following message is displayed:




The manual glovebox purge valve requires attention in case of inadequate gas supply or a power interruption, so it is recommended that the system be actively monitored when the purge valve is open.

## 6.3 ANTECHAMBER EVACUATE/REFILL PROCEDURE

**CAUTION: The vacuum pump in the system often provides vacuum for the antechamber, glovebox pressure control, and purifier regeneration. To avoid possible cross contamination, avoid evacuation of the antechamber during the evacuation cycle of the purifier regeneration.**

Any time the antechamber is exposed to atmosphere, the following procedure must be used before opening the inside antechamber door to the glovebox:

(a) Both antechamber doors must be closed as well as the antechamber refill valve (1/4 inch valve connecting the glovebox to the antechamber).
(b) Open the antechamber evacuation valve, a 1 inch ball valve on the main antechamber or a ¼ inch valve on the mini antechamber.
(c) Evacuate the antechamber for the specified amount of time (see below).
(d) Close the antechamber evacuation valve and open the refill valve. The antechamber will refill from the glovebox.
(e) Repeat the evacuation/refill process at least two more times before opening the inner door.
(f) On the final refill cycle, close the refill valve when the antechamber vacuum gauge stabilizes at the same pressure as the glovebox (about 0" Hg on the gauge).
(g) The inside antechamber door may then be opened.

**RECOMMENDED EVACUATION CYCLES AND TIMES**

15" diameter x 24" long main antechamber: 3 cycles, 3 minute evacuation time minimum per cycle.

6" diameter x 12" long mini antechamber: 3 cycles, 1 minute evacuation time minimum per cycle.

**CAUTION: VAC does not recommend utilizing a single evacuation/refill cycle, regardless of length, before opening the inner antechamber door. Multiple cycles are required to avoid affecting the oxygen and moisture levels established in the glovebox. These times and/or cycles may need to be increased based upon the materials being brought through the antechamber. For example, relatively porous materials need more time or more cycles.**

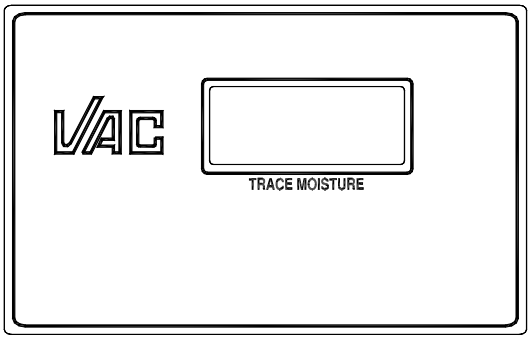
# 7 MOISTURE AND OXYGEN ANALYZERS

The OMNI-Lab provides optional moisture and oxygen analyzers mounted on the control panel. There are 2 models of each type of analyzer. The basic analyzers provide autoranging displays from 10 ppm to percent ranges. The moisture and oxygen analyzers are also available in models with added user adjustable setpoints for audio alarm activation.

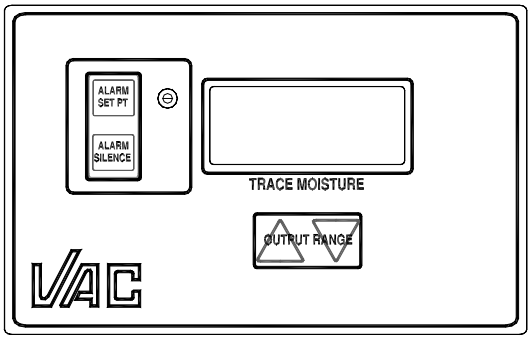
## 7.1 MOISTURE ANALYZER

The moisture analyzer consists of a NIST traceable thin film aluminum oxide probe installed in the glovebox with a two wire electrical connection to the moisture display.

### 7.1.1 Moisture Display Models




Basic Model




Moisture Display with Alarm

Both models provide a 3 1/2 digit LCD display that will allow monitoring of moisture levels from ppm to percent ranges.

### 7.1.2 Moisture Display with Alarm

If your OMNI-Lab is equipped with this model, an audio alarm will sound when the moisture level exceeds a user defined set point. The display also indicates ALARM in the lower left corner when this occurs. The user can silence the alarm by pressing ALARM SILENCE, but the ALARM display will remain until the moisture level is once again below the set point.

Setting the Alarm Level

1) Press the UP and DOWN arrows simultaneously and hold them down until the range is displayed.
2) Release the UP and DOWN arrows, then quickly select the range using the UP or DOWN arrow. If the range is correct, go to the next step. Note that the range is the maximum value of the alarm setpoint, so for example, if the intended alarm setpoint is 5 ppm, choose the 10 ppm range, and if the intended alarm setpoint is 12 ppm, choose the 50 ppm range.

3) Immediately press ALARM SET PT. The display will indicate ALARM in the lower left corner, and the current alarm set point will be displayed. Hold ALARM SET PT down and adjust the adjacent potentiometer until the desired setpoint is reached.
4) Release ALARM SET PT and after 5 seconds the normal display returns.

If at any point during this procedure, more than 5 seconds elapse between the time a key is released and the time the next key is pressed, the display reverts to normal and you will need to start again. DO NOT adjust the potentiometer while the display is in the normal mode - it will have no effect on the alarm setpoint until you re-enter the alarm setpoint procedure.

Checking the Alarm Level

Press ALARM SET PT while the normal display is on.

### 7.1.3 Changing the Moisture Probe

All moisture probes have a calibrated output so that the probes are interchangeable. The moisture probes should be calibrated approximately once a year and must be sent back to the factory for calibration.

To remove the moisture probe:

1) Disconnect the electrical connector on the probe.
2) Set the glovebox pressure between +4 and +5 inches of water column so the glovebox atmosphere leaks out while changing the probe.
3) Unscrew the probe from the coupling using the hex nut collar.
   Do not use the probe body to unscrew the probe.
4) Plug the coupling with a 3/4-16 thread bolt (wrap Teflon tape around the threads to prevent any leaking) while having the probe calibrated.
5) Return the glovebox pressure to normal conditions.

To re-install the probe, reverse the procedure.

### 7.1.4 Moisture Probe Specifications

Sensor Type: Thin film aluminum oxide moisture sensor probe

Dewpoint Range: -80$^{o}$C to +20$^{o}$C (display is in ppm, range is 0.5 ppm to 2.3%)

Accuracy: ±2$^{o}$C from –65 to 20$^{o}$C, ±3$^{o}$C from –80 to -66$^{o}$C

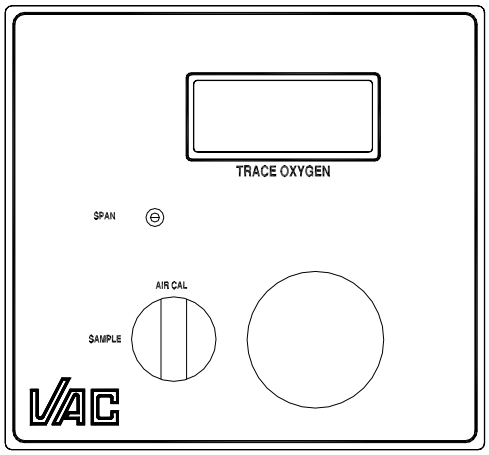
Repeatability: ±0.5$^{o}$C from –65 to 20$^{o}$C, ±1.0$^{o}$C from –80 to -66$^{o}$C

Response Time: <5 seconds for 63% of a step change of moisture content in either wet-up or dry down cycle.

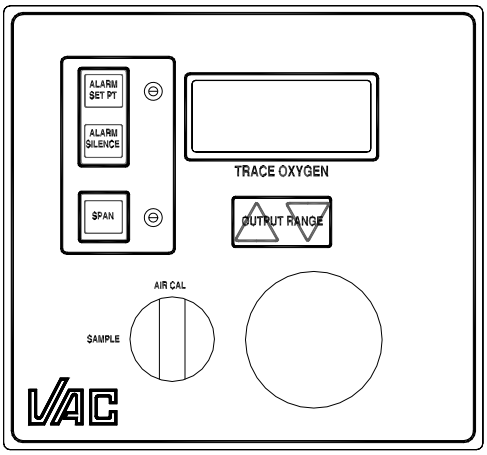
Operating Temperature: -40$^{o}$C to 60$^{o}$C

## 7.2 OXYGEN ANALYZER

### 7.2.1 Oxygen Analyzer Models




Basic Model- No Alarm




Oxygen Analyzer with Alarm

Each oxygen analyzer model features an autoranging 3 1/2 digit LCD display, front panel sensor access, and a manual isolation valve for air calibration using the front panel potentiometer.

The VAC oxygen analyzers use an industry standard electrochemical sensor. This measures the concentration of oxygen in a gas stream, using an oxygen specific chemistry. It generates an output current in proportion to the amount of oxygen present, and has zero output in the absence of oxygen, thus avoiding any requirement to zero the analyzer. The cell is linear throughout its range. Calibration of the unit is performed using ambient air.

In the SAMPLE mode, a small amount of the glovebox atmosphere flows through the analyzer, across the sensor cell and is then returned to the glovebox. Use is made of the differential pressure across the circulation blower to provide flow through the analyzer. In the AIR CAL mode, the sensor is isolated from the glovebox, exposed to air for a short amount of time, and the user adjusts the display to read 20.9% oxygen, the normal percentage of oxygen in dry air.

### 7.2.2 Oxygen Analyzer with Alarm

If your OMNI-Lab is equipped with this model, an audio alarm will sound when the oxygen level exceeds a user defined set point. The display also indicates ALARM in the lower left corner when this occurs. The user can silence the alarm by pressing ALARM SILENCE, but the ALARM display will remain until the oxygen level is once again below the set point.

Setting the Alarm Level

1) Press the UP and DOWN arrows simultaneously and hold them down until the LCD shows 3 dashes followed by a display of the output range setting. DO NOT RELEASE THE ARROW BUTTONS UNTIL THE OUTPUT RANGE IS DISPLAYED.

2) Release the UP and DOWN arrows, then quickly select the range using the UP or DOWN arrow. If the range is correct, go to the next step. Note that the range is the maximum value of the alarm setpoint, so for example, if the intended alarm set point is 5 ppm, choose the 10 ppm range, and if the intended alarm set point is 12 ppm, choose the 50 ppm range.
3) Immediately press ALARM SET PT. The display will indicate ALARM in the lower left corner, and the current alarm set point will be displayed. Hold ALARM SET PT down and adjust the adjacent potentiometer until the desired setpoint is reached.
4) Release ALARM SET PT and after 3 seconds the normal display returns.

If at any point during this procedure, more than 5 seconds elapse between the time a key is released and the time the next key is pressed, the display reverts to normal and you will need to start again. DO NOT adjust the potentiometer while the display is in the normal mode - it will have no effect on the alarm setpoint until you re-enter the alarm setpoint procedure.

Checking the Alarm Level

Press ALARM SET PT while the normal display is on.

### 7.2.3 Air Calibration

The oxygen analyzer should be calibrated approximately every 30 days. If the glovebox atmosphere is known to have been consistently in the low ppm range, the calibration interval may be increased to approximately 60 days, which will prolong the cell life. Exposure to air rapidly depletes the fuel cell, so do not calibrate the unit on air for more time than is absolutely necessary.

There are two separate calibration procedures. The first is to be used for the basic oxygen analyzer model (without alarm). The second is to be used for the oxygen analyzer with alarm.

#### 7.2.3.1 Air Calibration Procedure (No Alarm)

1) Rotate the SAMPLE/AIR CAL gas selector valve to the AIR CAL position. This will seal off the sample in/out gas ports between the analyzer and glovebox and therefore will not allow ambient air to diffuse in.
2) Unscrew the cell cap from the front panel of the analyzer. This will expose the oxygen sensor to ambient air which consistently contains 20.9% oxygen. QUICKLY start fanning air towards the exposed oxygen sensor. This will bring the level of oxygen inside the sensor compartment to 20.9% from previous low levels. After 30 to 45 seconds the oxygen reading will start to stabilize.
3) Once the reading has stabilized, adjust the SPAN potentiometer with a small screwdriver until the LCD reads 20.9%. Please note, for optimum results, this entire calibration procedure should take less than 90 seconds.
4) Calibration is now complete. Verify that the sealing o-ring is in place in the cell cap groove, and clean and free of any particulate. **Immediately** reinstall the cell cap, being careful not to cross thread it, and tighten firmly by hand. Do not over tighten. Rotate selector valve back to SAMPLE which will allow low oxygen level gas from the glovebox to flow past the sensor.

#### 7.2.3.2 Air Calibration Procedure (Analyzer with Alarm)

1) Rotate the SAMPLE/AIR CAL gas selector valve to the AIR CAL position. This will seal off the sample in/out gas ports between the analyzer and glovebox and therefore will not allow ambient air to diffuse in.
2) Unscrew the cell cap from the front panel of the analyzer. This will expose the oxygen sensor to ambient air which consistently contains 20.9% oxygen. QUICKLY start fanning air towards the exposed oxygen sensor. This will bring the level of oxygen inside the sensor compartment to 20.9% from previous low levels. After 30 to 45 seconds the oxygen reading will start to stabilize.
3) Once the reading has stabilized, you must gain security access into the analyzer. Press the UP and DOWN arrows simultaneously and hold them down until the LCD shows 3 dashes followed by a display of the output range setting. DO NOT RELEASE THE ARROW BUTTONS UNTIL THE OUTPUT RANGE IS DISPLAYED. Release the arrow buttons and within 3 seconds press and continue holding down the SPAN button while adjusting the SPAN potentiometer with a small screwdriver. Adjust it until the LCD reads 20.9%, then release the span button.

   After a few seconds, the unit will save the new calibration data and return to normal operating mode. Please note, for optimum results, this entire calibration procedure should take less than 90 seconds. If you make a mistake at any point, let go of the buttons for 5 seconds and allow the analyzer to cycle out of the security mode and then regain access, and repeat above steps.

4) Calibration is now complete. Verify that the sealing o-ring is in place in the cell cap groove, and clean and free of any particulate. **Immediately** reinstall the cell cap, being careful not to cross thread it, and tighten firmly by hand. Do not over tighten. Rotate selector valve back to SAMPLE which will allow low oxygen level gas from the glovebox to flow past the sensor.

### 7.2.5 Oxygen Sensor Cell Life

Typical useful life of the sensor cell is 6 months to more than 1 year, depending on the levels of oxygen to which the cell has been exposed. The oxygen analyzer with alarm has a feature whereby the user may monitor the approximate life left in the cell by pressing the SPAN button. A number is displayed between 1 and 1000, which indicates the position of the SPAN potentiometer. A reading that approaches 1000 means the sensor cell is near the end of its useful life.

Noting the difference in readings between consecutive calibrations is the best predictor of remaining cell life. Assuming regular calibration intervals, this difference should remain fairly constant until near the end of the cell life, at which point the difference will increase substantially. The user should be prepared to replace the cell at the next calibration interval if this occurs.

### 7.2.6 Oxygen Sensor Replacement

The sensor is provided in a special sealed bag. Do not open this until you are immediately ready to install the sensor.

1) Rotate the SAMPLE/AIR CAL gas selector valve to the AIR CAL position.
2) Unscrew the cell block cap, being careful not to lose the O-ring.
3) Carefully remove old cell by pulling the tab on the sensor label.
4) Inspect the cell block cavity, and if there is any sign of moisture, clean it out with a Q-tip or similar. Make sure that the contact springs inside the block are intact. Be careful not to snag them with the Q-tip.
5) Carefully open the bag using a pair of scissors or a knife. Make sure you don't cut yourself or stab the sensor! Make sure that there is no sign of any liquid in the bag, if so, do not proceed - you need a new sensor.
6) Remove the plug or other device that acts as a shorting clip. This may be found on the connection plate on the back of the sensor.
7) Holding the sensor by its tab, membrane side down, slide it into the cell block (gold plated contact side of sensor should be facing up touching the cell block contacts). The membrane side is covered by a convex gold plated mesh.

### 7.2.7 Oxygen Analyzer Specifications

Both Models

Standard ranges: 0 - 10 ppm, 0 - 100 ppm, 0 -1000 ppm, 0 – 10,000 ppm, 0 -25%

Sensitivity: 0.5% of full scale

Repeatability: +/- 1% of full scale at constant temperature, all scales except
+/- 3% of full scale at constant temperature, 0-10 ppm scale

Operating temperature: 5 - 45°C

Humidity: < 85%, non-condensing

Operational conditions: Pollution degree 2, Installation category I I.

Drift: +/- 1% of full scale in 4 weeks at constant temperature (dependent on sensor)

Expected cell life: 6 months.

Response times:

Trace: 90% of full scale in less than:

0 - 10 ppm - 25 sec

Other ranges -10 sec

Power requirements: 500mA @24VDC, wall mount adapter supplied for 110 VAC or 220 VAC 50/60 Hz.

Oxygen Analyzer with Alarm Model

Analog Output: 0 - 1 VDC, output depends on range selection.

Oxygen Alarm Contacts: 2 separate alarms. Contacts rated at 1 A, 110 VAC/30 VDC. Common, normally open, normally closed screw terminals for each alarm. Alarm 2 contacts are reset by ALARM SILENCE button on display.

# 8 MAINTENANCE AND TROUBLESHOOTING

## 8.1 GENERAL

Maintenance of the OMNI-Lab is uncomplicated due to the modular construction, integrity and simplicity of the design. However, standard safe practices should always be observed during maintenance.

Most maintenance and troubleshooting will involve external actuators and input transducers. External actuators include solenoid valves, circulation valves, and regeneration heaters. Input transducers include pressure sensor, moisture transmitter, and oxygen sensor.

## 8.2 ROUTINE MAINTENANCE

The following outlines several maintenance areas for providing optimal system performance. Always observe standard safe practices during maintenance of this system.

### 8.2.1 Glovebox

Use mild soap and water to clean the outside painted surfaces (do not use it on the window.) Dry the unit with compressed air. Glass cleaner may be used on the glovebox window.

### 8.2.2 Antechamber

Check the sealing O-rings periodically and replace when worn or damaged. Clean antechamber doors periodically with a mild solvent, and coat the sealing surfaces with a light coat of vacuum grease. If required, adjust antechamber door tension as follows (see Figure 8-1):

(a) Close door and loosen nut 2 (item J).
(b) Open door and rotate door clockwise (increase tension) or counterclockwise (decrease tension).
(c) Close door to fully closed position – firm pressure should be required to close door.
(d) Tighten nut 2 enough so that door cannot be rotated when opened.

NOTE: The mini antechamber doors look different, but are adjusted in the same way as described above.

### 8.2.3 Vacuum Pump

Replace the oil in the pump after each regeneration of the purifier to avoid moisture buildup. Refer to the pump manufacturer's instruction manual for oil replacement procedures and specifications.

### 8.2.4 Circulation Filters

The OMNI-Lab's circulation filters must permit gas to flow freely through the system. The pressure drop across the filters should not exceed 1 inch water column.

### 8.2.5 Lines and Connections

Inspect all lines, valves, fittings, and connections for mechanical and electrical integrity at 3-month intervals.

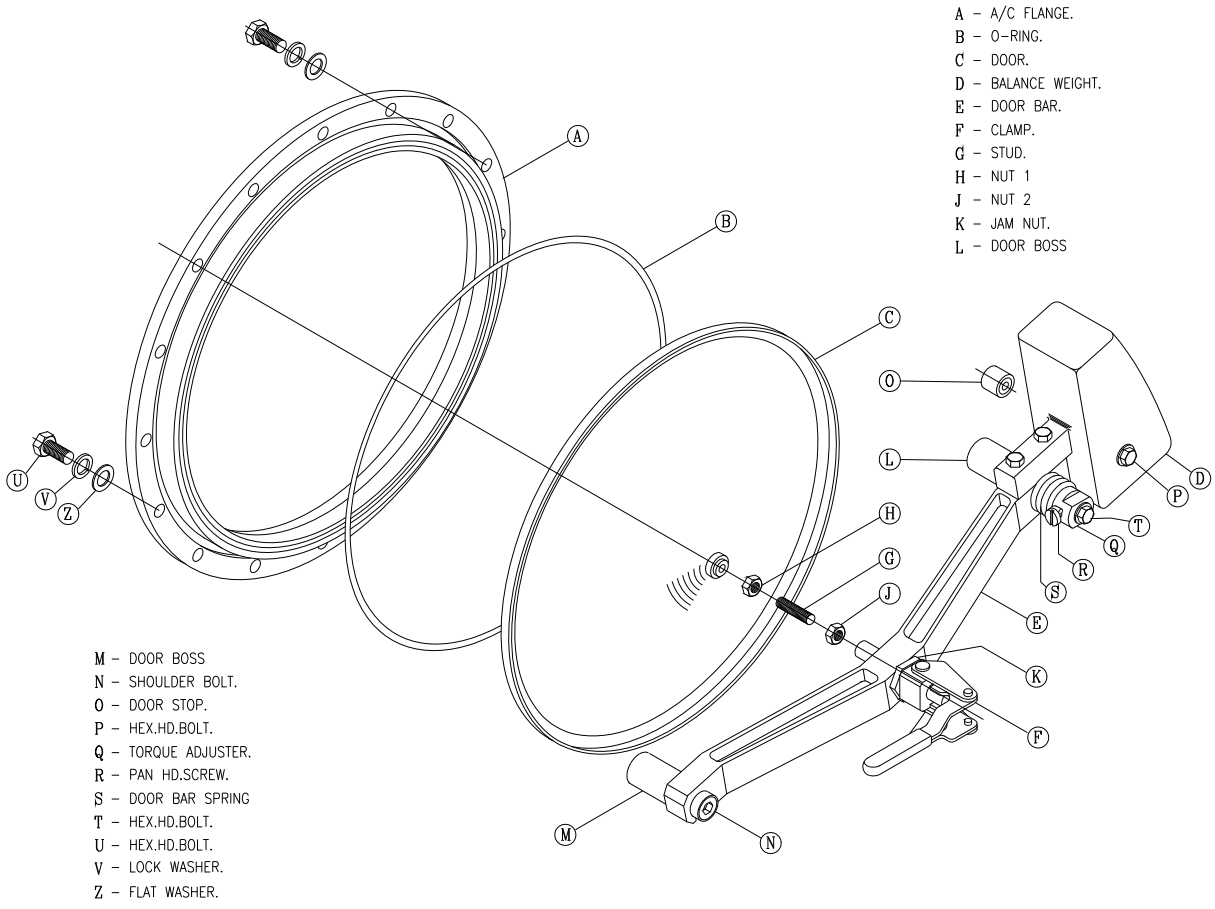



**Figure 8-1**
**Antechamber Door Assembly**

### 8.2.6 Glove Port Cover

The Internal Glove Port Cover is used to seal off the glovebox from the gloves to inspect or replace damaged gloves. The cover should be kept inside the glovebox. One per glovebox is provided.

### 8.2.7 Glove Replacement Procedure

1) This procedure assumes an inert atmosphere has been established and it is desired to maintain it while changing the glove. With hand in glovebox glove, pull cover through glove port until spring-loaded nylon clips latch onto the outside edge of the glove port. The O-ring surface should rest flat against the inside edge of the glove port. Tighten knob securely.
2) Damaged glove may now be removed and new glove installed (see Section 2.3, Initial Glove Installation Procedure) New glove requires purging of air prior to removing glove port cover as noted herein:

a) Increase and maintain positive pressure in glovebox at approx. +4” water column.
b) Loosen cover to allow glove to fill with inert gas from glovebox.
c) Once glove is pressurized, tighten cover again.
d) Roll glove slowly toward box, starting at fingers, intermittently releasing glove around glove port to allow pressure to release. Continue until glove has been rolled up to the glove port.
e) Repeat above process two or three times before removing cover and placing it back in the glovebox.

### 8.2.8 Glove Replacement Procedure Using Optional Evacuatable Glove Port Cover

1) This procedure assumes an inert atmosphere has been established and it is desired to maintain it while changing the glove.
2) Insert glove port cover through the glove port of the glove to be replaced, making sure that the cross bar (Figure 8-2, Item 4) is completely through the glove port (Figure 8-3, Item 8). Both ends of the bar will snap out allowing you to tighten the bar against the glove port by turning the center knob clockwise until the bar is secure against the glove port.
3) Locate the glove port cover vacuum valve beneath the 15 inch antechamber (near the vacuum pump plumbing). Open the valve at this time. Note that on some systems, the vacuum valve may be located at the top rear of the glovebox.
4) Slide valve on glove port cover should be in the refill position (Figure 8-2, Item 6).
5) Remove defective glove and replace per glove installation instructions.
6) By using the opposite glove, reach the sliding valve on the glove port and move it to the evacuate position.
7) At this time the glove will start evacuating. Allow glove to evacuate for approximately 3 minutes. Slide valve to the refill position, glove will refill. Repeat this process three times. Leave the slide valve in the refill position when finished.
8) Remove glove port cover from glove port, loosen center bar by turning knob counter clockwise.
9) Depress nylon tips on bar and push glove port into glovebox.

10) Store glove port cover on its bracket, top center of glovebox. Close the glove port cover vacuum valve.

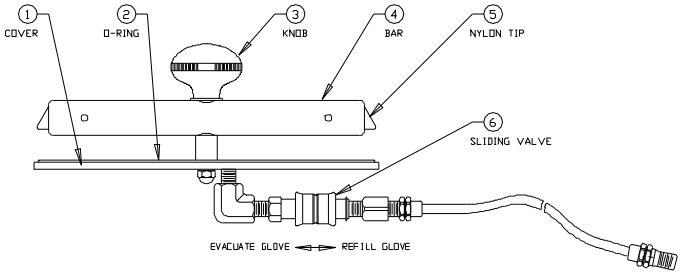



**Figure 8-2**
**Evacuatable Glove Port Cover**

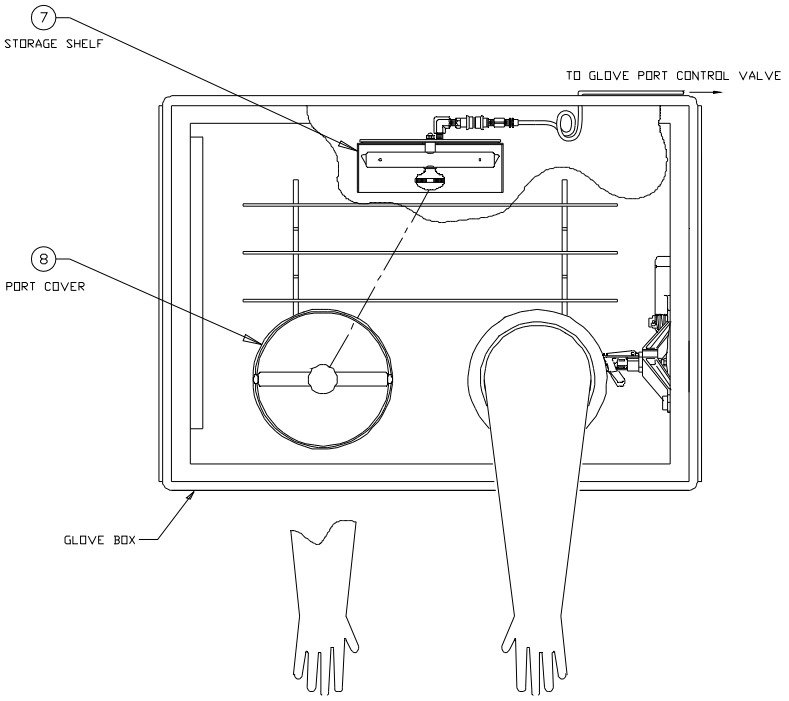



**Figure 8-3**
**Evacuatable Glove Port Cover**

## 8.3 TROUBLESHOOTING

### 8.3.1 Oxygen and Moisture Problems

| Symptom | Procedure |
|---|---|
| Gradual oxygen or moisture increase | 1) Verify that blower is running. If not, go to Section 8.3.5, Blower Problems. If levels do not drop, go to step 2.<br><br>2) Regenerate purifier. If problem still persists after regeneration, go to step 3.<br><br>3) Perform leak check on purification system. |
| High moisture / low oxygen readings | 1) Verify that the oxygen analyzer is reading correctly (calibrate or test with certified gas). If analyzer is reading correctly, go to step 2.<br><br>2) Verify that blower is running and that circulation valves are open.<br><br>3) Regenerate purifier. If problem still persists after regeneration, go to step 4.<br><br>4) Verify that moisture analyzer is reading correctly. |
| High oxygen / low moisture | 1) Verify that blower is running and that circulation valves are open.<br><br>2) Turn blower off. Purge glovebox. If level does not drop, then there may be a high oxygen level in the inert gas supply. If level does drop, go to next step.<br><br>3) Regenerate purifier. If problem still persists after regeneration, go to next step.<br><br>4) Verify that the oxygen analyzer is reading correctly (calibrate or test with certified gas). If analyzer is reading correctly, go to next step.<br><br>5) Perform leak test on glovebox and purification system. |

### 8.3.2 Pressure Problems

| Symptom | Procedure |
|---|---|
| Constant pressure decrease with pressure being corrected whenever lower set point is reached | 1) Set lower pressure limit to –1. If pressure decrease stops at 0, then perform the glovebox leak test (Section 8.3.12). If pressure decreases past 0, then go to next step.<br><br>2) Make sure that antechamber evacuation and refill valves are fully closed.<br><br>3) Refill both antechambers. If pressure decrease stops go to Section 8.3.6, Antechamber Problems.<br><br>4) Turn the vacuum pump off. If system has more than one pump, turn off the one dedicated to pressure control and regeneration. If pressure decrease stops, then either the V2 or V5 solenoid valve is leaking.<br>A. To determine which valve, turn the vacuum pump back on.<br>B. Turn blower off, then close the circulation valves.<br>C. If the box pressure continues to decrease, then V2 is leaking. If the box pressure stabilizes, then V5 is leaking.<br>D. Go to Section 8.4.1, Solenoid Valve Servicing.<br><br>5) If pressure still decreases after turning the pump off, check for any additional vacuum source connected to the glovebox. |
| Constant pressure increase with pressure being corrected whenever upper set point is reached | 1) Turn off the inert gas supply. If pressure increase stops, then the V1 solenoid valve is leaking. Verify that the gas pressure is not above 50 PSI (higher pressure can blow past the valve). If pressure increase continues, go to next step.<br><br>2) Turn off the regeneration gas supply. If pressure increase stops, then the V3 solenoid valve is leaking. Verify that the gas pressure is not above 50 PSI<br><br>3) If pressure increase continues after both gas supplies have been turned off, check for any additional gas source. |
| Box pressure decreases during antechamber evacuation | 1) Go to Section 8.3.6, Antechamber Problems. |
| Pressure increases past limit without being corrected | 1) Verify that the vacuum pump is running. If it is, go to the next step.<br><br>2) Depress the left side of the footswitch. If pressure decreases, there is a problem with the PLC. If it does not, go to the next step.<br><br>3) Verify that other solenoid valves are working. If not, check fuse F3 (see the system wiring diagram in Section 9 for details)<br><br>4) Verify that pressure is above the setpoint and perform the solenoid valve magnetic or electrical test (Sections 8.3.8, 8.3.9) on the V2 solenoid valve. |

| Symptom | Procedure |
|---|---|
| Pressure decreases past limit without being corrected | 1) Depress the right side of the footswitch. If pressure increases, there is a problem with the PLC.<br><br>2) If pressure does not increase, verify that there is adequate inert gas supply. If pressure still does not increase, go to the next step.<br><br>3) Verify that other solenoid valves are working. If not, check fuse F3 (see the system wiring diagram in Section 9 for details).<br><br>4) Verify that pressure is below the setpoint and perform the solenoid valve magnetic or electrical test (Sections 8.3.8, 8.3.9) on the V1 solenoid valve. |
| Pressure will not increase or decrease when pressing footswitch | 1) Check that solenoid valves are working. If not, check fuse F3 (see the system wiring diagram in Section 9 for details).<br><br>2) Check the footswitch connection at the electrical panel. If the footswitch is connected, then the cause is most likely a loose wire connection in one of the connectors or at the system controller. See the system wiring schematic for details. |
| Pressure drops far below set point during antechamber refill | 1) Check for adequate inert gas supply. Pressure should be set at 35 psig and should not drop more than 10 psi on the gauge when gas is flowing. |

### 8.3.3 Glovebox Purge Problems

| Symptom | Procedure |
|---|---|
| Pressure does not increase when purge is started | 1) Check for adequate inert gas supply. Gas pressure should be set to 35 psig and should not drop more than 10 psi on the gauge when gas is flowing<br><br>2) Locate the V1 valve (see Figure 8-5). Test it per Section 8.3.4, Solenoid Valve Problems. |

### 8.3.4 Solenoid Valve Problems

| Symptom | Procedure |
|---|---|
| Valves make a buzzing or chattering sound when actuated | 1) Valve must be cleaned or replaced. |
| Valves do not open | 1) Perform solenoid magnetic or electrical test (Sections 8.3.8, 8.3.9). If test shows that solenoid is actuating, then valve must be cleaned or replaced.<br><br>2) If test shows that solenoid is not actuating, check fuse F3.<br><br>3) If fuse is OK, then problem is with electrical connections or components on electrical panel. |

### 8.3.5 Blower Problems

| Symptom | Procedure |
|---|---|
| Blower cycles on and off (at 5 to 10 minute intervals) when it should be running constantly. | 1) Verify that circulation filters are not clogged and that there is no restriction in the circulation lines. If filters are causing a restriction, they should be replaced.<br>2) Verify that circulation valves are completely open. |
| Blower does not run | 1) Perform blower test procedure (Section 8.3.10). |
| Blower makes a 'grinding' noise when running | 1) This noise indicates that the blower motor bearings are bad. Blower must be replaced. |

### 8.3.6 Antechamber Problems

| Symptom | Procedure |
|---|---|
| Oxygen spikes upon opening inner door | 1) Verify proper antechamber evacuation time/number of cycles. It may be necessary to alter time/cycles based on the amount and type of material being brought through the antechamber.<br>2) Perform antechamber leak test (Section 8.3.11).<br>3) Verify that vacuum pump is performing as it should. A poorly running vacuum pump will not efficiently evacuate the antechamber. |
| Door clamp is too tight or loose when closing | 1) Verify door adjustment and make sure that both jam nuts are tightened properly. |
| Antechamber does not hold a static vacuum | 1) See antechamber leak test (Section 8.3.11) for possible sources of leaks. |
| Antechamber takes longer than normal to achieve (or will not evacuate to) the typical vacuum level | 1) Verify that vacuum pump is performing as it should. A poorly running vacuum pump will not efficiently evacuate the antechamber.<br>2) Perform antechamber leak test (Section 8.3.11). |
| Glovebox pressure decreases during antechamber evacuation | 1) Check inner antechamber door adjustment.<br>2) Verify door sealing surfaces are clean.<br>3) Verify that refill valve is closed. If so, refill valve may be leaking. |

### 8.3.7 Regeneration Problems

| Symptom | Procedure |
|---|---|
| Regeneration aborts or suspends with “Purifier Isolation Valve” message | 1) Verify that the circulation valves are completely closed. Verify that no one is working in the glovebox or moving the gloves. Restart regeneration. |
| Glovebox pressure increases during ‘purge & vent’ or decreases during ‘evacuation’ phases of cycle | 1) Verify that the circulation valves are completely closed.<br>2) If the pressure change continues after the isolation valves are closed, then the V6 (purifier refill) valve may be leaking. |
| After completing regeneration, glovebox atmosphere does not ‘clean up’ during circulation (levels stay about the same and do not decrease) | 1) Check the amount of regeneration gas used. It should about 300 - 400 lbs.<br>2) If less than the normal amount of gas was used, verify that pressure is set to 35 PSI.<br>3) If gas pressure is correct, there could be a partially blocked valve (most likely V4) or a restricted regeneration purge vent line. If there was more than the normal amount used, then there could be a leak in the system. Perform purification system leak test (Section 8.3.13).<br>4) If everything else tests out OK, run another regeneration cycle. If problem persists, the purifier charge may be bad. See list of damaging chemicals in Section 5, Purifier System Operation. |

### 8.3.8 Solenoid Valve Magnet Test

1) Actuate the solenoid to be tested either normally (e.g., by pressing the footswitch) or from the diagnostic screen.
2) Hold a small magnet over the red cap on the solenoid. If the solenoid is operating properly, the magnet will vibrate.
3) If the magnet does not vibrate, either the solenoid is not receiving power or it is defective.

### 8.3.9 Solenoid Valve Electrical Test

1) Actuate the solenoid to be tested either normally (e.g., by pressing the footswitch) or from the diagnostic screen.
2) Perform the solenoid magnet test first (it is an easier test).
3) If solenoid magnet test shows that solenoid is not actuating, then test the AC voltage at the black and white wire connections on the valve. If the voltage is 24 to 26 volts, then the solenoid coil is bad.
4) If there is little or no voltage, then there is an electrical problem with the wiring, 24 VAC supply transformer, fuse F3, or the PLC. See the system wiring diagram (Section 9) for details.

### 8.3.10 Blower Test Procedure

If it is suspected that the circulation blower is not running, perform this test to determine the cause of the problem.

**VERIFY BLOWER PROBLEM**

1) Verify that the glovebox atmosphere is not being scrubbed of oxygen and moisture. With the blower off, the oxygen and moisture levels will rise noticeably within hours. If the atmosphere remains at low oxygen and moisture levels, then the blower must be circulating the atmosphere (unless the glovebox is being purged).
2) If the glovebox atmosphere shows higher than normal levels of oxygen or moisture, verify that the purifier has been regenerated recently. A saturated purifier charge will also cause the oxygen and moisture levels to rise.
3) As a final check, make sure the room is fairly quiet and turn the blower off and on at 30 second intervals. You should be able to hear the blower make an accelerating or decelerating “whining” noise when its power is toggled.
4) If the blower is definitely not running, then perform the following tests to determine the cause.

**ELECTRICAL TEST**

5) Remove the cover panel from the top of the OMNI Lab (see Figure 8-4).
6) Locate the blower power binding post feedthrus (see Figure 8-4). There will be four binding posts (black, white, red, and yellow).
7) With the blower switched ON, measure the AC voltage across the BLACK and WHITE binding posts. There should be about 110 or 220 volts, depending upon the system power requirements.

8) Next measure the DC voltage across the RED and YELLOW binding posts. It should be about 3.5 VDC (for 110 volt systems) or about 2 VDC (for 220 volt systems).

9) If there is no voltage across either the BLACK and WHITE or RED and YELLOW binding posts, then there is most likely a bad wiring connection. Visually inspect the wire connections on the electrical panel, starting at the binding posts and following the wiring back to the power input.

10) If the proper voltage is present, then the problem is either a bad blower or a loose connector on the blower. With your hand in the glovebox in the glove below the rear of the blower, reach up to the blower connector and verify that it is pressed firmly into place (see Figure 8-4).

11) If the blower connector is in place, then the blower is most likely faulty and must be replaced.

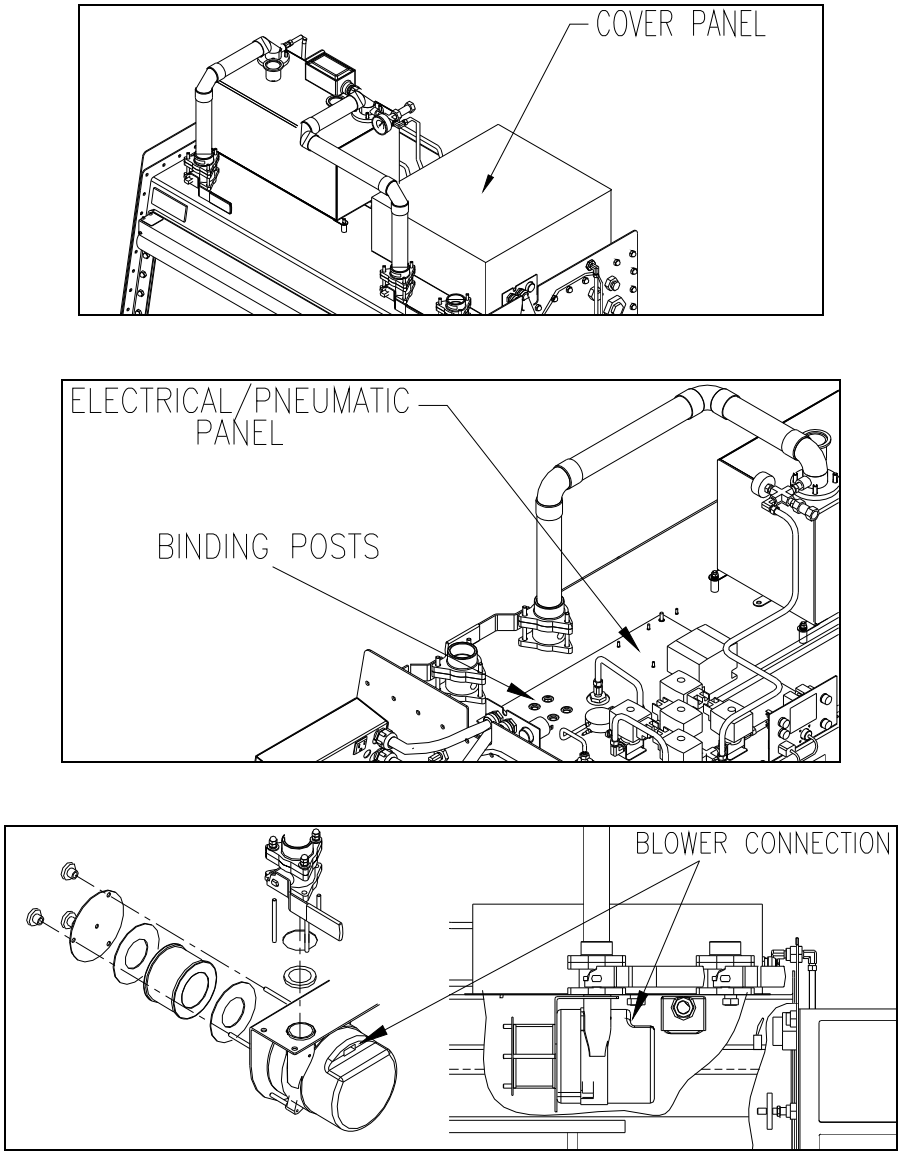



**Figure 8-4**
**Blower Testing**

### 8.3.11 Antechamber Leak Test

1) Make sure both antechamber doors are properly closed.
2) Evacuate the antechamber until the gauge reads 25 inches Hg then stop the evacuation, but do not refill the antechamber.
3) Wait 20 to 30 minutes then check the gauge to see if the vacuum level decreased. If it has, there is a leak in the antechamber.
4) Verify that the refill valve is completely closed (if the glovebox pressure drops during this test, the refill valve may be leaking). Check the door sealing surfaces and o-rings to make sure they are clean and undamaged. Check the tube fittings connected to the antechamber to be sure that they are tight and not leaking.

### 8.3.12 Glovebox Leak Test

1) Perform the antechamber leak test (Section 8.3.11) first to verify that there is no leak between the glovebox and antechamber.
2) Turn the circulation blower off. Wait a couple of minutes for pressure to stabilize.
3) Set the pressure limits to +5 and 0.
4) Use the footswitch to raise the pressure to +4 inches.
5) Watch the pressure for 5 to 10 minutes to see if it decreases.
6) If it does decrease, try to get an idea of the leak rate (how much it leaks in a given amount of time).
7) A. Turn the vacuum pump power switch off. If the pressure drop slows or stops, then either the V2 valve (vacuum supply for pressure control) or V5 valve (vacuum supply for purifier regeneration) is leaking. If turning the pump off does not affect the pressure drop, skip to step 8.
   B. Turn the vacuum pump back on. Close the circulation valves. If the pressure decrease slows or stops, watch the gauge mounted next to the purifier. If it begins to read below 0, then the V5 valve leaking.
8) If turning the pump off did not affect the pressure decrease, set the pressure limits to +4 and +5. The glovebox should call for gas periodically, depending on the size of the leak.
9) Close the circulation valves. If the pressure decrease stops, proceed to Section 8.3.13, Purification System Leak Test.
10) If the pressure decrease is still present, use snoop (or soapy water) to check around all of the seals, fittings, and feedthrus in the box to find the leak. If the snoop begins to form bubbles, then there is a leak at that point.
    Suggested areas to check are:
    --the gaskets between the box and the end panels and between boxes (if dual length)
    –the gloves
    –the seal between the box and the circulation and purge vent valves
    –around any feedthrus in the glovebox walls

### 8.3.13 Purification System Leak Test

1) If you have not already done so, turn the blower off.
2) Close the circulation valves.
3) Make sure that regeneration or inert gas is hooked up to the regeneration gas port and set to 35 psi.
4) Remove any vent tubing from the REGENERATION PURGE VENT port and plug the fitting with a 3/8 inch diameter cylindrical plug. Alternately, you can remove the fitting and seal it with a 1/4 inch NPT plug (be sure to use Teflon tape to get a good seal). This port is located next to the gas utility connections.
5) Press the upper right corner of the screen. The screen will now enter the diagnostic mode. NOTE: On some of the early versions of the software, the diagnostic mode is entered as follows:
   Turn the main power switch (located below the control panel) off then back on. The screen will initialize and a "continue to main screen" button will appear. Do NOT push the "continue…" button. Press the upper right corner of the screen. The screen will now enter the diagnostic mode.
6) Press the "V3-V4" button. This will energize the regeneration gas purge and vent valves and will start pressurizing the purifier and circulation plumbing. Watch the gauge mounted near the purifier. When it gets to +4 psi, press the "V3-V4" button again to turn off the valves.
7) Wait about 1 minute for pressure to stabilize, then watch the gauge for about 5 to 10 minutes to see if it decreases.

**WARNING: DO NOT OPEN THE CIRCULATION VALVES WHILE THERE IS PRESSURE IN THE CIRCULATION LINES. IT COULD BLOW THE GLOVES OFF OF THE BOX.**

8) If so, you can use snoop (soapy water) around all the fittings and sealing areas in or connected to the circulation system to pinpoint the leak. If you see bubbles forming after applying the snoop, then there is a leak.
   Suggested areas to check are:
   --the seal between the triangular flanges and circulation valves
   --the seal between the purifier and round flanges on the circulation plumbing
   –the pressure relief check valve (located behind the pressure gauge or on the purifier-to-blower plumbing on stand-alone OMNI)
   –the fittings at either end of the two lengths of 3/8" stainless steel tubing connected to the circulation plumbing
9) If you do not see the gauge pressure decrease, remove the plug from the REGENERATION PURGE VENT port and watch the gauge for 5 to 10 more minutes.
10) If the pressure decreases now, then the V4 (regeneration vent) solenoid valve is leaking.
11) When you are finished testing, press the "V5" button. This will energize the regeneration vacuum supply valve and remove the pressure from the purifier and circulation plumbing. Wait until the gauge reaches 0 psi then press the "V5" button again to turn the valve off. Push the "back" button to exit the diagnostic mode. If necessary, press the "continue to main screen" button to return to normal operation.
12) Replace the purge vent line at the gas feedthru port. If you removed the fitting, replace it using a suitable sealant, such as Teflon tape.

### 8.3.14 Diagnostics Mode

**CAUTION: While using the diagnostic mode, it is possible to perform actions that can contaminate the glovebox atmosphere, the purifiers, or possibly damage the OMNI-Lab. Do not use the diagnostic routine unless following specific instructions from Vacuum Atmospheres Company.**

To enter the diagnostics mode, Press the upper right corner of the screen. The diagnostic screen will now be displayed.
NOTE: On some early versions of the software, the diagnostic mode is entered as follows: Turn the main power switch (located below the control panel) off then back on. The screen will initialize and a "continue to main screen" button will appear. Do NOT push the "continue…" button. Press the upper right corner of the screen. The diagnostic screen will now be displayed.

**NOTE: If you have any problems while in the diagnostics menu, press the BACK button and the system will exit the diagnostics menu.**

Using Diagnostics menu:

To activate a function, press the corresponding labeled button. Pressing another function's button will turn off the previous function.

Definition of functions:

- BLOWER: This function activates the circulation blower.
- ALARM: This function activates the audio alarm.
- HTR: This function activates the regeneration heater for the purifier. NOTE: Under certain circumstances this function can out-gas oxygen and moisture into the glovebox and, if left on too long, damage the purifier charge and thermal blanket.
- V1: Inert gas supply solenoid valve for purge and pressure control. NOTE: If left on too long, this function can increase pressure in the glovebox until it sets off the pressure alarm.
- V2: Vacuum supply solenoid valve for pressure control. NOTE: If left on too long, this function can pull the glovebox negative and set off the pressure alarm.
- V3-V4: This function activates the V3 (regeneration gas inlet) solenoid valve and the V4 (regeneration purge outlet) solenoid valve. NOTE: under certain circumstances, activating this valve can introduce regeneration gas (hydrogen) into the glovebox or purifier affecting pressure in the glovebox.
- V5: This function activates the V5 (vacuum supply for purifier regeneration) solenoid valve. NOTE: under certain circumstances, activating this valve can expose the glovebox or purifier to vacuum, affecting pressure in the glovebox.
- V6: This function activates the V6 (purifier refill from glovebox) solenoid valve. NOTE: Under certain circumstances, activating this valve can expose the glovebox to regeneration gas (hydrogen) or vacuum, affecting pressure in the glovebox.

## 8.4 REPAIR/REPLACEMENT

### 8.4.1 Solenoid Valve Servicing

Refer to Figures 8-5 and 8-6 for details during this procedure.

Eventually one or more of the valves in the OMNI-Lab system can become clogged, worn out, or damaged. At this time the valve(s) will need to be cleaned or replaced. When replacing valves, the valve body will not be replaced. This part will remain connected to the valve manifold. All of the removable parts (not including the solenoid) will be replaced.

NOTE: The V1, V2, and V6 valves are connected directly to the glovebox. Disassembly of any of these valves will create a leak in the glovebox. The V3 and V4 valves are connected to the purifiers. Disassembling one of these valves will expose the purifiers to air. Refer to the Gas Flow Diagram (Figure 9-3) for more details. Take appropriate precautions when servicing any of the solenoid valves.

1) To prevent any contamination of the glovebox atmosphere, raise the glovebox pressure to +4.5 and +5 inches. Shut off the power, inert gas, and forming gas supply to the OMNI-Lab system. Isolate the glovebox by closing the circulation valves.
2) If you are not servicing the V3 valve, remove the cover panel from the top of the OMNI-Lab (Figure 8-4).
3) Locate the valve that needs to be serviced (Figure 8-5). The valves can be identified by a label on the black solenoid wire. Refer to the list below for valve functions. If that valve is V1, V2, or V6 disassembly of the valve will create a leak in the glovebox. To prevent any contamination of the glovebox atmosphere, have the replacement valve ready to install as soon as the old valve and o-ring have been removed. As an alternative to this, strong tape (such as duct tape) may be used to cover the top of the valve body. This will prevent the positive pressure in the glovebox from leaking out rapidly.
4) Using a small, flat blade screwdriver, remove the red cap on the top of the solenoid.
5) Press the body of the solenoid down towards the valve body (it is spring loaded). Insert the screwdriver into the ‘notch’ at the base of the retainer plate (nearest the wire connections) and pry the retainer plate ‘foreword’, away from the wire connections. It should come off.
6) Pull the solenoid off of the valve. There is no need to disconnect the wires. Remove the spring washer and store it with the red cap and retainer plate.
7) Unscrew the plunger tube from the valve body. It is easiest to do this using a 1-inch deep socket and ratchet, however it is possible to use a crescent wrench or 1 inch open-end wrench. Break the plunger tube loose with the socket, then unscrew it the rest of the way by hand.
8) Remove the plunger tube and plunger assembly (Figure 8-6, Items 1 & 8) as one unit.
9) Remove the housing seal o-ring (Figure 8-6, Item 7).
10) Clean out any debris or contamination in the valve body.
11) Examine the o-ring and the rubber seal on the end of the plunger assembly for damage. The o-ring cross section should be round without any nicks. Replace it if it is flattened or cut.
12) The rubber seal on the plunger assembly should be flush with the edge of the plunger. If the seal is swollen past the plunger edge or appears otherwise damaged, replace it.

13) The plunger should be fairly smooth with no deep scratches or 'notching'. If the plunger appears to have a 'stepped notch' around its circumference where the part of the plunger nearest the seal appears to have a larger diameter than other end, replace it.

14) If you noticed none of these signs and the valve components appear similar to those in the picture, clean off any dust or contamination and reassemble the valve.

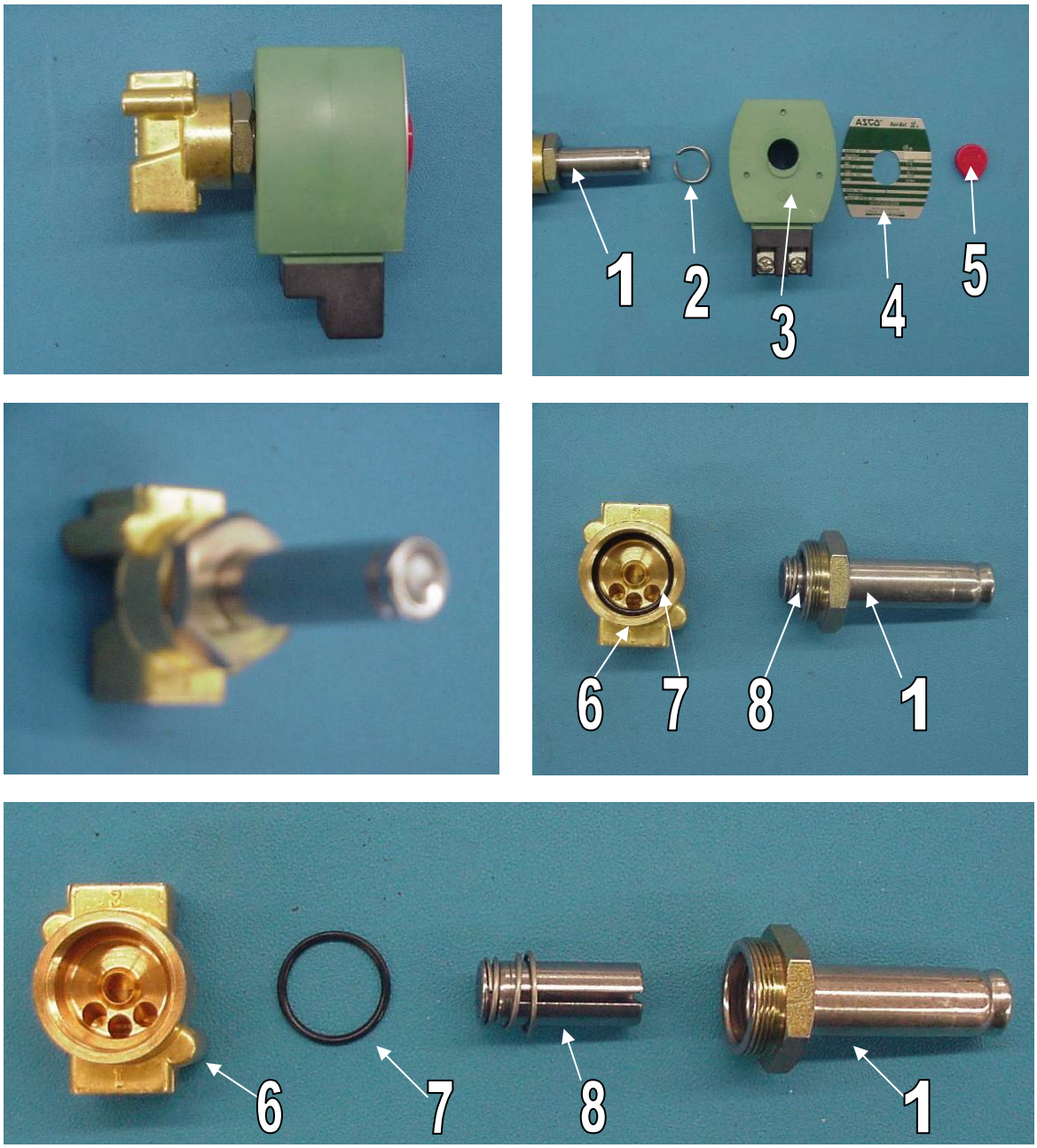
15) Replace the top cover, if necessary, and reconnect the inert and regeneration gas supplies. Turn the system power back on.

**NOTE: Depending upon which valves were serviced, the purifiers or circulation plumbing may have been exposed to a small amount of air. It is recommended to begin purging the glovebox at the time circulation is started. Stop the purge after a few minutes if no oxygen or moisture rise is indicated**


**VALVE FUNCTIONS**

V1 = Inert gas supply valve for pressure control
V2 = Vacuum supply valve for pressure control
V3 = Regeneration gas inlet valve for purifier regeneration (not shown – located next to regeneration gas supply connection port)
V4 = Regeneration gas vent valve for purifier regeneration
V5 = Vacuum supply valve for purifier regeneration
V6 = Refill (from glovebox) valve for purifier regeneration

**Figure 8-5**
**Electrical/Pneumatic Panel Layout**




1) plunger tube/solenoid base
2) spring washer
3) solenoid
4) retainer plate
5) red cap
6) valve body
7) housing seal o-ring
8) plunger & spring assembly

**Figure 8-6**
**2-Way Valve**

### 8.4.2 Ball Valve Servicing

Refer to Figure 8-7 for details during this procedure.

The OMNI-Lab system uses ball valves for purifier circulation / glovebox isolation, glovebox purge, and antechamber evacuation. These valves are 1-1/2 inch flange diameter. Eventually one or more of the ball valves may become worn out or damaged. At this time the valve will have to be rebuilt or replaced. A ball valve rebuild kit is necessary for this procedure (see Section 8.5, Spare Parts List).

**CAUTION: Disassembling the circulation or purge vent valves will expose the purifier charge and glovebox atmosphere to air. Make sure that any sensitive materials are stored in an airtight container or place them into the antechamber. Disassembling the antechamber evacuation valve will expose the antechamber to air.**

1) Turn the blower off and shut off power to the system. If equipped, isolate the oxygen analyzer by switching the SAMPLE/AIR CAL valve to AIR CAL.
2) If you are servicing the circulation valves proceed to Section 8.4.3, Circulation Ball Valve Servicing. If you are servicing the glovebox purge vent or antechamber evacuation valves, continue to the next step.
3) If you are servicing the purge vent valve, close the circulation valves. This will isolate the purifier from the glovebox, preventing the need for regeneration.
4) Place the valve handle (on the valve to be removed) so that the valve is in the open position. This will prevent the valve ball from falling out of the valve body during disassembly.
5) Remove the valve handle.
6) If this is the evacuation valve, remove the three sets of nuts and bolts that hold the main valve body between the flanges. If this is the purge vent valve, remove the fastening hardware mounting the valve to the glovebox.
7) If this is the evacuation valve, carefully pull the plumbing-side flange away from the valve and remove the main valve body. The plumbing is usually flexible to allow the valve to be pulled out easily. If this is the purge vent valve, remove the triangular flange then lift the valve off of the mounting studs.
8) Rotate the valve stem so that the valve is in the closed position (first picture, Figure 8-7). Press the ball so that valve seat and the ball come out the other side of the valve body. Remove the other valve seat and the valve to flange o-ring seals from the valve body.
9) Push the valve stem from the outside of the valve until it is completely out of the valve body.
10) Remove the stem o-ring seals and the plastic washer from the valve stem.
11) Thoroughly clean the valve stem, valve ball, and the inside of the valve body.
12) Lightly lubricate the new o-ring seals and valve seats with vacuum grease.
13) Install the stem o-ring seals and the plastic washer on the valve stem (as shown in the fourth picture, Figure 8-7).
14) Install the valve stem into the valve body. Be careful not to let the plastic washer get pinched between the valve body and the stem flange.
15) Install one of the valve seats into one side of the valve body. The beveled side should face the inside of the valve body and seat against the ball.
16) Install the valve ball into the valve body, and then install the second valve seat.

17) Install the valve-to-flange o-ring seals. The valve should now look like the one in the first picture, Figure 8-7.

18) Replace the main valve body between the flanges (or between the flange and the glovebox), making sure that the valve stem and handle stop are facing the correct direction. You may need to use a little extra vacuum grease on the valve-to-flange o-rings to keep them from falling out of the valve body during installation.

19) Replace and tighten the fastening hardware that holds the main valve body between the flanges (or between the flange and the glovebox).

20) Replace the valve handle.

21) If the purge vent valve was serviced, purge the glovebox per the instructions in Section 3.2, Establishing an Inert Atmosphere.

22) Once the glovebox has been purged below 200 ppm oxygen, follow the directions in Section 3.3, Start-Up Conclusion.

23) After the insert atmosphere is reestablished, the system will be ready for use.

### 8.4.3 Circulation Ball Valve Servicing

Refer to Figures 8-7 for details during this procedure.

**NOTE: This operation will expose the glovebox and the purifier to air. After completion, you will need to purge out the glovebox and regenerate the purifier.**

Because of the work and the glovebox down-time involved with this operation, VAC recommends servicing both of the circulation valves at the same time.

1) If you have not already done so, turn off the blower and shut off power to the system. If equipped, isolate the oxygen analyzer by switching the SAMPLE/AIR CAL valve to AIR CAL.

2) Place the valve handle (on the valve to be removed) so that the valve is in the open position. This will prevent the valve ball from falling out of the valve body during disassembly.

3) Remove the valve handle.

4) Remove the three sets of fastening hardware that hold the main valve body between the flange and the glovebox.

5) Remove the four sets of fastening hardware that mounts the circular flange to the top of the purifier.

6) Remove the plumbing from the valve and purifier. Be careful not to lose the o-ring located between the circular flange and the purifier.

7) Lift the valve off of the mounting studs.

8) Rotate the valve stem so that the valve is in the closed position (first picture, Figure 8-7). Press the ball so that valve seat and the ball come out the other side of the valve body. Remove the other valve seat and the valve to flange o-ring seals from the valve body.

9) Push the valve stem from the outside of the valve until it is completely out of the valve body.

10) Remove the stem o-ring seals and the plastic washer from the valve stem.

11) Thoroughly clean the valve stem, valve ball, and the inside of the valve body.

12) Lightly lubricate the new o-ring seals and valve seats with vacuum grease.

13) Install the stem o-ring seals and the plastic washer on the valve stem (as shown in the fourth picture, Figure 8-7).

14) Install the valve stem into the valve body. Be careful not to let the plastic washer get pinched between the valve body and the stem flange.

15) Install one of the valve seats into one side of the valve body. The beveled side should face the inside of the valve body and seat against the ball.

16) Install the valve ball into the valve body, and then install the second valve seat.

17) Install the valve-to-flange o-ring seals. The valve should now look like the one in the first picture, Figure 8-7.

18) Replace the valve onto its mounting studs. You may need to use a little extra vacuum grease on the valve-to-flange o-rings to keep them from falling out of the valve body during installation. Be careful not to let the o-rings get caught on the purifier flange screens.

19) Replace the purifier plumbing, being careful not to let the circular flange o-ring fall out.

20) Replace the plumbing fastening hardware on both the circular and triangular flanges, then tighten it.

21) Replace the valve handle.

22) Perform a purification system leak test to make sure that the circulation system is leak free (Section 8.3.13).

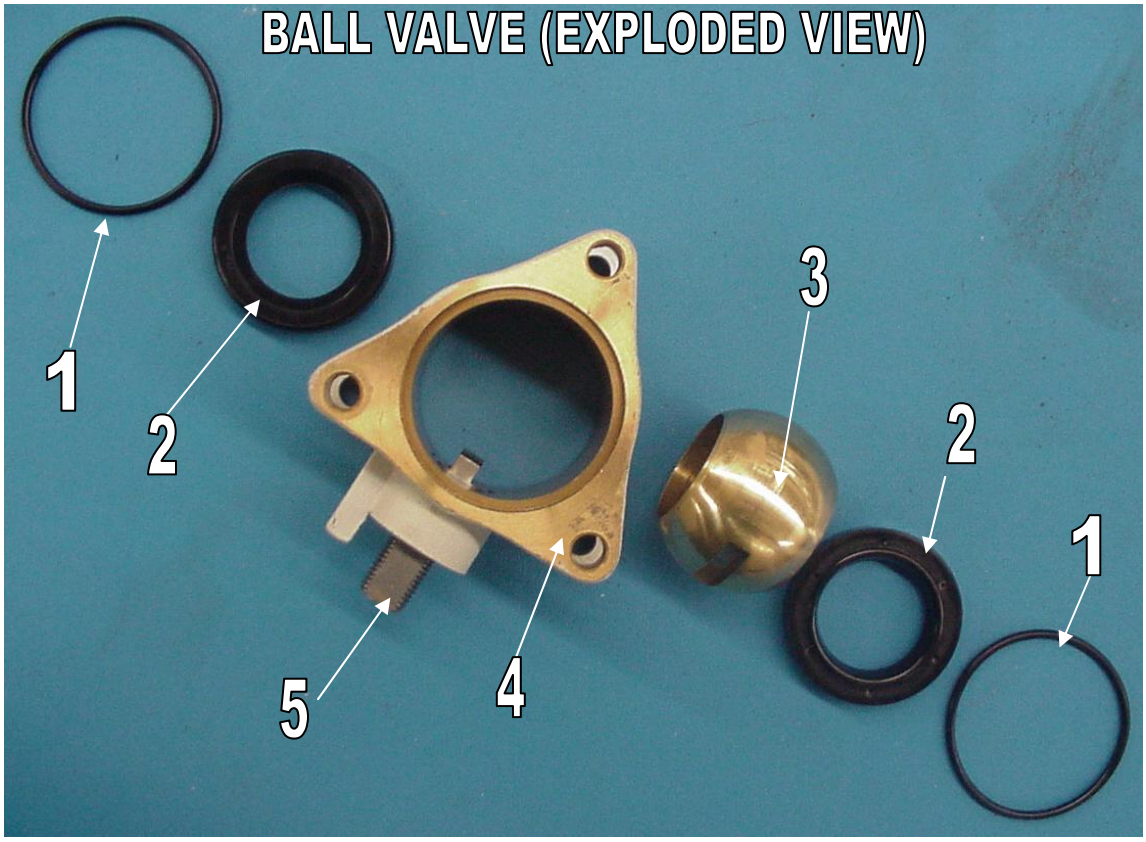
23) Close the circulation valves.

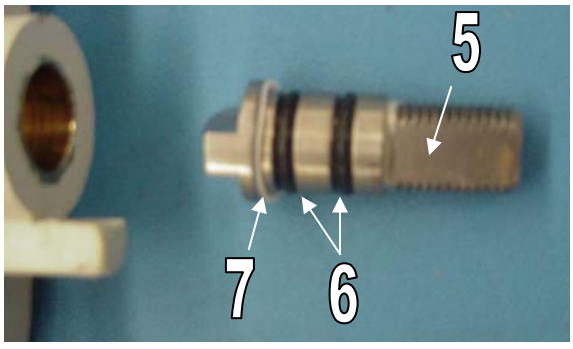
24) Purge the glovebox per the instructions in Section 3.2, Establishing an Inert Atmosphere.

25) Once the glovebox has been purged below 200 ppm oxygen, start a regeneration as described in Section 5.2, Regeneration.

26) After the regeneration is complete, follow the directions in Section 3.3, Start-Up Conclusion.

24) After the insert atmosphere is reestablished, the system will be ready for use.




1) valve-to-flange o-ring seal
2) valve seat
3) valve ball
4) valve body
5) valve stem
6) stem o-ring seals
7) plastic washer

**Figure 8-7**
**Ball Valve (1-1/2 inch) Exploded View**

### 8.4.4 Replacing the Purifier Charge

The charge inside the purifier seldom needs replacing under normal properly controlled operating conditions. However, certain contaminants permanently reduce the oxygen removal capacity of the catalyst. If this occurs, remove the catalyst and replace with fresh uncontaminated catalyst using the procedure below. See the warning in Section 5, Purifier System Operation for a list of chemicals that may deactivate the charge.

**WARNING: Protective masks, clothing, etc., may be required when handling and/or breathing the fumes of the contaminated chemicals. The nature and extent of protection required depends on the nature of the suspected or confirmed contaminants present in the expended chemicals.**

The determination of the type and extent of precautions required is the sole responsibility of the user. Always discard contaminated material in a safe and responsible manner in accordance with federal, state, and local regulations.

Refer to Figure 8-8 for details during this procedure.

1) Start and complete a regeneration first if the source of the contamination is a solvent or flammable material. The regeneration exhausts vapors and makes removing the old catalyst less hazardous. Do not return the system to circulation mode after this regeneration.
2) Turn off OMNI-Lab power.
3) Close both glovebox circulation valves.
4) Remove the KF flanges on top of the purifier.
5) Remove the old purifier charge with a vacuum. A “shop-vac” type with a 1” dia. flexible hose can be used to remove the spent charge through the fill ports. Do not use metal objects and be careful not to damage the heating elements. Avoid pushing the vacuum hose into the plenum screen with too much force, as damage to the screen could result. It is not necessary to remove all the old charge, but the plenum screen at the bottom of the purifier should be visible.
6) Install the new catalyst in the purifier through the fill ports. Each side of the purifier will contain 15 lb. of charge when the procedure is finished. First, pour 5 lb. of molecular sieve (13X) into the bottom of each side of the purifier (5 lb. in the left and 5 lb. in the right). Next, pour 5 lb. of copper catalyst (Q-5) into the middle of each side of the purifier. Finally, pour 5 lb. of molecular sieve (13X) into the top of each side of the purifier. Check to make sure the new charge is at least 1 inch below the filling port to allow a plenum between the top of the charge and the top of the purifier.
7) Clean and replace the KF flange. Perform a regeneration following the procedure in the Purifier System Operation section. Ultimate performance will be gained by doing a second regeneration.

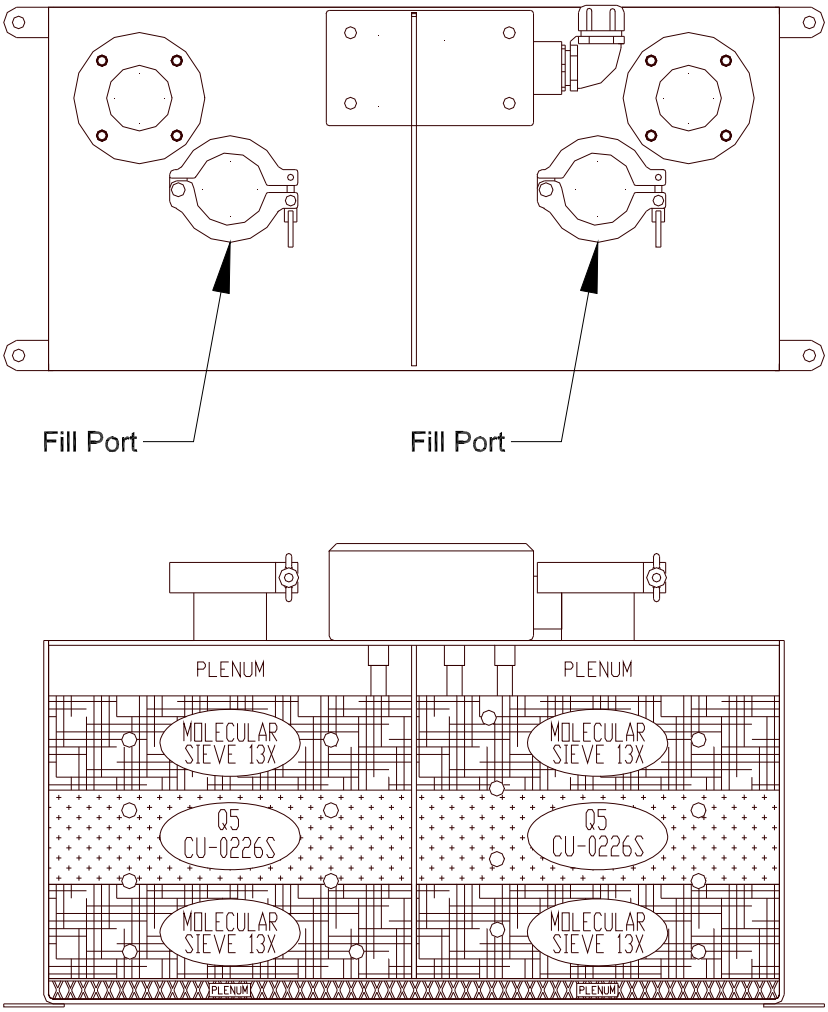



**Figure 8-8**
**Purifier Charging**

### 8.4.5 Circulation Blower Replacement

Follow these instructions in the event that the circulation blower must be replaced. Be sure to read through the instructions first before starting the procedure.

Tools Needed:
-- Ratchet with a 3/8 inch socket and an 8-10 inch extension
-- #2 Phillips screwdriver

1) Cycle the new circulation blower through the main antechamber to bring it into the glovebox.
2) Turn the blower selection to OFF.
3) Reach into the glovebox and remove the filter cover plate and filter. Allow the filter cover to hang from the oxygen sample tube.

NOTE: Oxygen reading will not read the actual level in the box during this procedure, since there is no flow present.

4) Disconnect the electrical connector from the blower (Figure 8-4).
5) Use a ratchet and 3/8 inch socket with an extension of the appropriate length (about 8-10 inches) to remove the two sets of nuts, lock washers, and flat washers on the rear of the blower mounting bracket. These fasteners secure the mounting bracket to the ceiling of the glovebox.
6) While supporting the blower with your left hand (or a mechanical support, if this is easier), remove the two sets of nuts, lock washers, and flat washers on the front of the blower mounting bracket and lower the blower to the glovebox floor.
7) Use a #2 Phillips screwdriver to remove the screws fastening the blower to the blower bracket and remove the bracket from the blower.
8) Install the bracket onto the new blower.
9) Hold the blower in place on the ceiling of the glovebox (use a mechanical support, if necessary) and start one of the nuts onto one of the front mounting studs. Tighten this nut sufficiently to hold the blower into place on the glovebox ceiling.
10) Install the flat washers, lock washers, and nuts onto the other three mounting studs and tighten.
11) Remove the first nut and reinstall with the flat washer and lock washer.
12) Connect the electrical connector to the blower.
13) Replace the filter and the filter cover plate.
14) Turn the blower selection to ON.
15) Verify the blower rotation.

## 8.5 SPARE PARTS LIST

| Description | Part Number |
|---|---|
| Circulation filter, .3 micron HEPA……... | 400037 |
| O-ring, 15 inch antechamber door seal……. | 2633 |
| O-ring, 6 inch antechamber door seal……... | 1334 |
| O-ring, for gloves…….. | 2631 |
| Seal Assembly, KF-40 (for purifier fill ports)…… | 400001 |
| Clamp, mini-antechamber door…….. | 022551 |
| Gloves, ambidextrous, pair, 15 mil thick, butyl rubber……. | 2681 |
| Gloves, ambidextrous, pair, 30 mil thick, butyl rubber……. | 2682 |
| Gloves, left & right, pair, 15 mil thick, butyl rubber…….. | 2681-2 |
| Gloves, left & right, pair, 30 mil thick, butyl rubber…….. | 2682-2 |
| Vacuum pump oil (for Edwards pumps), 1 Liter…….. | 7470-5 |
| Oxygen sensor (for oxygen analyzer)……. | 400674 |
| Moisture probe (for moisture analyzer)…… | 2258 |
| Fuse, 10 amp……. | 400487 |
| Fuse, 4 amp……... | 400101 |
| Fuse, 5 amp……... | 400417 |
| Fuse, 2 amp……... | 400100 |
| Solid state relay (for heater and vacuum pump power control)…… | 400058 |
| Solenoid valve, 2-way, 24 VAC, 50/60 Hz…….. | 400003 |

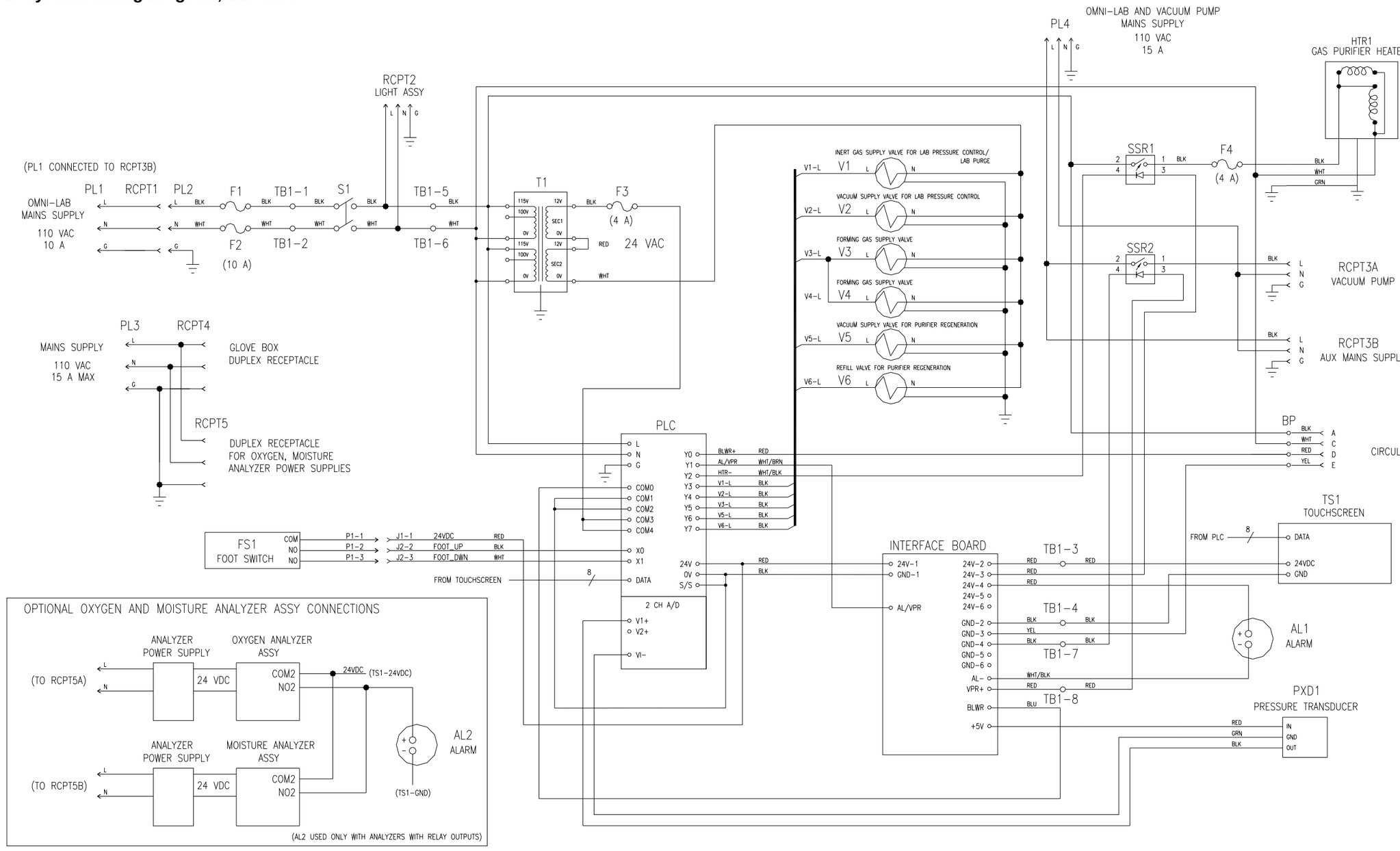
| | |
|---|---|
| Valve, ¼ inch ball valve…… | 7699-1 |
| 1-1/2 inch ball valve rebuild kit……. | 2743-4 |
| Valve, purifier pressure relief (10 PSI)…….. | 400102 |
| Purifier Charge Kit (replaces charge in one purifier column)…….. | 102691 |
| Blower, 110 VAC (motor only)…….. | 100587 |
| Blower, 220 VAC (motor only)……. | 100753 |

# 9 SYSTEM WIRING AND FLOW DIAGRAMS

This section contains the following:

- Figure 9-1 System Wiring Diagram, 110 VAC
- Figure 9-2 System Wiring Diagram, 220 VAC
- Figure 9-3 Gas Flow Diagram

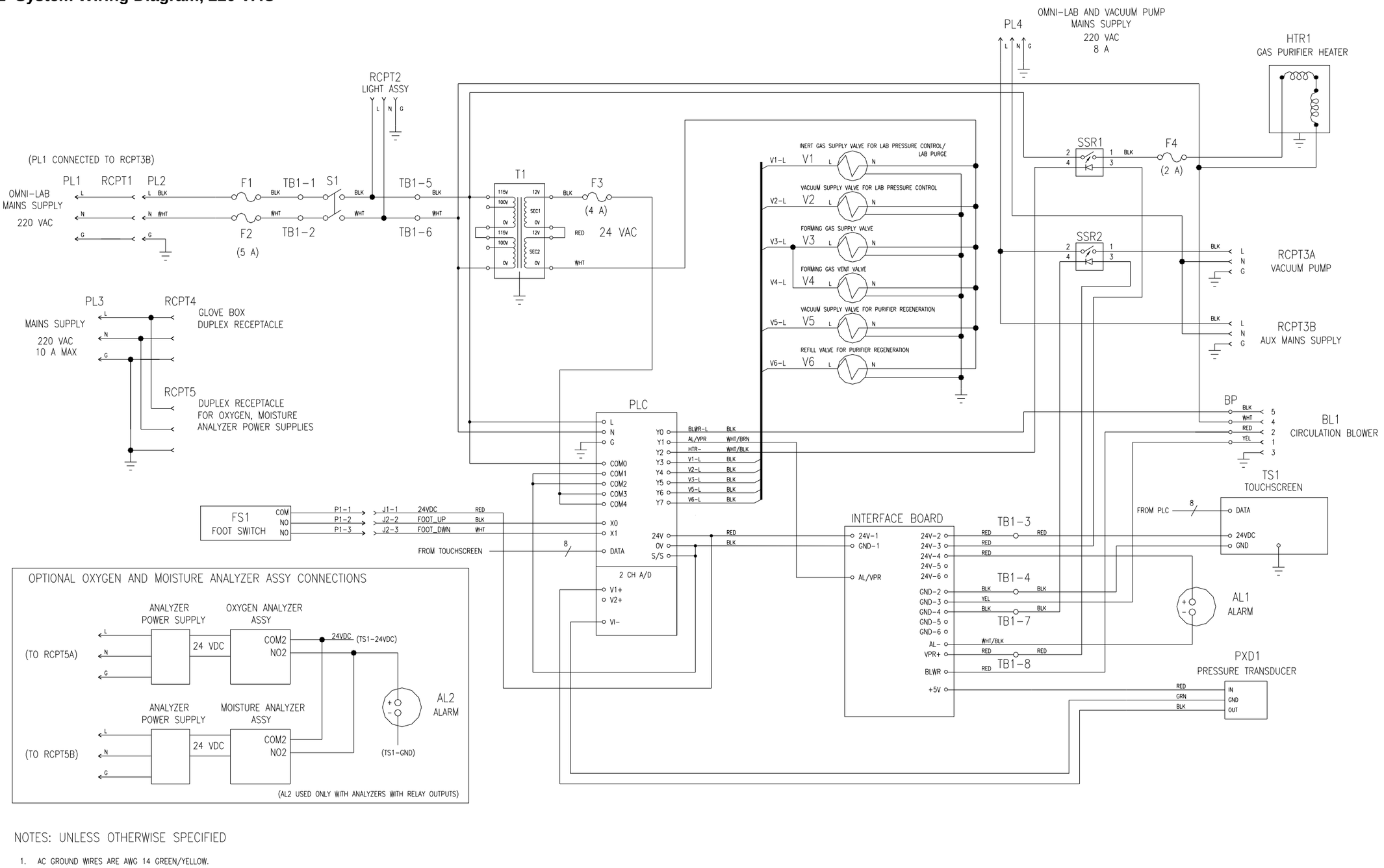
## Figure 9-1 System Wiring Diagram, 110 VAC




NOTES: UNLESS OTHERWISE SPECIFIED

1. AC GROUND WIRES ARE AWG 14 GREEN/YELLOW.

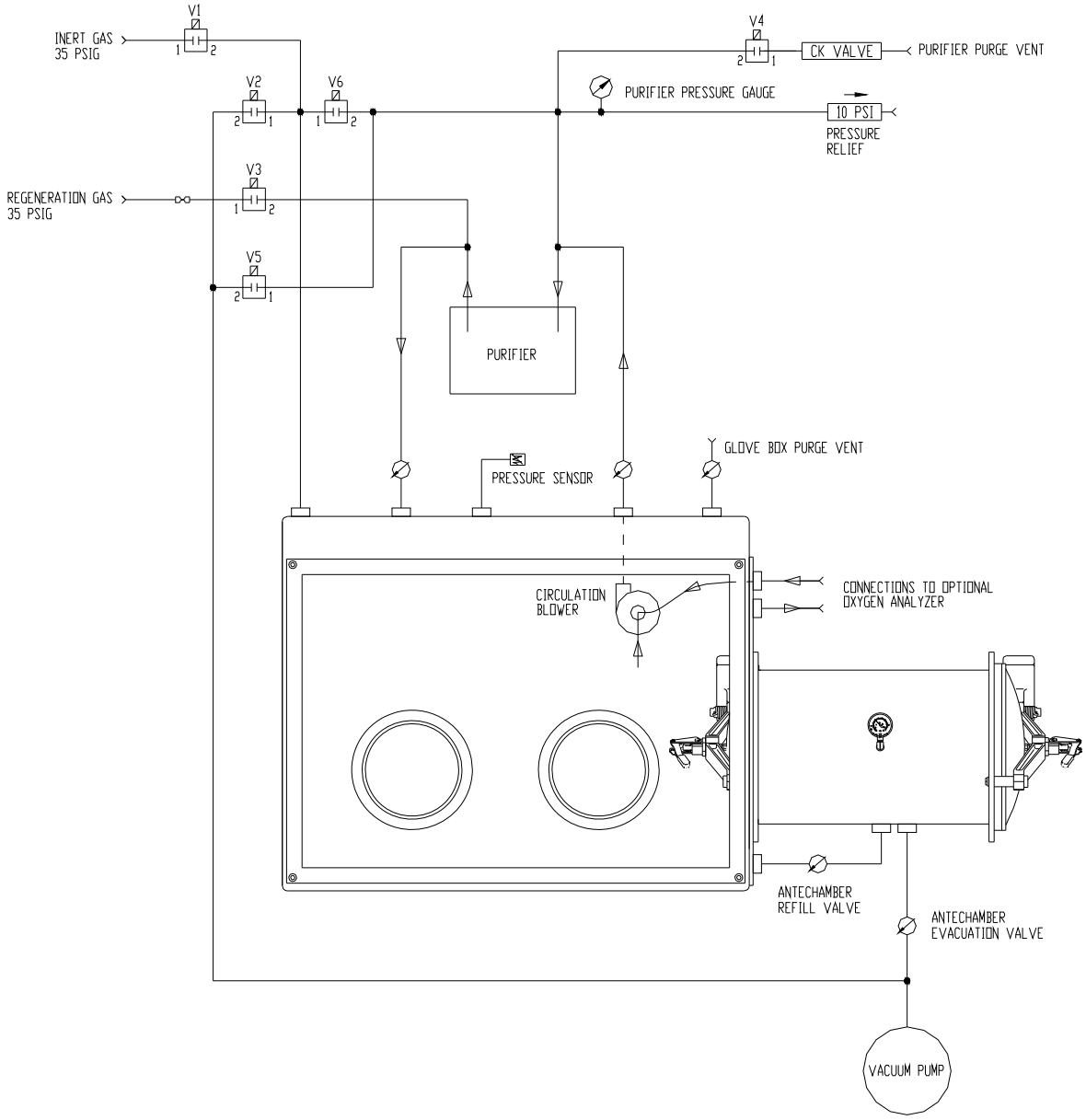
## Figure 9-2 System Wiring Diagram, 220 VAC




NOTES: UNLESS OTHERWISE SPECIFIED

1. AC GROUND WIRES ARE AWG 14 GREEN/YELLOW.

## Figure 9-3 Gas Flow Diagram




SOLENOID VALVE FUNCTIONS

V1 = Inert gas supply valve for pressure control

V2 = Vacuum supply valve for pressure control

V3 = Regeneration gas inlet valve for purifier regeneration

V4 = Regeneration gas vent valve for purifier regeneration

V5 = Vacuum supply valve for purifier regeneration

V6 = Refill (from glovebox) valve for purifier regeneration

# 10 OMNI-LAB SPECIFICATIONS

Electrical

Input Power:

P/N 101965 and 102282: 100-120 Volts AC Models - Single phase connection, 15 amps, 50/60 Hz, with 10’ power cord and NEMA 5-15P plug

P/N 101975 and 102283: 200-240 Volts AC Models - Single phase connection, 8 amps, 50/60 Hz, with 10’ power cord and NEMA L6-15P plug

Internal Glovebox Receptacle: One duplex receptacle with separate 10’ power cord, 15 amps maximum

Gas Connections

Inert Gas: 35 psi nominal, 40 psi recommended maximum, 65 psig absolute maximum, 1/4” NPT female with compression fitting, accepts 3/8” O.D. copper or stainless tube.

Regeneration Gas: 35 psi nominal, 40 psi recommended maximum, 65 psig absolute maximum, 1/4” NPT female with compression fitting, accepts 3/8” O.D. copper or stainless tube.

Vent Connections

Purifier Purge Vent: 1/4" NPT female with compression fitting, accepts 3/8” O.D. copper or stainless tube.

Purifier Pressure Relief Valve: 1/4” NPT female

Glovebox Purge Vent: 1-1/2” I.D. sweat flange

Customer Interface (to Glovebox)

Two 1/4” NPT female feedthrus on end panel

Environmental

Ambient Temperature: $59^{o}$ – $90^{o}$ F ($15^{o}$ –$32^{o}$ C)
Ambient Humidity: 0–90% non-condensing

System Weight and Shipping Specifications

See Installation Specifications

Safety Approvals

This product has been tested to the requirements of UL 61010-1 Issued: 2004/07/12 Ed: 2 Rev: 2008/10/28, Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements.

This product has been tested to the requirements of CAN/CSA-C22.2 No. 61010-1, second Edition, including Amendment 1.

## Revision Record

| Rev | Description | Date | Approved |
|---|---|---|---|
| A | E.O. 15126 | 07/30/02 | WCM |
| B | E.O. 15327 | 11/25/03 | WCM |
| C | E.O. 15350 | 01/22/04 | WCM |
| D | E.O. 15749 | 06/23/05 | WCM |
| E | E.O. 15976 | 01/29/08 | WCM |
| F | E.O. 16236 | 01/04/12 | WCM |
| G | E.O. 16247 | 02/03/12 | WCM |
| H | E.O. 16316 | 09/17/12 | WCM |
| J | E.O. 16371 | 04/03/13 | WCM |
| K | E.O. 16442 | 12/18/13 | WCM |
| L | E.O. 16452 | 02/13/14 | SCJ |
| M | E.O. 16500 | 07/29/14 | WCM |
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