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User's Manual

AtmosPure™ Re-Gen Gas Purifier

Models	Voltage, Frequency	Electrical Receptacle Plug Type
5121810	100-115V, 50/60 Hz	North America
5121831	208-230V, 50/60 Hz	British (UK)
5121835	208-230V, 50/60 Hz	Schuko
5121840	208-230V, 50/60 Hz	China/Australia
5121845	208-230V, 60 Hz only	North America

To receive important product updates,
complete your product registration card
online at register.labconco.com

Please read the User's Manual before operating the equipment.

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Warranty

Labconco Corporation provides a warranty to the original buyer for the repair or replacement of parts and reasonable labor as a result of normal and proper use of the equipment with compatible chemicals. Broken glassware and maintenance items, such as filters, gaskets, light bulbs, finishes and lubrication are not warranted. Excluded from warranty are products with improper installation, erratic electrical or utility supply, unauthorized repair and products used with incompatible chemicals.

The warranty for AtmosPure™ Re-Gen Gas Purifier will expire one year from date of installation or two years from date of shipment from Labconco, whichever is sooner. Warranty is non-transferable and only applies to the owner (organization) of record.

Buyer is exclusively responsible for the set-up, installation, verification, decontamination or calibration of equipment. This limited warranty covers parts and labor, but not transportation and insurance charges. If the failure is determined to be covered under this warranty, the dealer or Labconco Corporation will authorize repair or replacement of all defective parts to restore the unit to operation. Repairs may be completed by 3rd party service agents approved by Labconco Corporation. Labconco Corporation reserves the rights to limit this warranty based on a service agent's travel, working hours, the site's entry restrictions and unobstructed access to serviceable components of the product.

Under no circumstances shall Labconco Corporation be liable for indirect, consequential, or special damages of any kind. This warranty is exclusive and in lieu of all other warranties whether oral, or implied.

Returned or Damaged Goods

Do not return goods without the prior authorization from Labconco. Unauthorized returns will not be accepted. If your shipment was damaged in transit, you must file a claim directly with the freight carrier. Labconco Corporation and its dealers are not responsible for shipping damages.

The United States Interstate Commerce Commission rules require that claims be filed with the delivery carrier within fifteen (15) days of delivery.

Limitation of Liability

The disposal and/or emission of substances used in connection with this equipment may be governed by various federal, state, or local regulations. All users of this equipment are required to become familiar with any regulations that apply in the user's area concerning the dumping of waste materials in or upon water, land, or air and to comply with such regulations. Labconco Corporation is held harmless with respect to user's compliance with such regulations.

Contacting Labconco Corporation

If you have questions that are not addressed in this manual, or if you need technical assistance, contact Labconco's Customer Service Department or Labconco's Product Service Department at 1-800-821-5525 or 1-816-333-8811, between the hours of 7:30 a.m. and 5:30 p.m., Central Standard Time.

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION	1
General Description	3
Circulation System	3
Purifier System	3
Regeneration Control	4
CHAPTER 2: PREREQUISITES	5
Support Requirements	6
Exhaust Requirements for the Regeneration Vent Valve	6
Electrical Requirements	6
Plumbing Requirements for Circulation, 4% Hydrogen/ Inert Gas Mixture, Vacuum, and Exhaust Vent	7
Space Requirements	7
Safety Precautions	7
CHAPTER 3: GETTING STARTED	9
Unpacking the Gas Purifier	9
Installing the Gas Purifier on a Supporting Structure & Work Surface	10
Connecting the Electrical Supply Source to the Gas Purifier	10
Connect the Plumbing Lines for Circulation, 4% Hydrogen/ Inert Gas Mixture, Vacuum, and Exhaust Vent	11
Connecting the Circulation Plumbing	14
Connecting the Regeneration Plumbing	16
Initial Start-up of the Gas Purifier for Removal of Oxygen and Moisture	19
Regenerating the Gas Purifier Catalysts	21
CHAPTER 4: FEATURES AND SAFETY PRECAUTIONS	26
Gas Purifier Performance Features	26
Safety Precautions	30
CHAPTER 5: USING YOUR GAS PURIFIER	32
Routine Daily Work Procedures	32
Hazardous Use with Chemicals	34
Prohibited Materials Use	34

CHAPTER 6: MAINTAINING YOUR GAS PURIFIER	35
Routine Maintenance Schedule	35
Initial Certification	35
Recertification	36
Solenoid Valve Replacement	36
Catalyst Replacement	36
CHAPTER 7: ACCESSORIZING YOUR GAS PURIFIER	38
CHAPTER 8: TROUBLESHOOTING	42
APPENDIX A: REPLACEMENT PARTS	43
APPENDIX B: DIMENSIONS	45
APPENDIX C: SPECIFICATIONS	46
APPENDIX D: ATMOSPURE RE-GEN GAS PURIFIER OXYGEN & MOISTURE REMOVAL RATES	47
APPENDIX E: CONVERSIONS	55
APPENDIX F: REFERENCES	56

Chapter 1: Introduction

The AtmosPure™ Re-Gen Gas Purifier reduces the levels of oxygen and moisture inside the controlled atmosphere glove box. The Gas Purifier enables the user to work in an inert gas environment with materials that are sensitive to oxygen and moisture. The Gas Purifier comes fully regenerated and ready to use after the main chamber oxygen and moisture levels are reduced to 3000-5000ppm using evacuation and re-fills of an inert gas. The Gas Purifier has been tested with all three controlled atmosphere glove box liner materials manufactured by Labconco (stainless steel, fiberglass (FRP), and polyethylene). All three Labconco controlled atmosphere glove boxes meet or exceed ISO 10648-2 standards when used with the Gas Purifier. The test results are as follows:

	Gas Permeant	Glove Port Covers	<i><u>Precise(polyethylene)</u></i>	<i><u>Protector(FRP)</u></i>	<i><u>Protector(stainless)</u></i>
Attainable	O ₂	Installed	3.5	0.4	0.2
Purity	H ₂ O	Installed	5	2	1
(ppm)	O ₂	None	4.5	0.9	0.8
	H ₂ O	None	5	3	2
Oxygen Permeation at -4"w.g. per ISO 10648-2 Test Method (ppm/min)	O ₂	None	0.60	0.30	0.16
ISO 10648-2 Acceptance Level for Class 1 Controlled Atmosphere Glove Box (ppm/min)	O ₂	None	<1.67	<1.67	<1.67
Normal Permeation with pressure from (-1"w.g. to +1"w.g.) (ppm/min)	O ₂	None	0.33	0.16	0.14
	H ₂ O	None	0.21	0.17	0.10

The Gas Purifier has the capacity to remove up to 5 liters of oxygen (13,500ppm) and 660 grams of moisture (18 million ppm) at standard temperature and pressure (STP). Depending on the application, glove box liner material chosen, and frequency of use, regeneration may be necessary only once every 1-3 months and take only 13 hours to complete the process.

The AtmosPure Re-Gen Gas Purifier offers many unique features to enhance performance with use of controlled atmosphere glove boxes. To take full advantage of all the features, you **must** read and understand this manual and keep it handy for future reference during regeneration.



AtmosPure Re-Gen Gas Purifier shown with Labconco Protector Controlled Atmosphere Glove Box with Auto Pressure Control mounted on an Adjustable Height Base Stand

Figure 1-1

General Description

The AtmosPure Re-Gen Gas Purifier consists of three distinct systems:

- A. Circulation System
- B. Purifier System
- C. Regeneration Control

Circulation System

The circulation blower continually circulates the inert gas inside the glove box through the Gas Purifier to remove oxygen and moisture. As the blower circulates the glove box inert atmosphere through the purifier column, water molecules are adsorbed by the molecular sieve. Molecular sieve is a synthetic zeolite that adsorbs all molecules less than 10 angstroms in size. Oxygen molecules are removed from the inert gas by reacting with the copper catalyst and forming copper oxide.

Purifier System

A six inch diameter stainless steel column contains 5 lbs of molecular sieve for H₂O removal and 5 lbs of a reactant copper catalyst material for O₂ removal. The purifier is equipped with components necessary for regeneration of the molecular sieve and copper scavenging media.

Attached to the column are:

- Two isolation valves (manually operated). These valves are kept open during circulation of the glove box gas through the purifier and **MUST BE CLOSED** during the regeneration procedure.
- Three solenoid valves for connecting 4% hydrogen/inert gas mixture, exhaust vent, and vacuum. These are located at the back of unit.
- A flow meter for 10-25 CFH regulation of the 4% hydrogen/inert gas mixture during regeneration.
- A 180 watt electric heating coil imbedded in the purifier media. The heating coil is used in regeneration of the catalysts.
- Ceramic fiber, high temperature insulation.
- An exterior metal case to protect all the components.

Regeneration Control

Regeneration is controlled by a microprocessor which automatically sequences the solenoid valves during the regeneration cycle. The regeneration cycle restores the molecular sieve and copper catalyst. It is programmed for the following time functions:

- Initial 2 minute purge to allow adjustment of 4% hydrogen/inert gas mixture flow rate to 10-25 CFH. (10 CFH Helium/4% Hydrogen, 20 CFH Nitrogen/4% Hydrogen, 25 CFH Argon/4% Hydrogen).
- Heat cycle – 3 hours.
- Purge cycle – 2 hour – 4% hydrogen/inert gas mixture flows through purifier (heat also remains on).
- Vacuum cycle – 8 hours minimum (continues until manually shut-off and red LED flashes).

The control panel contains push button switches for automatic cycling (H₂ SET, HEAT, H₂ PURGE, VACUUM). The lighted display shows which stage the regeneration process is in.

NOTE: Refer to Chapter 3, Chapter 4 and Chapter 5 for more detailed descriptions of performance features, control functions, operating instructions, and safety features.

Chapter 2: Prerequisites

Before you install the Gas Purifier to the controlled atmosphere glove box, you need to prepare your site for installation. You must be certain that the area is level and of solid construction. In addition, a dedicated source of electrical power should be located near the installation site to power the glove box and the Gas Purifier. Additionally, the glove box and accessory Gas Purifier should be strategically placed in the lab to provide efficient workflow and prevent operator interference from normal traffic flow.

Carefully read this chapter to learn the requirements for your installation site:

- The support and location requirements.
- The exhaust requirements for the regeneration vent valve.
- The electrical power requirements.
- The plumbing requirements for the circulation system of the Gas Purifier, the regeneration 4% hydrogen/inert gas mixture, vacuum, and exhaust vent.
- The space requirements.

Refer to *Appendix B: Gas Purifier Dimensions*.

Refer to *Appendix C: Gas Purifier Specifications* for complete electrical and environmental conditions, specifications and requirements.

Support Requirements

In the preparation of installing the Gas Purifier at the glove box site, please consider the following:

- A bench or stand that rests on the floor or fixed to the wall, but not both, may be appropriate. 35" to 40" (889mm to 1,016mm) is typical for standing height (Labconco stands offered in Chapter 7 vary from 33" to 40" or 838mm to 1,016mm). The stands Labconco offers include a convenient place on the right side shelf to support the AtmosPure Re-Gen Gas Purifier. See Figure 1-1 in Chapter 1.

Exhaust Requirements for the Regeneration Vent Valve

The vent valve exhausts 4% hydrogen/inert gas during the regeneration process and must be vented safely to the outside or exhausted to a fume hood. The regeneration vent valve is exhausted through the gas flow regulator. An open compression fitting is attached to the gas flow regulator and can be used to connect the exhaust hose from the Regeneration Plumbing Kit. Refer to Chapter 7 to purchase the Regeneration Plumbing Kit and Chapter 3 for start up.

Electrical Requirements

Electrical receptacles should be located nearby for connecting the Gas Purifier and the controlled atmosphere glove box. The Gas Purifier is rated 100-115V, 10A or 230V, 5A. One exterior outlet for a vacuum pump connection is located on the rear of the Gas Purifier and is rated for 100-115V, 8A or 230V, 4.5A. A single shared vacuum pump can be used for glove boxes configured with auto pressure control, please see *Chapter 7: Accessories* to order the AtmosPure C.A. COM Cable (6-pin). Accessory oxygen or moisture monitors can be programmed to provide automatic control of the Gas Purifier's blower. Please see *Chapter 7: Accessories* to order the AtmosPure Oxygen/Moisture Monitor Cable (9-pin), Oxygen or Moisture Monitor, and Sealed Electrical 9-pin Pass-Through. Chapter 3 details all the connections for proper start-up. Figure 3-8 shows a typical connection diagram for electrical connections.

Plumbing Requirements for Circulation, 4% Hydrogen/Inert Gas Mixture, Vacuum, and Exhaust Vent

The Gas Purifier has two 3/4" compression fittings for connecting the inlet/outlet of the circulation system of the Gas Purifier to the glove box inert gas and three solenoid valves with 3/8" compression fittings for connection to the regeneration system (Regeneration Control). Refer to *Chapter 3: Getting Started* and *Chapter 7: Accessories* to select the proper Circulation Tubing Kit for attachment of the AtmosPure Re-Gen Gas Purifier. Labconco offers neoprene lined tubing kits and stainless steel tubing kits. Labconco also offers a 3/4" to 3/8" adapter elbow used to connect to 3/8" fittings found on polyethylene and older style glove boxes. An AtmosPure Regeneration Tubing Kit should be selected from *Chapter 7: Accessories* as it provides all the plumbing to connect the 4% hydrogen/inert gas mixture, vacuum pump, and exhaust vent. A rotary vane vacuum pump must also be selected from *Chapter 7: Accessories*. Rotary vane vacuum pumps establish a very deep vacuum below 10 microns that allows the copper catalyst and molecular sieve to be properly regenerated. Chapter 3, the detailed Figures in Chapter 3, and Figure 3-8 show typical connections for all plumbing.

Space Requirements

The dimensions are shown in *Appendix B: Dimensions*. Adequate space is provided to support the Gas Purifier on Labconco Adjustable Base Stands as listed in *Chapter 7: Accessories*. The lower shelf of the adjustable base stand provides a convenient location to place the Gas Purifier on the right side below the glove box transfer chamber and out of the way of the operator. Refer to Figure 1-1 in *Chapter 1: Introduction*.

Safety Precautions

When lifting this product, use at least two (2) persons and always use safe lifting practices.

Do **NOT** use a detachable power cord that is not adequately rated for this product.

Always disconnect power before beginning service operations.

Do not damage internal wiring or other components while service panels are removed. If internal wiring or components are damaged, do not restore power, contact Labconco's Product Service Department immediately.

Wear all required Personnel Protective Equipment (PPE) during service operations. At a minimum, this includes: eye protection, breathing protection, skin protection. Do not wear loose fitting clothes that can catch on internal surfaces.

After service, verify safe state of use before using the product. Contact Labconco's Product Service Department for questions on determining safe state of this product.

Verify protective earth ground continuity before using equipment.

No special ventilation requirements.

No hazards exist for: explosion, implosion, or release of toxic or flammable gases arising from the materials being heated.

No Heat Transfer Media is required for the normal operation of this equipment.

Cleaning solutions that do not contain chlorine-based disinfectants (such as Bleach or hypochlorites) may be safely used on this equipment.

If there is any doubt about the compatibility of decontamination or cleaning agents, contact Labconco's Product Service Department.

Chapter 3: Getting Started

Once the site for your Gas Purifier is properly prepared, you are ready to unpack, inspect, and install your system. Read this chapter to learn how to:

- Unpack and move the Gas Purifier.
- Set up the Gas Purifier with the proper supporting structure.
- Connect the electrical supply.
- Connect the plumbing lines for circulation, 4% hydrogen/inert gas mixture, vacuum, and exhaust vent.
- Start-up the Gas Purifier for removal of oxygen and moisture.
- Regenerate the Gas Purifier catalysts after 1-3 months of use.

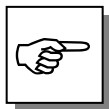


Each Gas Purifier model weighs 75 lbs each (34 kg). The shipping container allows for lifting with a mechanical lift truck or floor jack. If you must lift the Gas Purifier manually, follow safe-lifting guidelines. Do not lift by the upper sheet metal façade and front panel as damage can occur.

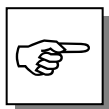
Unpacking the Gas Purifier

We recommend that you do not remove the Gas Purifier from its shipping container until it is ready to be placed into its final location.

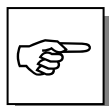
Carefully remove the shrink-wrap on the Gas Purifier and inspect it for damage that may have occurred in transit. **If damaged, notify the delivery carrier immediately and retain the entire shipment intact for inspection by the carrier.**



THE UNITED STATES INTERSTATE COMMERCE COMMISSION RULES REQUIRE THAT CLAIMS BE FILED WITH THE DELIVERY CARRIER WITHIN FIFTEEN (15) DAYS OF DELIVERY.



DO NOT RETURN GOODS WITHOUT THE PRIOR AUTHORIZATION OF LABCONCO. UNAUTHORIZED RETURNS WILL NOT BE ACCEPTED.



IF GAS PURIFIER WAS DAMAGED IN TRANSIT, YOU MUST FILE A CLAIM DIRECTLY WITH THE FREIGHT CARRIER. LABCONCO CORPORATION AND ITS DEALERS ARE NOT RESPONSIBLE FOR SHIPPING DAMAGES.

Do not discard the packing material until you have checked all of the components and tested the Gas Purifier with the controlled atmosphere glove box.

Installing the Gas Purifier on a Supporting Structure and Work Surface

Exercise caution when lifting or moving the Gas Purifier. Do not lift the Gas Purifier using the isolation valve handles.

When installing the Gas Purifier onto a surface, ensure that the structure can safely support the weight of the Gas Purifier and any related equipment such as the vacuum pump. The Labconco base stands from Chapter 7 offer a lower shelf with optimized placement of the Gas Purifier on the right side under the transfer chamber. Refer to Figure 1-1 in Chapter 1 and Figure 3-8 in Chapter 3. The lower shelf can also support the rotary vane vacuum pump accessory as shown in Figure 3-8.

Connecting the Electrical Supply Source to the Gas Purifier

Connect the power cord supplied to the IEC electrical supply plug located on the back of the Gas Purifier. 100-115V models are rated at 10 amps total. 230V models are rated at 5 amps total. If a dedicated vacuum pump is used for the Gas Purifier, one electrical outlet is located on the rear of the Gas Purifier for vacuum pump use and is rated at 100-115V, 8A or 230V, 4.5A.

Connect the Plumbing Lines for Circulation, 4% Hydrogen/Inert Gas Mixture, Vacuum, and Exhaust Vent

All the plumbing lines to the Gas Purifier **must** be connected properly. Carefully follow the instructions that follow and refer to Figure 3-1 and Figure 3-8 that depict views of the rear of the Gas Purifier where all the plumbing connections are made. Furthermore, refer to Figure 3-2 and Figure 3-8 that shows a typical plumbing connection of the rear of the glove box for the circulation lines.

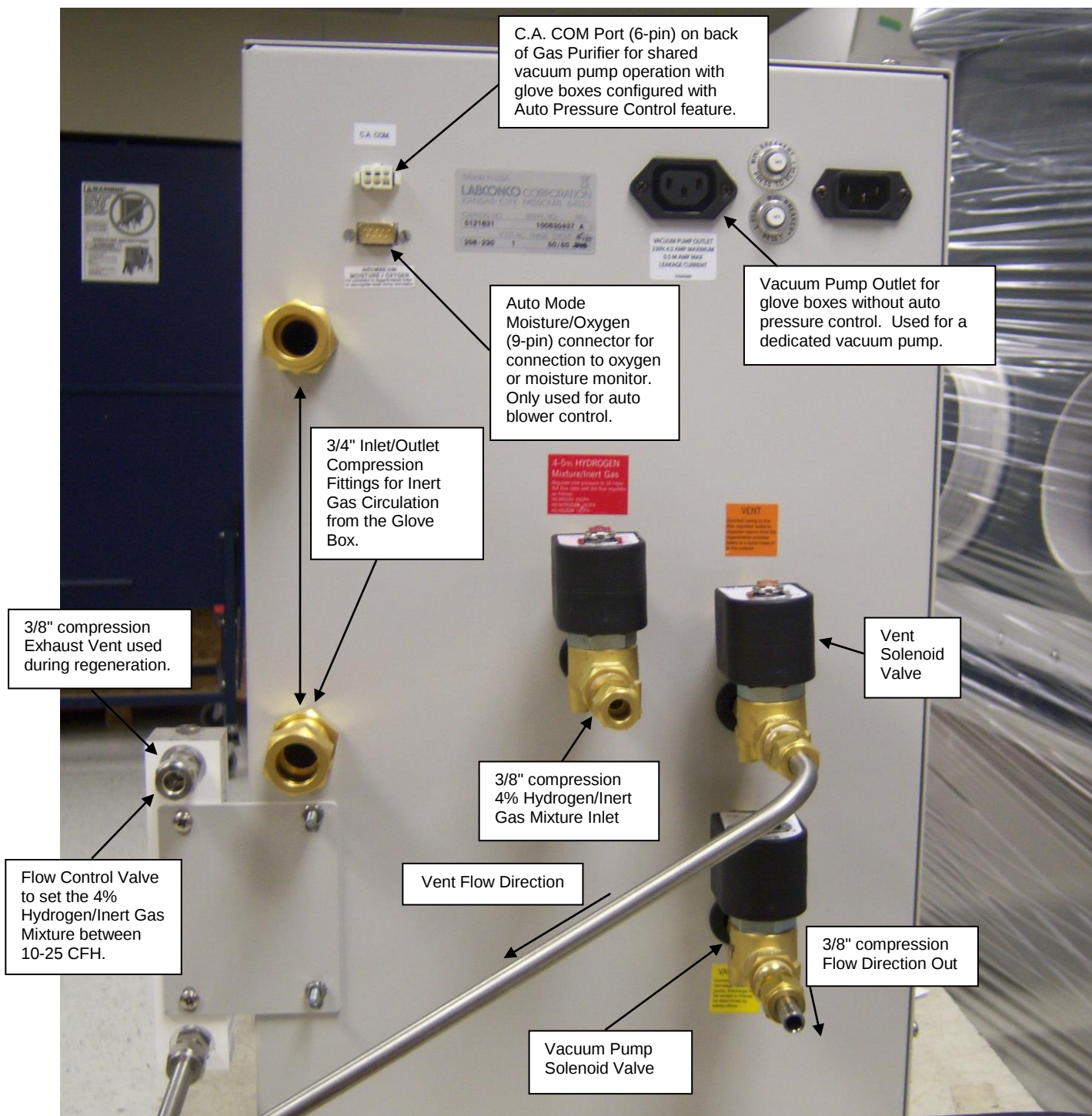


Figure 3-1
Rear View of AtmosPure Re-Gen Gas Purifier



Figure 3-2
Typical Plumbing Connection for the Circulation Lines

Connecting the Circulation Plumbing

The circulation plumbing continuously circulates the inert gas atmosphere from the controlled atmosphere glove box and purifies it by removing oxygen and moisture. The connections from the 3/4" inlet/outlet compression fittings must be made to the glove box. Depending on the neoprene lined tubing kit or stainless steel tubing kit selected, route one line from the inlet of the Gas Purifier to the outlet of the glove box. Refer to Figures 3-1, 3-2, and 3-8. Next, route the outlet of the Gas Purifier to the inlet of the glove box. A continuous tubing loop for Gas Purifier circulation is now established. **Be sure to properly tighten all the 3/4" compression fittings at least 1-1/4 turns past finger tight as leaks will affect Gas Purifier performance.** The orientation of all the compression fittings must be properly set per Figure 3-3. Should your glove box have 3/8" compression fittings (such as Labconco polyethylene glove boxes), use the 3/4" to 3/8" adapter kits to route the circulated air through the neoprene lined hose kit. Refer to Chapter 7 to order all circulation kits and adapter kits.



Note: The Gas Purifier ships fully regenerated and ready to use. Keep the isolation valves (manually operated) closed until ready to use. The isolation valves (Figure 3-4) must be closed until the glove box inert gas atmosphere is below 5000 ppm. Opening the isolation valves before the Gas Purifier and glove box are ready for operation will cause a loss in oxygen and moisture removal capacity.

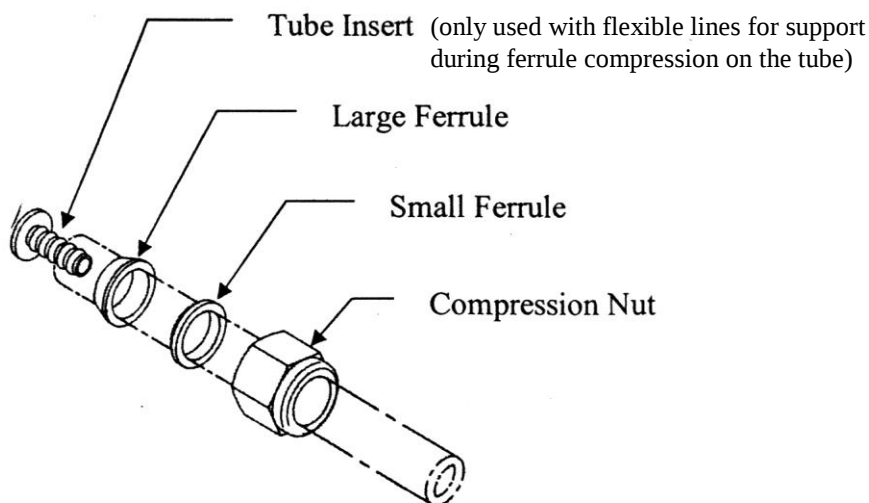


Figure 3-3
Typical Orientation of Ferrules

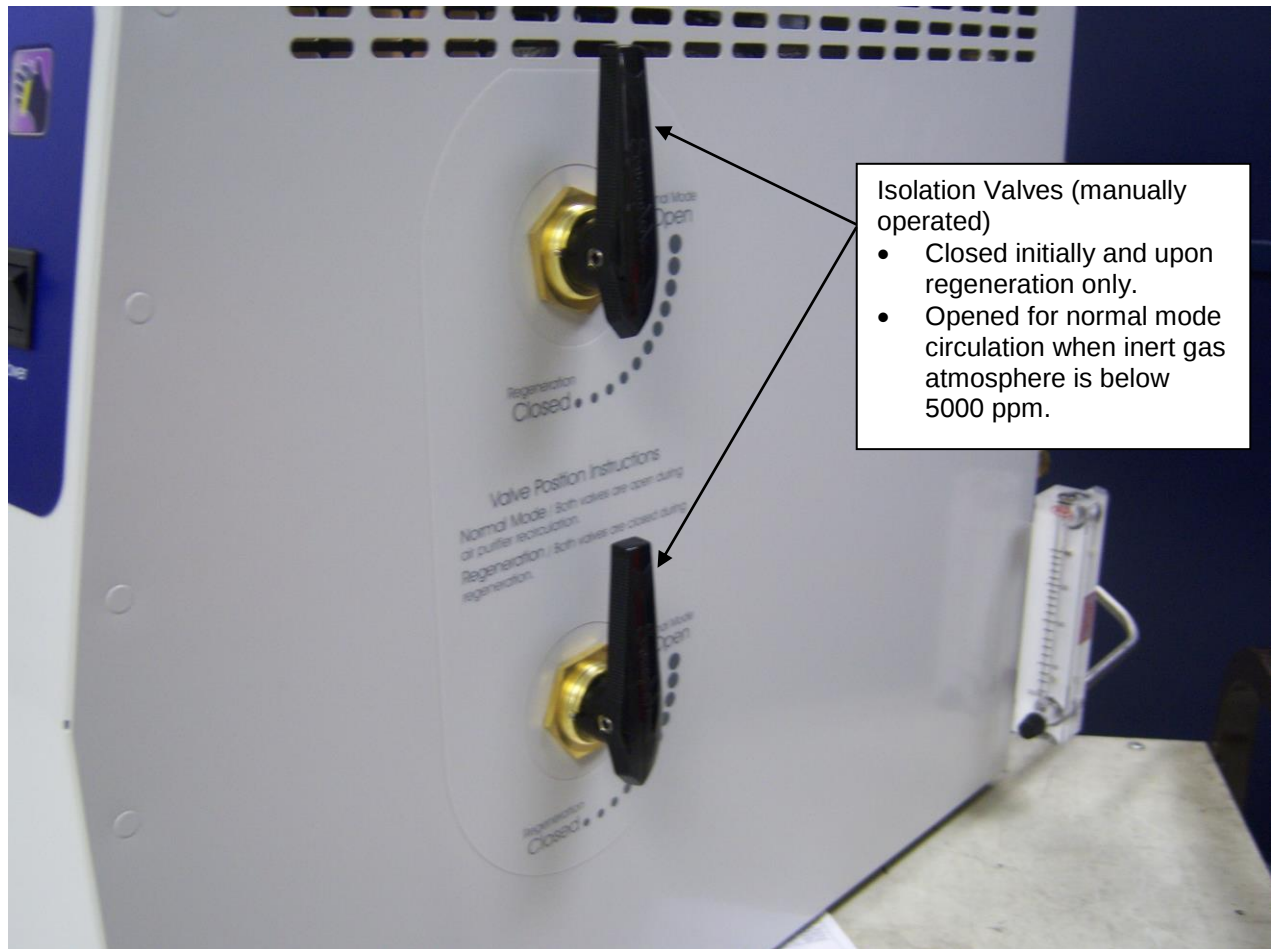


Figure 3-4
Isolation Valves

Connecting the Regeneration Plumbing

The Regeneration Plumbing allows the copper catalyst and molecular sieve to be regenerated as needed. The regeneration process takes 13 hours and may be completed overnight. Refer to Figures 3-1, 3-3, and 3-8.

First, locate the tank of 4% hydrogen/inert gas mixture. Using the AtmosPure Regeneration Tubing Kit, route the tubing from the 4% hydrogen gas mixture pressure regulator to the valve inlet per Figures 3-1 and 3-8. The 4% hydrogen mixture provides the gas to restore the copper catalyst. Be sure to orient the ferrules properly and install the tube insert into the flexible line on both ends per Figure 3-3. Tighten the compression fittings on both ends 1-1/4 turns past finger tight.

Second, locate the vacuum pump and route the vacuum line from the vacuum pump to the vacuum solenoid valve located on the back of the AtmosPure Re-Gen Gas Purifier per Figure 3-1. The vacuum line connection tubing is included in the Gas Purifier Regeneration Tubing Kit. Again, be sure to orient the ferrules properly, install the tube inserts, and tighten the compression fittings 1-1/4 turns past finger tight. An alternate view for connection to the vacuum solenoid valve is provided in Figure 3-5. If one shared vacuum pump will be used and shared between the controlled atmosphere glove box and the Gas Purifier, then the AtmosPure C.A. COM cable (6-pin) must be connected between the Gas Purifier and the back of the glove box Auto Pressure Control (refer to Figures 3-1, 3-6, and 3-8). If shared with the controlled atmosphere glove box (only with auto pressure control), then plug the vacuum pump into the back of the glove box (refer to Figure 3-6). If a dedicated vacuum pump will be used for the Gas Purifier, plug the vacuum pump into the electrical outlet on the back of the AtmosPure Re-Gen Gas Purifier (Figure 3-1).

Third, the vent valve is exhausted through the 10-25 CFH flow control valve as viewed in Figure 3-1. The vent line **must** be exhausted to the outside or to a fume hood. From the Regeneration Tubing Kit, install the exhaust line to the flow control valve and route the tubing to the outside or to a fume hood. Again, properly install the tubing per Figure 3-3.

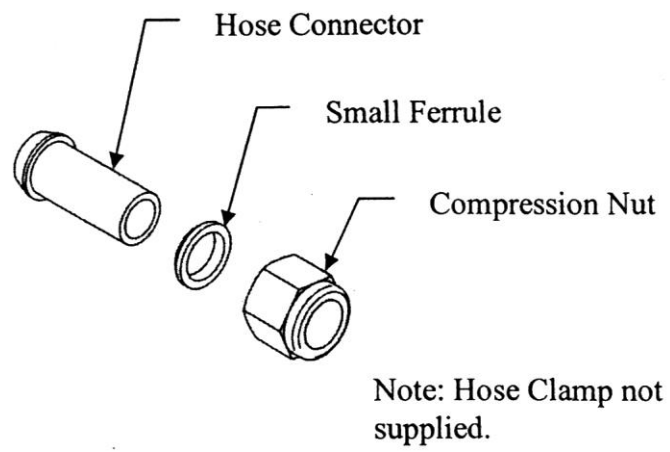


Figure 3-5
Alternate View for Vacuum Connection

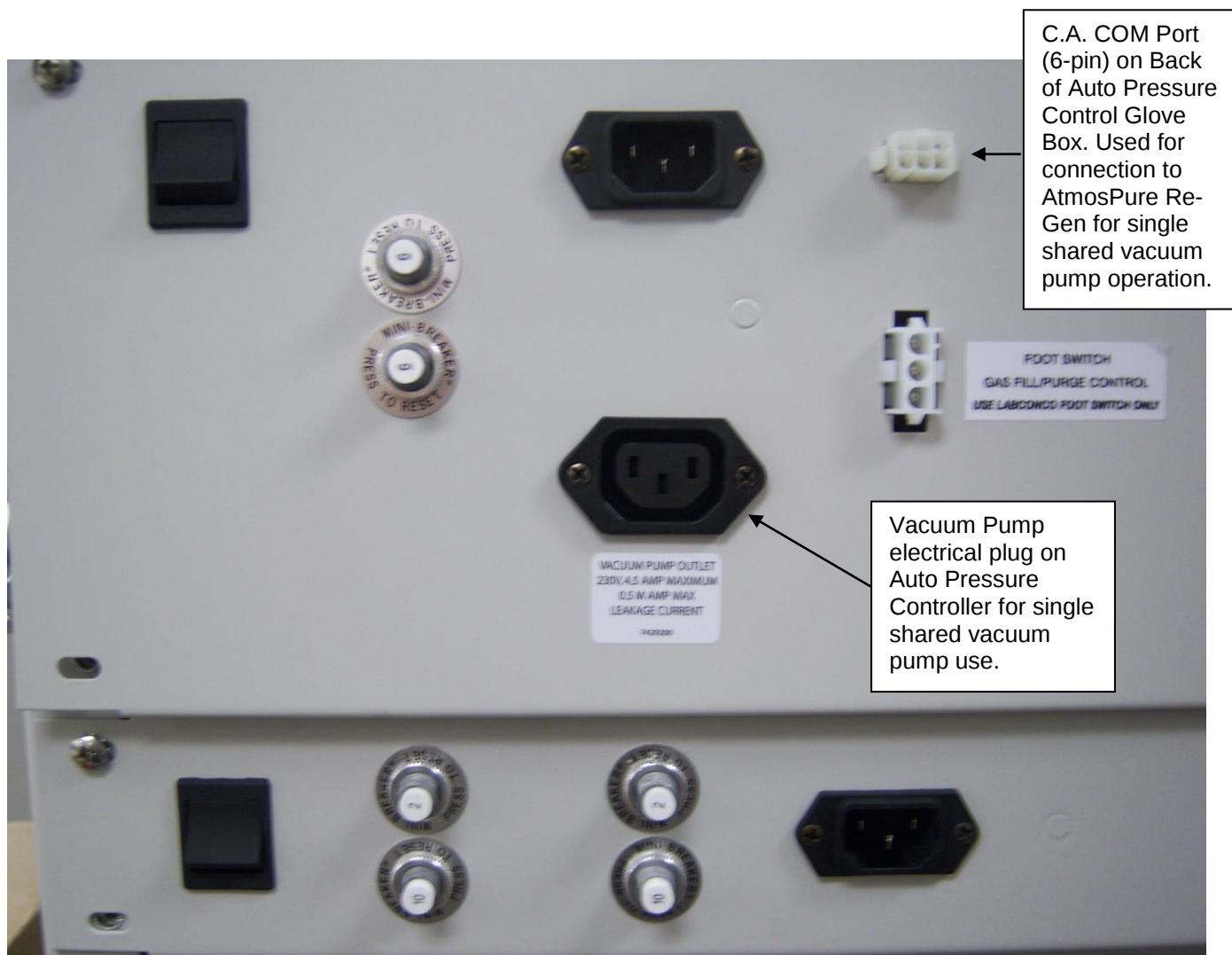


Figure 3-6
Rear View of Auto Pressure Control on Glove Box

Initial Start-up of the Gas Purifier for Removal of Oxygen and Moisture

Do **not** open the isolation valves (Figure 3-4) until the inert atmosphere in the controlled atmosphere glove box main chamber has been reduced below 5000 ppm for both oxygen and moisture. The Gas Purifier arrives fully regenerated and ready for use. Usually 5000 ppm can be attained through 200 evacuation and fill cycles of inert gas into the glove box. Once 5000 ppm or less is achieved, the Gas Purifier isolation valves may be opened and the blower turned on. Simply turn the blower ON as identified on the control panel per Figure 3-7. Once turned ON, the blower circulates inert gas air from the glove box through the Gas Purifier column; oxygen and moisture will start to drop immediately. The button switches the Gas Purifier blower between ON, OFF, and AUTO. ON operates the blower continuously, OFF shuts the blower down, and AUTO turns the blower on and off if an oxygen or moisture monitor control range is desired. If AUTO is chosen, the oxygen or moisture monitor (available from Chapter 7) must be programmed and the monitor automatically controls the blower function.

The oxygen or moisture monitor should be placed inside the glove box for best results. The accessory Oxygen/Moisture Monitor Cable (9-pin) and Electrical 9-pin Sealed Pass-Through must be installed between the monitor (oxygen or moisture) and the Gas Purifier. Please refer to Figure 3-1, Figure 3-8 and Chapter 7 for accessories and connections for AUTO mode control of the sealed circulation blower inside the Gas Purifier.



CAUTION: Some chemicals used in a glove box will “poison” the copper catalyst inside the Gas Purifier and reduce the oxygen removal capability. These chemicals should not be used in the glove box in order to avoid replacing the copper catalyst and molecular sieve.

1. Sulfur containing compounds (hydrogen sulfide, carbonyl sulfide, disulfides, sulfur dioxide, sulfur trioxide)
2. Halides and halogens (Freon)
3. Alcohols
4. Hydrazine
5. Heavy Metals
6. Mercury
7. Arsine
8. Phospene

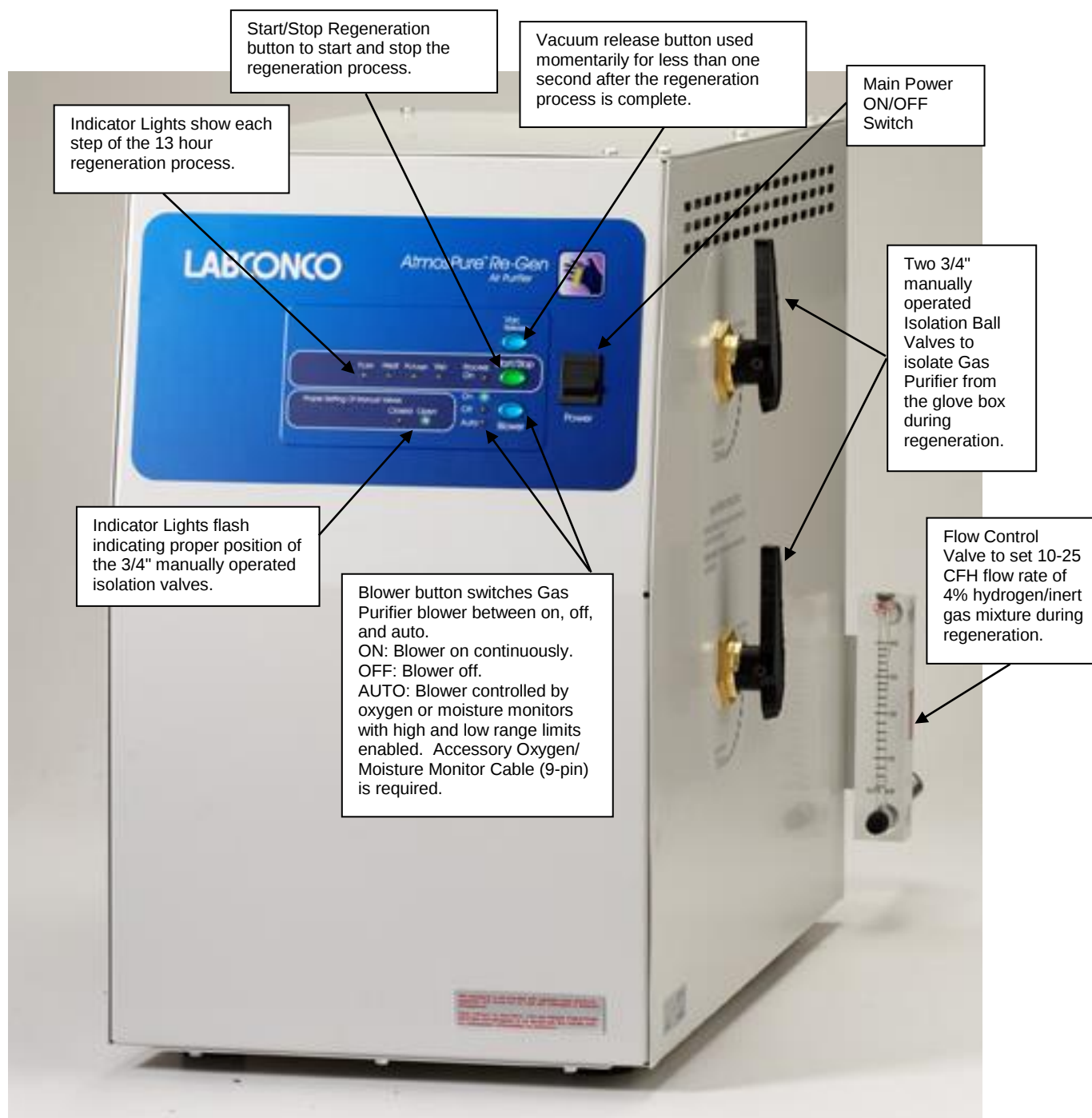


Figure 3-7
AtmosPure Re-Gen Control Panel Features

Regenerating the Gas Purifier Catalysts

The AtmosPure Re-Gen Gas Purifier is initially shipped with the copper catalyst and molecular sieve fully regenerated and ready to use. The copper catalyst can last 1-3 months with normal use. The performance levels and frequency of regeneration are dependent on several influencing factors including:

- Purity of inert gas being used and the amount of O₂/H₂O removal by evacuation and filling during initial glove box operation with the inert gas.
- Permeation rate of the glove box rubber gloves.
- Oxygen and moisture content of materials introduced into the glove box.
- Glove box liner material and its permeation rate.
- Frequency of use and applications that introduce oxygen and moisture into the inert atmosphere.

The regeneration procedure requires 13 hours and may be done overnight. Refer to Figure 3-7 for control panel features.



WARNING: Before starting the regeneration procedure, make sure that the Gas Purifier exhaust vent is connected, to safely discharge vapors from the regeneration process to the outside or to a fume hood. The exhaust vent is attached to the flow control valve per Figure 3-1.

Regeneration Mode (isolation valves must be closed):

The regeneration process consists of a H₂ Set cycle, a Heat cycle, a H₂ Purge cycle (using 4% hydrogen/inert gas mixture), and a Vacuum cycle that takes 13 hours and can be done overnight. Moisture is driven from the molecular sieve by the heat. Oxygen is removed from the heated copper catalyst by the hydrogen combining with the copper oxide, which forms H₂O. After the heat and purge cycles, the vacuum cycle removes the residual gas and moisture from the purifier. The H₂ set cycle allows the operator to set the 4% hydrogen/inert gas mixture flow rate with the flow control valve (Figures 3-1 and 3-7) as follows:

4% hydrogen/ 96% helium, 10 CFH

4% hydrogen/ 96% nitrogen, 20 CFH

4% hydrogen/ 96% argon, 25 CFH

Regeneration Steps:

Step 1 – Check to see that the 4% hydrogen/inert gas mixture tank valve is open and its pressure regulator is set between 10-14 psi. At least ½ a tank of 4% hydrogen/inert gas must be available. Also, be sure that the vacuum pump electrical power cord is plugged in.

Step 2 – Close both isolation valves.



CAUTION: Both isolation valves must remain closed until the entire regeneration cycle is completed and vacuum is released.

Step 3 – Push the automatic START/STOP button on the AtmosPure control panel (see Figure 3-7) to begin automatic regeneration.

Step 4 – Adjust the Hydrogen Purge Flow Rate Knob to provide CFH reading as specified on the back of the Gas Purifier and listed in this instruction manual on the previous page. If proper flow cannot be set within the two minute period, push Start/Stop switch to cancel program. Return to Step 3 when you are ready. Regeneration will begin with the heat cycle after the two minute flow adjustment period. After the 3 hour initial heat cycle, the 2 hour H₂ purge cycle will begin automatically.

Step 5 – With the vacuum pump on and properly connected, the vacuum pump will run for at least eight hours after completion of the heat and H₂ purge cycles.

Step 6 – After a minimum 8 hour vacuum cycle, push the START/STOP button to end regeneration.

Step 7 – Turn off the vacuum pump then push the VAC. REL. button for one second or less.

Note: An optional method releases the vacuum through the inert gas inside the glove box and enhances oxygen removal capacity.

Step 8 – Optional – Do not push the VAC. REL. button. Instead partially open both isolation valves. The isolation valves **must** be opened partially to slowly replace the vacuum inside the Gas Purifier with inert gas from the glove box. As the glove box pressure drops due to the Gas Purifier vacuum, refill the glove box with inert gas from the inert gas tank directly or use the Auto Pressure Control of the glove box. Hold the glove box pressure between +1" w.g. to +4" w.g. Once the vacuum is fully released, open the isolation valves 100%. This method fully preserves the regenerated copper catalyst and molecular sieve.

Step 9 – The regeneration procedure has now been completed. The blower button needs to be turned on to begin circulating the inert gas in the glove box through the Gas Purifier.

AUTOMATIC REGENERATION PROGRAMMED FUNCTIONS

FUNCTION	TIME	HEATER	SOLENOID VALVES		
			4% HYDROGEN INLET	VENT	VACUUM
H ₂ Set Initial Purge (manual adjustment of 4% hydrogen/inert gas flow rate)	2 MIN.	ON	OPEN	OPEN	CLOSED
HEAT	3 HRS.	ON	CLOSED	OPEN	CLOSED
H ₂ PURGE	2 HRS.	ON	OPEN	OPEN	CLOSED
VACUUM	Continues until manually switched off by operator pushing Start/Stop button 8 hr. (min.)	OFF	CLOSED	CLOSED	OPEN
VACUUM RELEASE	Momentary (by operator)	OFF	CLOSED	OPEN MOMENTARILY	CLOSED

NOTE: The Gas Purifier has optimized programming of each function as shown in the above chart.

Electrical Power Outage:

The regeneration system automatically compensates for power outages. If the outage is longer than 10 minutes, the regeneration system will reset and start over.

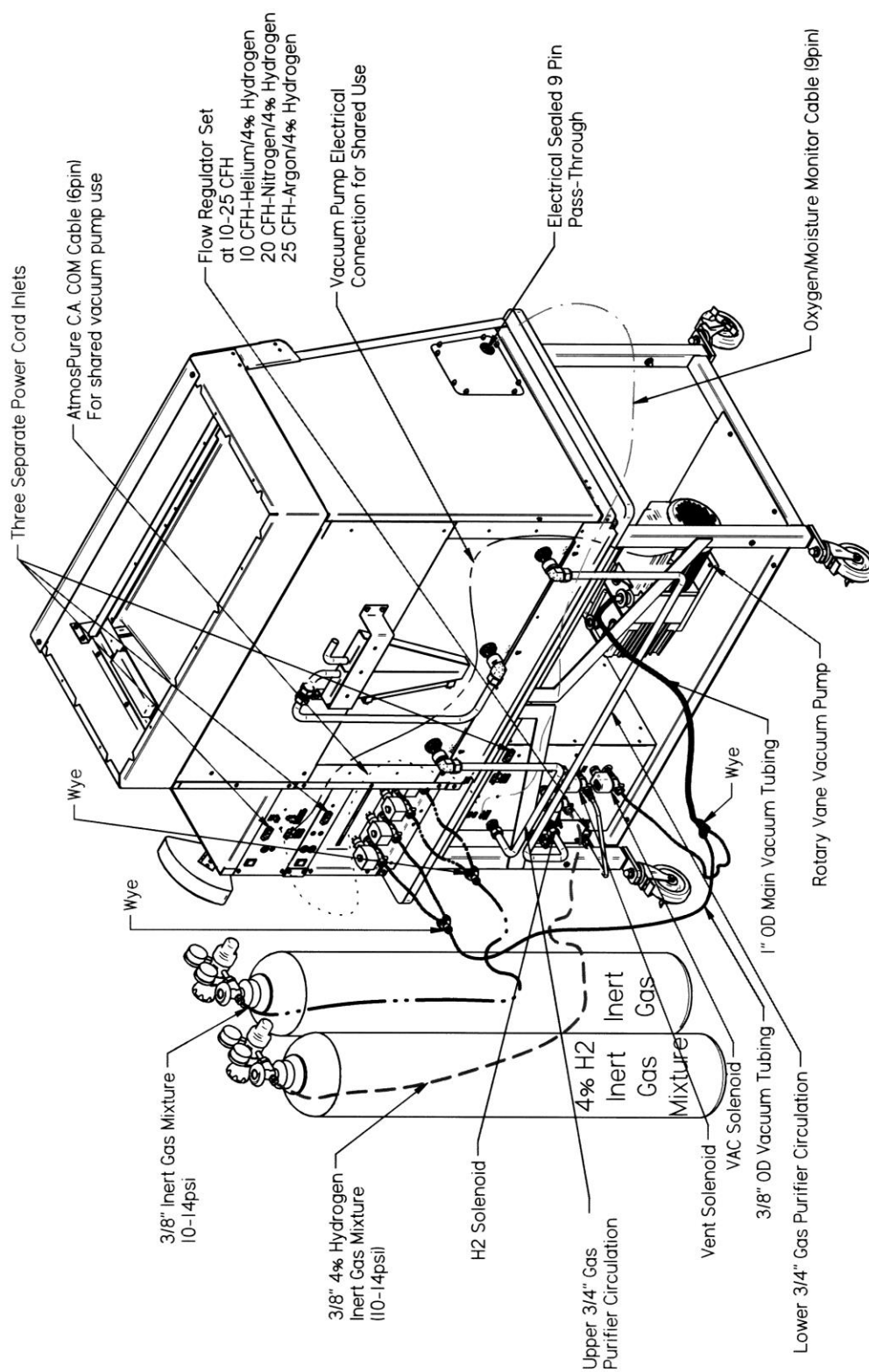


Figure 3-8
Connection Diagram for AtmosPure Gas Purifier
and Controlled Atmosphere Glove Box

Requirements Note: Refer to Chapter 7 for proper accessories required for set-up. At a minimum, you will require the following from Chapter 7:

- Adjustable height base stand
- Regeneration Tubing kit
- Circulation Tubing kit
- Gas/Vacuum/Vent Tubing kit
- Direct drive rotary vane vacuum pump
- Oxygen or Moisture monitor or both
- (Recommended) A glove box configured with auto pressure controller facilitates best performance of the AtmosPure Re-Gen Gas Purifier.

Chapter 4: Features and Safety Precautions

Labconco has engineered the Gas Purifier to meet the ISO 10648-2 Class 1 atmosphere leak specification when used with Labconco controlled atmosphere glove boxes. The information that follows details performance features so you can get the most out of your Gas Purifier. Refer to Figure 4-1.

Gas Purifier Performance Features

- 1.) Capacity to remove up to 5 liters of oxygen (13,500 ppm) and 660 grams of moisture (18 million ppm) with normal oxygen and moisture permeation rates below 0.16 ppm/min. The adsorption column contains 5 lbs of copper catalyst to remove oxygen and 5 lbs of molecular sieve to remove moisture. Depending on the application and use, the Gas Purifier may operate for 1-3 months before initiating the required 13 hour regeneration process to restore the catalysts.
- 2.) Ability to reduce oxygen to 1 ppm in less than 2 hours starting from 1000 ppm. See Appendix D.
- 3.) Ability to reduce moisture below 15 ppm in 2 hours starting from 1000 ppm. The Gas Purifier can further reduce moisture below 10 ppm in 6 hours, below 5 ppm in 16 hours, below 2-3 ppm in 2 days, and as low as 1 ppm in 3-6 days. See Appendix D.
- 4.) Internal stainless steel tubing has low permeation rates below 0.10 ppm/min for both oxygen and moisture.
- 5.) The sealed blower and circulation system assures leak tight operation for optimized performance.
- 6.) The Gas Purifier has been tested on all three Labconco glove box liner materials: stainless steel, fiberglass (FRP), and polyethylene. All three liners meet ISO 10648-2 test methods for oxygen permeation rates below 1.67 ppm/min when tested at -4 inches of water gauge. The lowest attainable oxygen levels are 0.2 ppm for stainless steel, 0.4 ppm for FRP, and 3.5 ppm for polyethylene. The lowest attainable moisture

- levels are 1 ppm for stainless steel, 2 ppm for FRP, and 5 ppm for moisture.
- 7.) The vacuum pump outlet on the back is rated at 115V, 8A or 230V, 4.5A.
 - 8.) Three solenoid valves control the regeneration of the copper catalyst and molecular sieve. All are located on the back of the Gas Purifier for easy connection to the 4% hydrogen/inert gas mixture, vacuum pump, and vent exhaust. A flow control valve regulates the 4% hydrogen/inert gas mixture between 10-25 CFH. Two 3/4" diameter isolation valves are closed during the regeneration process, isolating the catalysts from the glove box environment. After the 13 hour regeneration process is complete, the isolation valves are slowly opened up to relieve the vacuum in the column and return the Gas Purifier back to normal circulation mode.
 - 9.) Control Panel features include:
 - a.) Blower button controls the Gas Purifier blower between on, off, and auto. In the ON position the blower runs continuously, OFF shuts the blower off, and AUTO controls blower with pre-programmed auto mode which can be adjusted using control settings on the Labconco oxygen/moisture monitors. An accessory Oxygen/Moisture Monitor Cable (9-pin) must be used to control the Gas Purifier to high or low limit settings of the oxygen/moisture monitors.
 - b.) Flashing indicator lights show proper positioning of the 3/4" manually operated isolation valves.
 - c.) Start/Stop Regeneration button starts the programmed 13 hour regeneration process. The isolation valves must be closed. Indicator lights show each step of the regeneration process. Once the regeneration process is complete, the red indicator light will flash indicating successful program completion. The Start/Stop button is pushed to end the process.
 - d.) The Vacuum Release button can be used to momentarily release the vacuum in the purifier column after regeneration is complete. However, Labconco recommends operators should release the column vacuum through the glove box chamber by slowly opening the isolation valves and allowing the auto pressure controller to compensate for the vacuum with inert gas. Set the glove box main chamber pressure between +1" w.g. to +4" w.g. for this preferred method. This method is preferred because it maximizes the capacity of the Gas Purifier and does not allow atmospheric air to deplete the Gas Purifier column. **Note: Atmospheric air contains 21% oxygen (210,000 ppm). 40% relative humidity air contains 11,250 ppm moisture.**
 - e.) Main power switch turns the inlet power to the Gas Purifier on and off.
 - 10.) The optimized regeneration process is completed in 13 hours and may be completed overnight while unattended.

- 11.) The Gas Purifier automatically compensates for power outages and restarts the regeneration process if interrupted for 10 minutes or longer. This feature assures complete regeneration of the copper catalyst and molecular sieve as the system would cool and not regenerate properly.
- 12.) Leak tight. Each Gas Purifier has been factory tested with a helium mass spectrometer and found to have no detectable leaks greater than 1×10^{-6} cc/sec.
- 13.) Each Gas Purifier ships fully regenerated and is ready to use. The Gas Purifier has the capacity to remove 13,500 ppm oxygen and 18 million ppm moisture.
- 14.) The Gas Purifier may be programmed by selecting auto mode and connecting it to an accessory oxygen or moisture monitor. The back of the Gas Purifier has an Auto Mode Moisture/Oxygen Connector (9-pin) for connection to the oxygen or moisture monitor relays. Refer to Labconco accessories for oxygen monitors, moisture monitors, and the Oxygen/Moisture Monitor Cable (9-pin).
- 15.) The Gas Purifier inlet/outlet connections are 3/4" compression fittings. Connection accessory kits are available with either neoprene lined flexible hose or hard plumbed stainless steel tubing. All glove boxes were tested with the neoprene lined hose. An accessory 3/4" to 3/8" adapter kit is also available for connection to polyethylene glove boxes and pre-2011 fiberglass/stainless steel glove boxes.
- 16.) The Gas Purifier's compact design easily rests beneath the glove box on Labconco's base stands. Dimensions are 14.9"W x 21.9"H x 31.8"D.
- 17.) The Gas Purifier can be connected to one vacuum pump, shared with the glove box and powered by the glove box vacuum pump outlet receptacle. A controlled atmosphere communications port (C.A. COM 6-pin) on the back of the Gas Purifier allows for shared access of the vacuum pump when used with Controlled Atmosphere glove boxes with Auto Pressure Control. A separate accessory C.A. COM. Cable with 6-pin connectors is available for communication between the Gas Purifier and the Auto Pressure Controller of the glove box. The cable must be used to share the one vacuum pump.

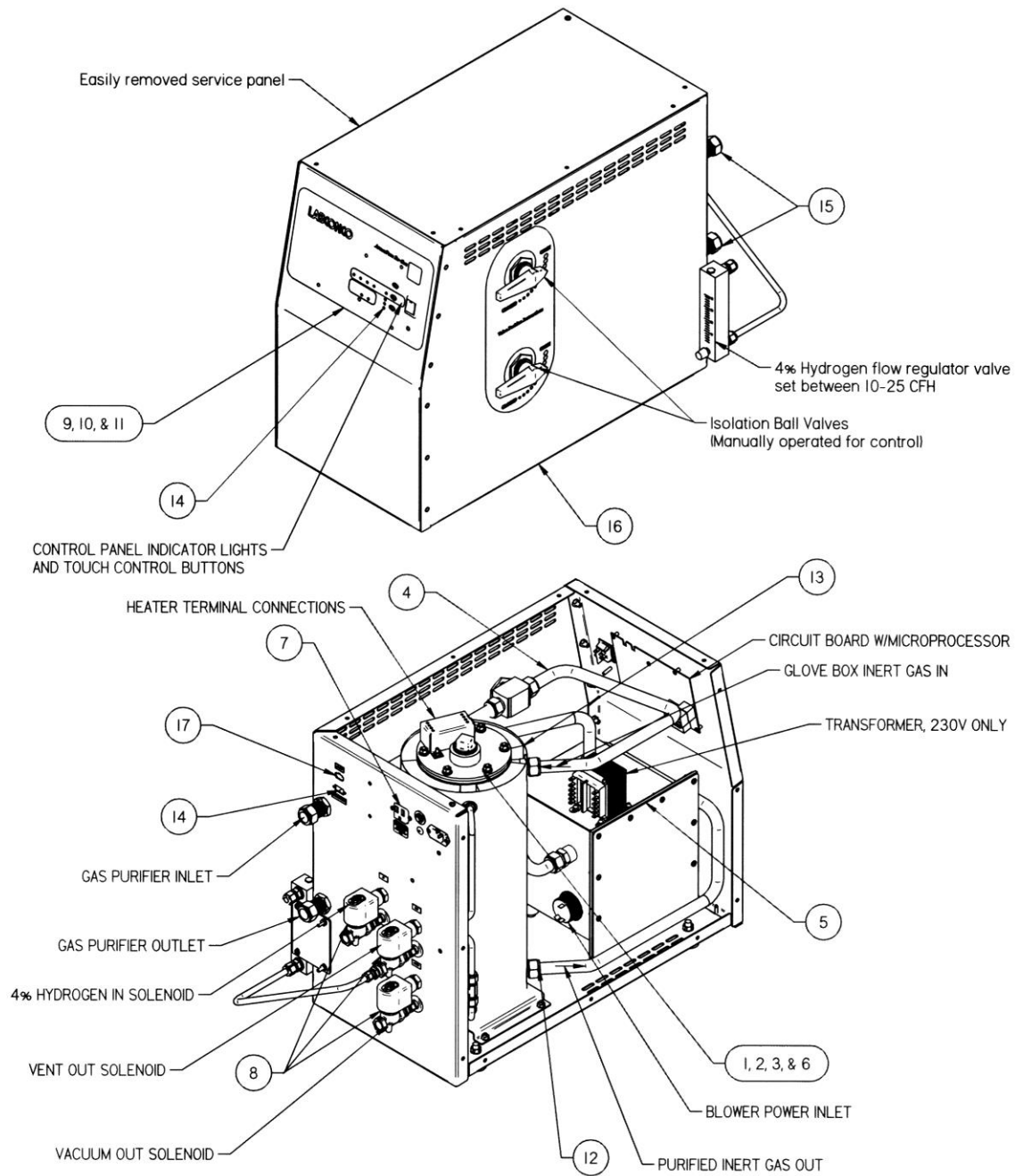


Figure 4-1
Features

Safety Precautions

1. It is the responsibility of the user to determine the suitability of this product for the intended applications. Consult your Safety Officer for application review.
2. **This product is not designed or intended to be explosion proof.** It is the responsibility of the user to determine and avoid the lower explosive limits and flammability of the enclosed gases used within the controlled atmosphere glove box. The user is responsible for taking proper precautions to prevent equipment damage or injury due to an explosion or combustion of chemicals.
3. The use of flammable gases or solvents in the glove box should be limited as these gases are exposed to the Gas Purifier. Care must be taken to ensure against the concentration buildup of flammable or explosive gases or vapors. These vapors can potentially poison the Gas Purifier catalysts and reduce their efficiency. See Chapter 3 for materials that reduce Gas Purifier effectiveness. **DANGER: The addition of oxygen inside the glove box must be avoided to prevent explosion, death, or serious injury.**
4. Perchloric acid use in this Gas Purifier is prohibited.
5. Radioisotope material usage in the glove box and Gas Purifier should be approved by your Safety Officer.
6. A qualified certification technician should test the Gas Purifier with the glove box before it is initially used.
7. The Gas Purifier should be recertified at least annually after installation. See Chapter 6.
8. The use of safety goggles, protective clothing, and any other personal protective equipment recommended by your safety officer should be observed.
9. **Exhaust vacuum pumps should be filtered and/or ducted to the outside when using hazardous materials.** Consult your Safety Officer. Manipulations that generate gases from toxic chemicals or radionuclides, must be evaluated carefully from the standpoint of buildup to dangerous levels. The decontamination and compliance with applicable regulations is the responsibility of the operator and safety officer. Venting or filtering of vacuum pump exhaust is the operator's responsibility.
10. Ensure that the Gas Purifier and glove box is connected to electrical service in accordance with local and national electrical codes. Failure to do so may create a fire or electrical hazard. Do not remove or service any electrical components without first disconnecting the glove box from electrical service.

11. Ensure only trained operators use the Gas Purifier with the glove box. New users **must** review the User's Manual and should be trained by operators familiar with glove box operation.
12. Tag the Gas Purifier and glove box with appropriate warnings, if work inside the glove box is hazardous or needs to remain untouched. Tag the Gas Purifier and glove box if it requires servicing.
13. Consult your Safety Officer before removing any hoses to vacuum pumps, gas lines, pressure gauges, or exhaust hoses; they may be contaminated with chemicals.

Chapter 5: Using Your Gas Purifier

Now that the installation of your Gas Purifier and glove box is completed, you are ready to use it.

Read this chapter to learn about:

- Routine Daily Work Procedures.
- Hazardous Use with Chemicals.
- Prohibited Materials Use.

Routine Daily Work Procedures

Planning

- Thoroughly understand procedures and equipment required before beginning work. Work from a written plan.
- Consult your Safety Officer for personal protective equipment recommendations and operating pressure confirmation.

Start-up

- Basic start-up procedure includes: turning on the vacuum pump, opening the inert gas valve on the gas supply tank, turning on the glove box light and turning on the blower to the Gas Purifier once an inert atmosphere below 5000 ppm is established.

Loading Materials and Gas Purifier Set-Up

- Load only the materials and equipment required for the procedure. Do not overload the glove box. When loading, ensure the inner door is closed before opening the outer door. Then close the outer door.

- Perform evacuation and fill cycle on the transfer chamber of the glove box using the vacuum outlet and gas inlet valves. Depending on the vacuum level achieved, it takes 1-5 cycles to reduce oxygen and moisture levels below 1%. Porous materials being transferred may require longer sustained vacuum evacuations to remove the oxygen and moisture trapped in the materials.
- In order to achieve the lowest oxygen and moisture levels in a glove box, perform the required evacuation and fill cycles on the main chamber using the vacuum outlet and gas inlet valves. To automate the evacuation and fill cycles (1-499) for both glove box chambers, the addition of the Automatic Pressure Controller (5238600 or 5238601) is recommended (see Chapter 7) or use a Protector Controlled Atmosphere Glove Box with Auto Pressure Control. Normally 75-100 evacuation and fill cycles will reduce moisture and oxygen levels below 1%. An additional 100 cycles will reduce moisture and oxygen levels below 0.3% or 3,000 ppm. The AtmosPure Gas Purifier blower can now be turned on. **The use of external glove port covers will expedite the evacuation and fill cycle time and help maintain low moisture and oxygen levels when the glove box is not in use.**
- Maintaining a -1" to +1" water gauge pressure difference can help to preserve the glove box atmosphere.
- The AtmosPure Re-Gen Gas Purifier is **required** to maintain oxygen and moisture levels below 0.3%-0.5%. Turn the Gas Purifier blower on to start circulation and reduce oxygen and moisture. **Labconco AtmosPure Re-Gen Gas Purifiers can maintain oxygen levels below 1 ppm and moisture levels below 1 ppm depending on liner material and applications.**
- Monitoring moisture and oxygen levels inside the glove box is **recommended** by using accessory monitors (see Chapter 7).
- The Gas Purifier catalysts will last for 1-3 months before requiring regeneration. See Chapter 3 for instructions to start regeneration.

Work Techniques

- Maintain work at a slightly negative pressure if working with hazardous compounds.
- Continuously run the Gas Purifier blower to **preserve** the inert atmosphere if so desired.

Transferring Materials to the Outside

- All open chemical weigh vessels or containers **must** be sealed before removing materials from the glove box main chamber.
- Objects in contact with previously contaminated internal atmospheres **must** be surface decontaminated or bagged before removal from the glove box through the transfer chamber.
- After placing materials to be removed in the transfer chamber and locking the internal door, the transfer chamber **must** be evacuated and filled approximately 1-5 times depending on vacuum level achieved. This ensures the removal of any remaining airborne contaminants before the outer door is opened. **Never** apply a high vacuum purge below 2" mercury pressure on sensitive electronic moisture and oxygen monitors. The exact number of cycles should be determined by your Safety Officer.

Shutdown

- To help preserve the controlled atmosphere, leave the glove box main chamber under -1" to +1" water gauge pressure and continuously run the Gas Purifier blower. The use of the accessory external glove port covers can assist in preserving the inert atmosphere by reducing permeation through the gloves.
- Keep the outer door closed when not in use.

Hazardous Use with Chemicals

Hazardous chemicals may be used safely only when the glove box vacuum pump is properly vented and/or filtered to the outside. Consult your Safety Officer for proper venting and filtering of the vacuum pump exhaust.

Prohibited Materials Use

Due to stainless steel components, the Gas Purifier and glove box interior **must** not be exposed to mineral acid. The Gas Purifier and glove box life spans will be limited with use of mineral acids. Additionally, materials referenced in Chapter 3 cannot be used (such as alcohols, halides, halogens, hydrazine, heavy metals, mercury, arsine, phosphene, and sulfur containing compounds) because they will poison the Gas Purifier catalysts and reduce their effectivity and lifespan.

NOTE: Should the catalysts inside the Gas Purifier become ineffective after two regeneration cycles, the two catalysts can be replaced. See *Chapter 6: Maintenance* and *Appendix A: Replacement Parts* for replacement.

Chapter 6: Maintaining Your Gas Purifier

Review this chapter on maintenance for the following:

1. Routine maintenance.
2. Initial certification.
3. Recertification.
4. Solenoid valve replacement.
5. Catalyst replacement.

Routine Maintenance Schedule

Weekly

- Monitor and record oxygen and moisture levels inside the glove box with accessory monitors (see Chapter 7).

1-3 Months

- Regenerate the catalysts every 1-3 months depending on your application, glove box liner material, and frequency of use.

Initial Certification

Each Gas Purifier has been leak tested at the factory with helium gas at positive 5" w.g. pressure; no leaks greater than 1×10^{-6} cc/sec are allowable. The Gas Purifier and glove box should be certified by your Safety Officer before use, with one of the two tests listed below under Recertification.

Recertification

Under normal operating conditions, the Gas Purifier and glove box system should be recertified at the time of installation and at least annually thereafter. The certifier should choose and perform one of the following tests. Both tests validate the system Leak Test of the Gas Purifier connected to the glove box.

- Oxygen Method Leak Test per ISO 10648-2 test methods. See glove box manual.
- Pressure Change Leak Test per ISO 10648-2 test methods. See glove box manual.

Solenoid Valve Replacement

1. Decontaminate the glove box interior and Gas Purifier, if required.
2. Wear appropriate protective equipment as determined by your Safety Officer.
3. Turn the Gas Purifier and vacuum pump OFF. Close the manually operated isolator valves.
4. Remove the solenoid valve. Refer to Figure 3-1 that shows the solenoid valves.
5. Install the new solenoid valve.
6. Regenerate the catalysts and follow the 13 hour Regeneration listed in Chapter 3.
7. Turn the glove box and Gas Purifier ON and re-certify.

Catalyst Replacement

1. The catalysts can become ineffective for a number of reasons as described in Chapters 3-5.
2. Turn the unit off and remove the outer service panel. Loosen the large nut near the heater terminal connections on top of the Gas Purifier cylinder. Refer to Figure 4-1 and Figure A-1.
3. Remove the catalysts using a vacuum cleaner hose. Catalysts are hazardous and need to be disposed of properly.
4. Fill the bottom with 4 pounds of molecular sieve, followed by 5 pounds of copper catalyst, and then followed by 1 pound of molecular sieve on top.

5. Replace the large nut and seal with pipe sealant compound.
6. Install the outer service panel.
7. Follow 13 hour Regeneration procedure from Chapter 3.
8. Once regenerated, the Gas Purifier blower can be run as soon as the glove box inert atmosphere is reduced to 3000-5000 ppm through 100-200 evacuation/fill cycles.

Chapter 7:

Accessorizing Your Gas Purifier

There are many ways to accessorize the Gas Purifier for your use with the glove box. These include many different accessories listed in this chapter.

1. Adjustable Height Base Stands with Work Surface (Part #5235500 w/casters, Part #5235501 w/adjustable feet)

These stands, 60" x 31", with attached black laminate work surfaces have an adjustable height range from 33" to 40" (838mm-1,016mm) and include a lower shelf for supporting accessory equipment. See Figure 1-1.

2. AtmosPure Roughing Pre-Filter Kit (Part #5441500)

Provides two roughing particulate pre-filters and clamp plates to mount inside Protector Glove Boxes only. It is used to filter the inlet and outlet of the glove box as the inert gas is purified.

3. AtmosPure P100 Particulate Filter Kit (Part #5441600)

Provides two P100 particulate filters and mount housings that are similar to respirator cartridges. It is used to filter the inlet and outlet of the glove box as the inert gas is purified.

4. AtmosPure Regeneration Plumbing Kit (Part #5441700)

The regeneration plumbing kit includes flexible tubing and fittings to make all the regeneration tubing connections only. These are the three connections to the 4% hydrogen inert gas mixture, vacuum, and vent.

5. AtmosPure Circulation Kits (see Part #'s below)

The circulation kits include all the plumbing to make connection from the Gas Purifier to the glove box. There are options for neoprene lined hose and hard ducted stainless steel.

Part #	Description	Used On
5441800	3/4" I.D. Neoprene lined hose	All Glove Boxes, single width
5441801	3/4" I.D. Neoprene lined hose	All Glove Boxes, double width
5441802	3/4" Rigid Stainless Steel	Protector Glove Boxes, single width
5441803	3/4" Rigid Stainless Steel	Protector Glove Boxes, double width

6. AtmosPure 3/4" to 3/8" Adapter Kit (See Part #'s below)

Fittings permit 3/4" ID neoprene hose included with 5441800 and 5441801 Kits (sold separately) to attach to glove box's 3/8" inlet/outlets. Two fittings included with each kit. Not required on current Protector Glove Boxes (manufactured after November 2010)

Part #	Description	Used On
5441900	Elbows	Precise Glove Boxes
5441901	Reducers	Pre-2011 Protector Glove Boxes

7. AtmosPure 6-pin Communication Cable (Part #5442000)

Required for use when AtmosPure and glove box configured with Auto Pressure Controller are sharing one vacuum pump.

8. AtmosPure 9-pin Oxygen/Moisture Monitor Cable (Part #5442100)

Required for use when the AtmosPure is used in AUTO mode. Allows for automatic control of the AtmosPure blower from an accessory Oxygen or Moisture Monitor (sold separately).

9. Electrical 9-pin Sealed Pass-Through Kit (Part #5075619)

Provides a leak-tight connection for data transfer via the 5442100 Cable (sold separately) connected to the AtmosPure Re-Gen Gas Purifier to an interior-mounted Oxygen or Moisture Monitor. Includes sealed 9-pin connector (D-subminiature with male pins on one side and female pins on the other) and 10' cord. Note: For Precise polyethylene glove boxes or Pre-2001 Protector glove boxes, order the 9-pin installation kit separately which includes all the drill bits and hole saws for field installation (Part #5241100).

10. Gas Inlet / Vacuum Outlet Tubing Kits and Direct Drive Vacuum Pumps

These kits provide the necessary flexible tubing and fittings to make connections to an inert gas supply tank and a rotary vane vacuum pump. See Figure 3-8.

Part #	Descriptions	Used With
5245100	Complete Gas/Vac Tubing Kit (Manual)	Manual Valves, all Protector Glove Boxes
5245200	Complete Gas/Vac Tubing Kit (Auto)	Pressure Controller accessory only
1472100	Direct Drive Vacuum Pump, 115V, 50/60Hz	Both
7739400	Direct Drive Vacuum Pump, 230V, 50/60Hz, NEMA 6-15P plug	Both, International Version
7739402	Direct Drive Vacuum Pump, 230V, 50/60Hz with reverse IEC plug	Both, International Version

11. Oxygen Monitors

Oxygen monitors allow the user to continuously monitor oxygen levels inside the glove box. Monitors are normally placed inside the main chamber to provide the best performance. **Never operate a transfer chamber vacuum evacuation on sensitive oxygen monitors as damage can occur.**

Part #	Descriptions
5244500	0-10,000 ppm Oxygen Monitor (with three ranges of 0-100 ppm, 100-1,000 ppm, and 1,000-10,000 ppm) 100V/115V – 50/60 Hz
5244501	0-10,000 ppm Oxygen Monitor (with three ranges of 0-100 ppm, 100-1,000 ppm, and 1,000-10,000 ppm) 230V – 50/60 Hz – International
5244400	0.1-100% Oxygen Monitor (1,000 ppm lowest) 100V/115V/230V – 50/60 Hz

12. Moisture Monitors/Hygrometers

Moisture monitors or hygrometers allow the user to continuously monitor moisture levels inside the glove box. Moisture monitors are normally placed inside the main chamber to provide the best performance. **Never operate a transfer chamber vacuum evacuation on these sensitive hygrometers as damage can occur.**

Part #	Descriptions
5244900	1-1000 ppm Moisture Monitor/Hygrometer (Factory Set at 1-1,000 ppm, with three settings of 1-10 ppm, 1-100 ppm, and 1-1,000 ppm) 100V/115V – 50/60 Hz
5244901	1-1000 ppm Moisture Monitor/Hygrometer (Factory Set at 1-1,000 ppm, with three settings of 1-10 ppm, 1-100 ppm, and 1-1,000 ppm) 230V – 50/60 Hz – International
5244800	0-100% Hand Held Digital Hygrometer with Temperature Display; measures relative humidity and temperature
5442200	Moisture Meter Probe and Calibration Stand -80 to 0°C dew point range or 0 to 6000 ppm (Display is in dew point only)

13. Exterior Monitor Plumbing Kits (Part #'s below)

The exterior monitor plumbing kits provide attachment plumbing to oxygen or moisture monitors outside the glove box. **Note:** The control and accuracy of the oxygen and moisture monitors will be reduced due to the surrounding ambient air rather than inert gas inside the glove box.

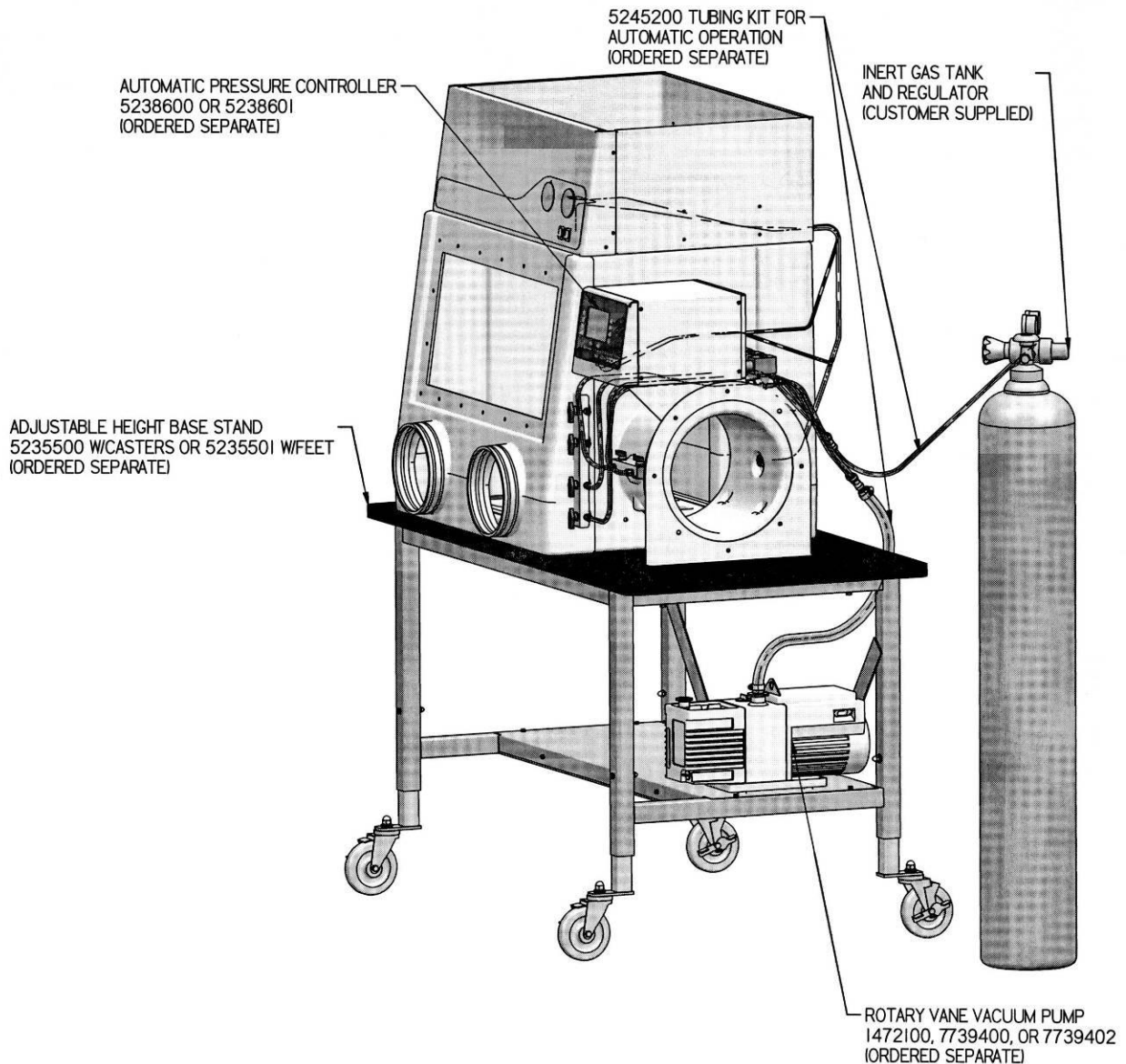
Part #	Descriptions	Used With
5442400	Plumbing Kit for Oxygen Monitor (0 to 10,000 ppm)	5244500, 01
5442500	Plumbing Kit for Monitor/Hygrometer with pump (0 to 10,000 ppm)	5244900, 01
5442300	Plumbing Kit for Moisture Meter/Probe -80 to 0°C (or 0 to 6000 ppm)	5442200

14. Automatic Pressure Controller (for use with Precise polyethylene and manual control Protector Glove Boxes)

The Pressure Controller provides the operator the convenience of automatically regulating pressure and vacuum within the glove box main chamber and transfer chamber. The end user can also automate

the evacuation/fill cycles up to 499 cycles for the main chamber and up to 199 cycles on the transfer chamber. The vacuum and pressure can be automatically regulated between -5 to +5 inches of water gauge in the main chamber and between 0 to -29 inches of mercury gauge in the transfer chamber. See illustration below and figures in Chapter 3.

Part #	Electrical Configuration
5238600	100/115 Volts, 50/60 Hz operation
5238601	230 Volts, 50/60 Hz operation



Chapter 8: Troubleshooting

Refer to the following table if your Gas Purifier box fails to operate properly. If the suggested corrective actions do not solve your problem, contact Labconco for additional assistance.

PROBLEM	CAUSE	CORRECTIVE ACTION
Control panel lights won't operate.	Unit not plugged into outlet.	Plug unit into appropriate electrical service and turn main power switch on.
	Circuit breaker(s) tripped.	Reset or replace circuit breaker.
	Switch is defective.	Replace switch.
Regeneration process not working	Circuit board defective.	Replace circuit board.
	Defective solenoid valve.	Replace solenoid valve.
Regeneration process not working	Defective heater.	Replace heater.
	Catalysts poisoned.	Replace catalysts.
No power to exterior vacuum pump electrical receptacle.	Unit not plugged in.	Plug unit into electrical service.
	Circuit breaker(s) tripped.	Reset or replace circuit breaker.
Gas Purifier blower won't operate.		
	Isolation valves closed.	Open manually operated isolation valves so blower can circulate inert gas and purify the gas.
	Blower not running.	Check electrical connection and make sure terminals are connected.
	Circulation blower not working.	Replace blower. For 230V, replace blower and transformer.

Appendix A:

Replacement Parts

The components that are available for your Gas Purifier are listed. The parts shown are the most commonly requested. If other parts are required, please contact Product Service.

Item	Qty.	Part Number	Description
			<u>Electrical Components</u>
1	1	5410700	Circuit Board, Re-Gen/Blower
2	1	1307000	Main Power Switch , DPST (2 POS)
3A	1	1327201	Circuit Breaker, 10A
3B	2	1327204	Circuit Breaker, 5A
4A	1	1305800	Power Cord, 100-115V, N. America
4B	1	1332600	Power Cord, 208-230V, British (UK)
4C	1	1336100	Power Cord, 208-230V, Schuko
4D	1	1332700	Power Cord, 208-230V, China/Australia
4E	1	1338000	Power Cord, 208-230V, N. America
5A	1	1289101	Relay, Panel Mount, 115V Coil
5B	1	1289102	Relay, Panel Mount, 230V Coil
6	1	5442800	Transformer, 230V Only (Blower)
			<u>Gas Purifier Components</u>
7	1	5430300	Sealed Blower Assy. Complete
8	1	5122500	Blower Assy. Only
9	1	5429500	Gasket, Blower
10	1	5075600	Sealed Receptacle
11	1	1645700	O-Ring, Receptacle
12	5 lbs.	1931000	Molecular Sieve (4 lbs. on bottom, 1 lb. on top)
13	5 lbs.	1930900	Copper Catalyst (5 lbs. in middle)
			<u>Regeneration Components</u>
14A	1	5431500	Re-Gen, Sub Assy. w/heater and catalysts complete, 115V
14B	1	5431501	Re-Gen, Sub Assy. w/heater and catalysts complete, 230V
15A	1	5118300	Heater Top Weld Assy., 115V
15B	1	5118301	Heater Top Weld Assy., 230V
16	1	5117300	Gasket, Cylinder Top
17A	1	1414700	Plug, Cylinder Top (access to load catalysts)
17B	1	1581200	Pipe Sealant, Loctite PST 567
18	5 lbs.	1931000	Molecular Sieve (4 lbs. on bottom, 1 lb. on top)
19	5 lbs.	1930900	Copper Catalyst (5 lbs. in middle)
20	2	5418500	Manual Isolation Ball Valve 3/4" Compression
21A	3	5417602	Solenoid Valve Assy. w/Back Pressure, 115V
21B	3	5417603	Solenoid Valve Assy. w/Back Pressure, 230V
22	1	1953100	Flow Regulator Valve (from vent solenoid to control 4% hydrogen inert gas mixture flow rate)
			<u>Plumbing Components</u>
23	2	5432200	Bulkhead Union, 3/4" Compression w/ferrules and nut (used to route circulation to glove box)

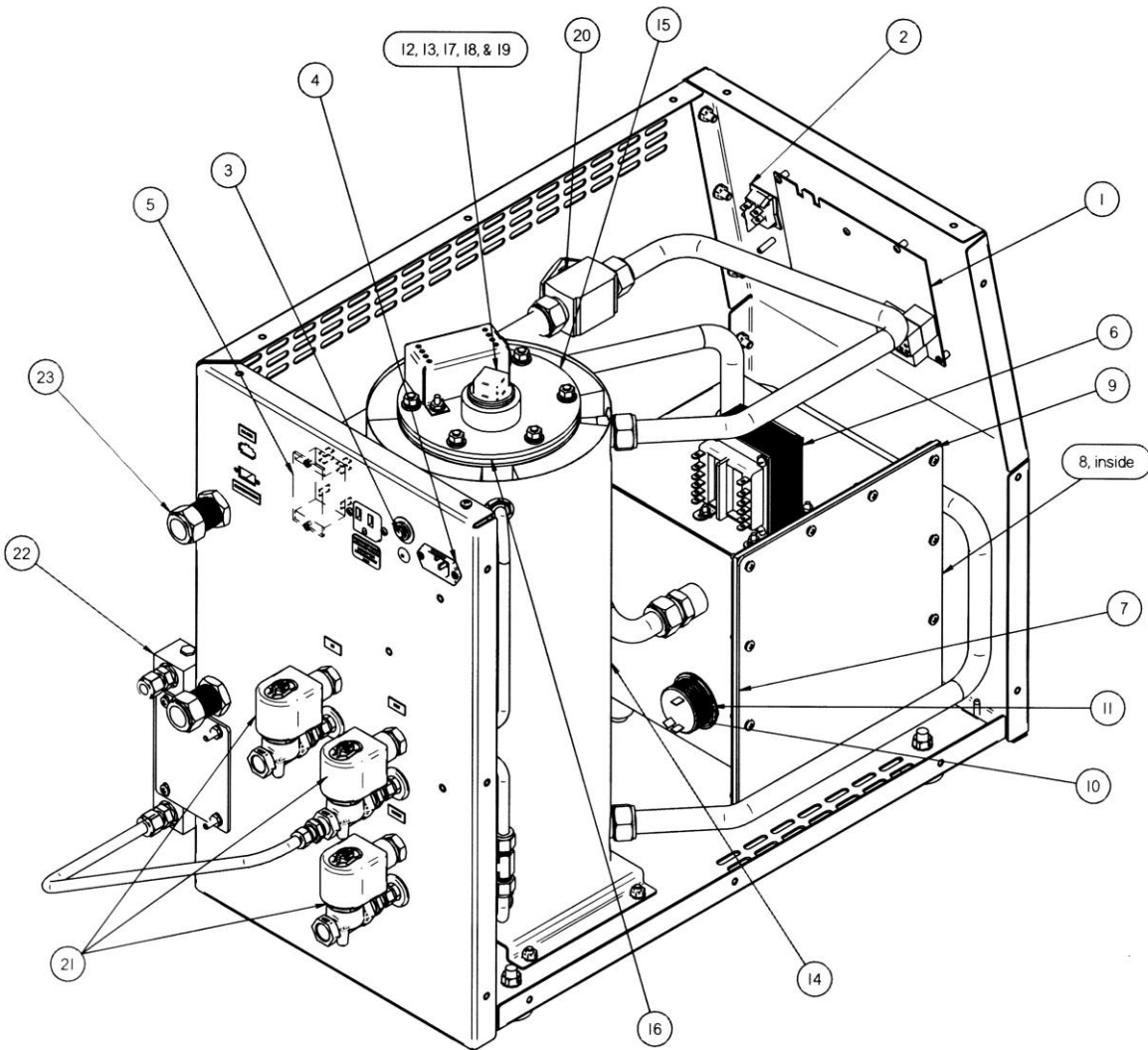


Figure A-1
Replacement Parts for AtmosPure Re-Gen Gas Purifier

Appendix B: Dimensions

The following dimensions are for all the Gas Purifiers. All dimensions in inches and metric.

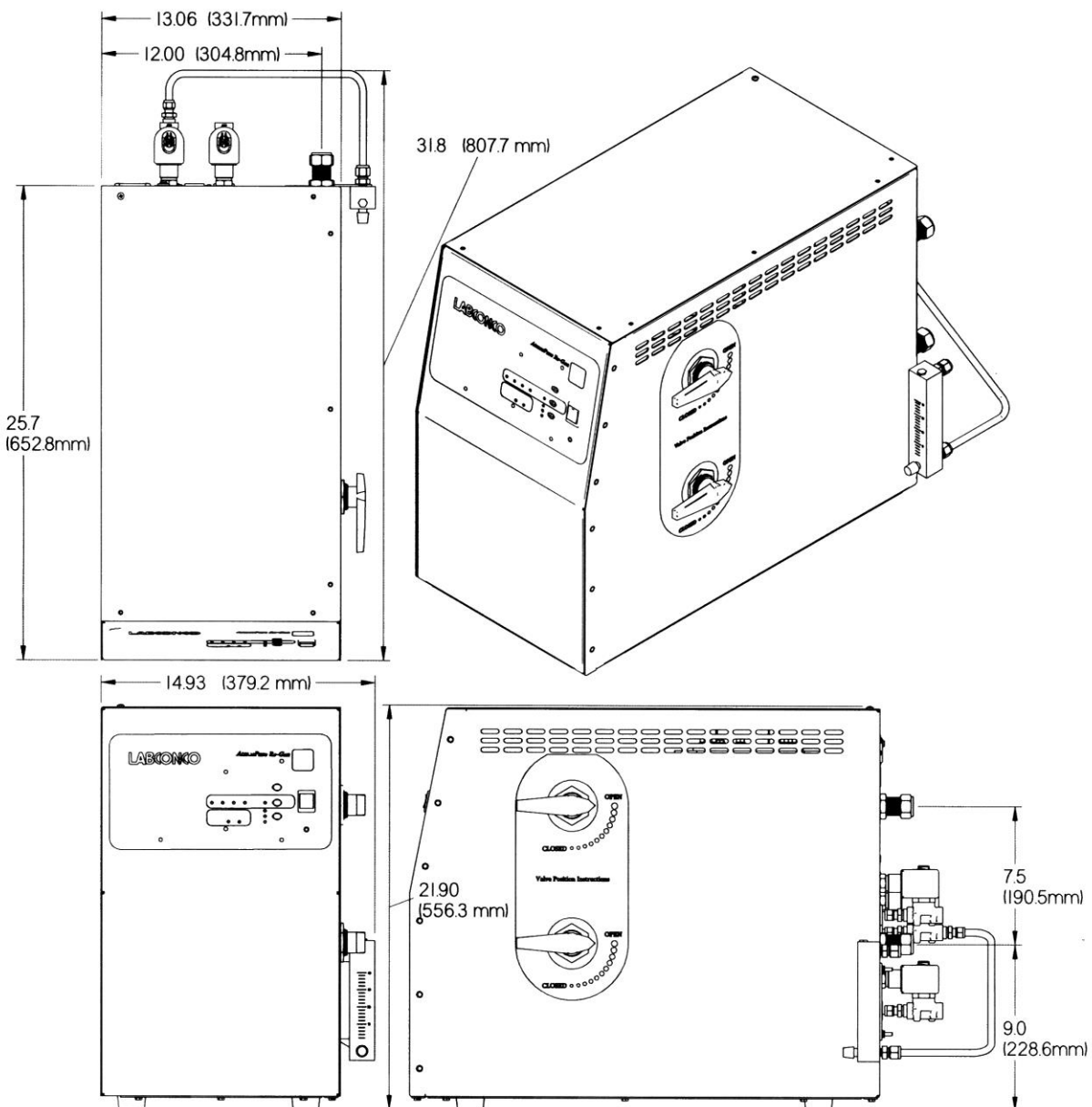


Figure B-1

Appendix C: Specifications

This Appendix contains technical information about all the Gas Purifiers including electrical specifications and environmental operating conditions.

- 10 Amps, 100-115V or 5 Amps, 230V, 50/60 Hz AtmosPure Re-Gen Gas Purifier.

Environmental Conditions

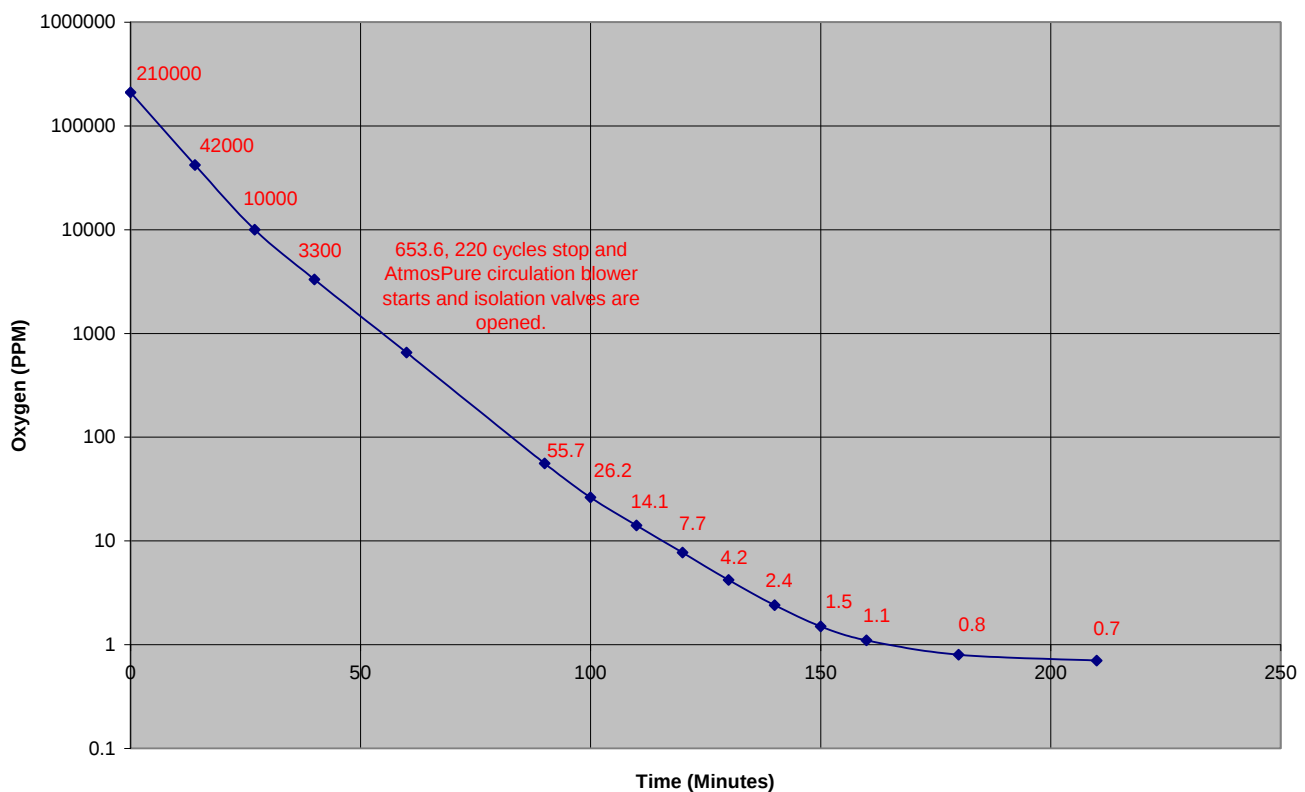
- Indoor use only.
- Maximum altitude: 12,000 feet (3,657 meters).
- Ambient temperature range: 41° to 104°F (5° to 40°C).
- Maximum relative humidity: 80% for temperatures up to 88°F (31°C), decreasing linearly to 50% relative humidity at 104°F (40°C).
- Main supply voltage fluctuations not to exceed $\pm 10\%$ of the nominal voltage.
- Transient over-voltages according to Installation Categories II (Over-voltage Categories per IEC 1010). Temporary voltage spikes on the AC input line that may be as high as 1500V for 100-115V models and 2500V for 230V models are allowed.
- Used in an environment of Pollution degrees 2 (i.e., where normally only non-conductive atmospheres are present). Occasionally, however, a temporary conductivity caused by condensation must be expected, in accordance with IEC 664.

Appendix D:

AtmosPure Re-Gen Gas Purifier

Oxygen and Moisture Removal Rates

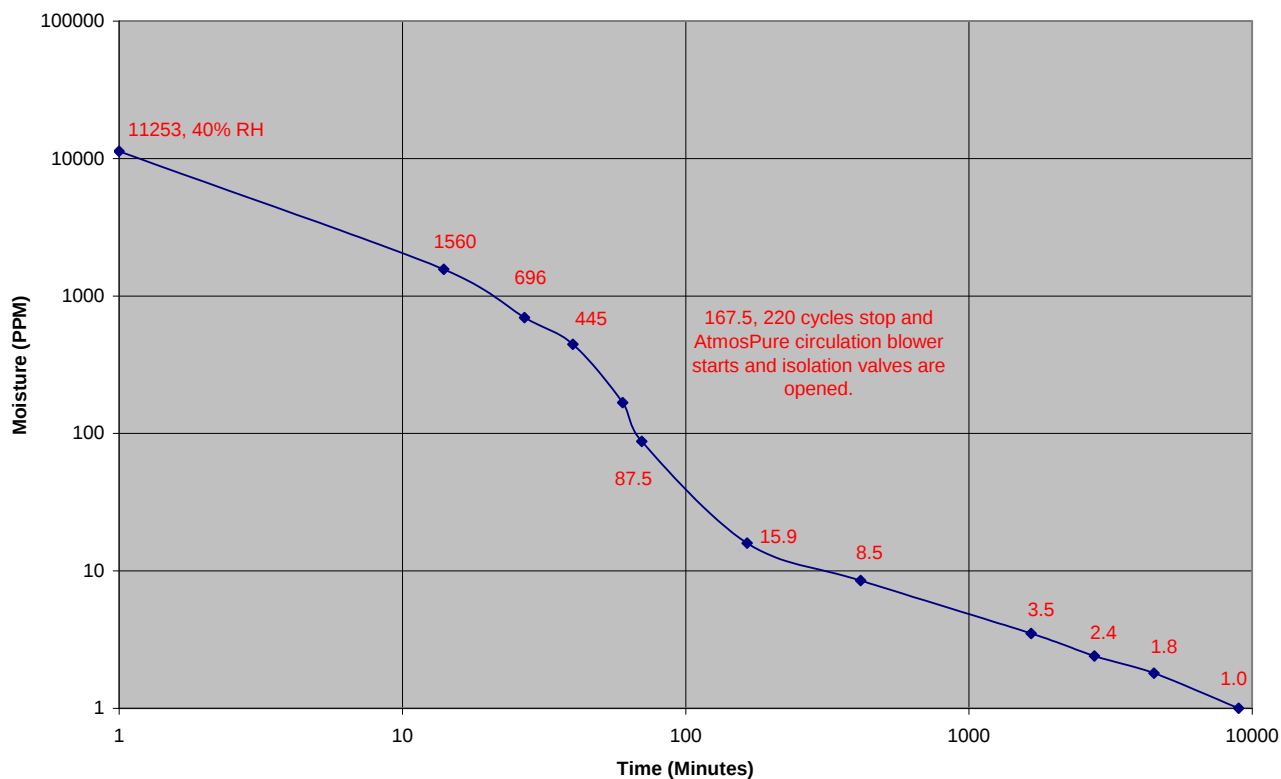
Protector CA (Stainless Steel) Oxygen Removal with AtmosPure Re-Gen Gas Purifier



This chart shows oxygen level decrease from 210,000 ppm at atmospheric conditions to 0.7 ppm after 210 minutes. Two separate calibrated oxygen monitors confirmed results.*

* Results were attained at Labconco Corporation under controlled conditions. Actual results may vary.

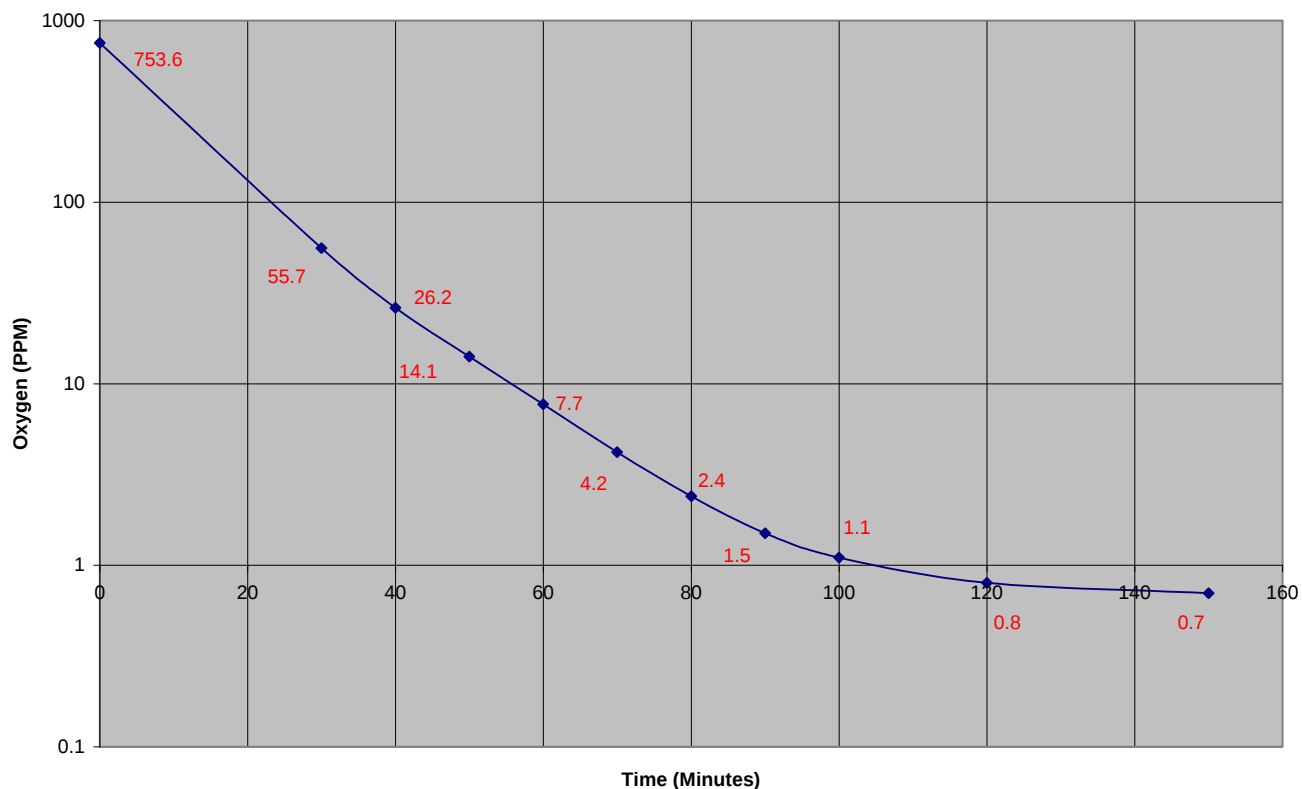
Protector CA (Stainless Steel) Moisture Removal with AtmosPure Re-Gen Gas Purifier



This chart shows moisture level decrease from 11,253 ppm (40% relative humidity) to 1.0 ppm after 8965 minutes. Two separate calibrated moisture monitors confirmed results.*

* Results were attained at Labconco Corporation under controlled conditions. Actual results may vary.

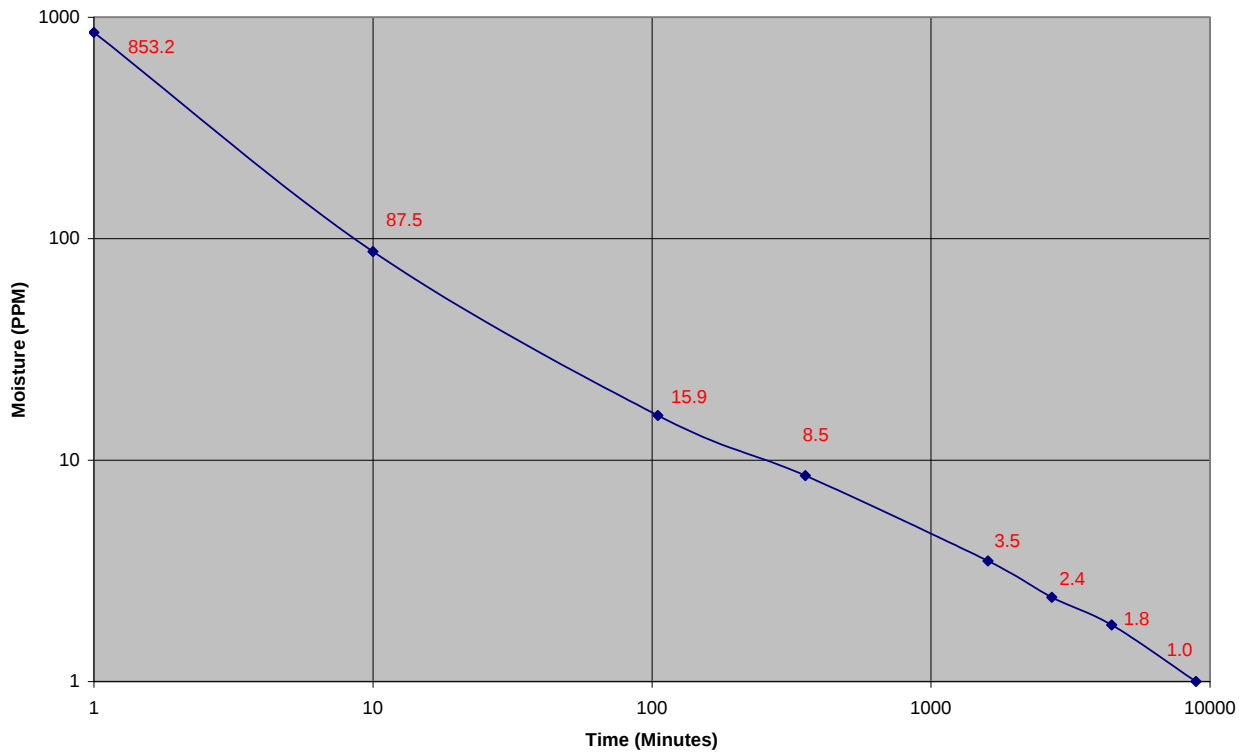
Protector CA (Stainless Steel) Oxygen Removal with AtmosPure Re-Gen Gas Purifier



This chart shows oxygen level decrease from 753.6 ppm to 0.7 ppm after 150 minutes. Two separate calibrated oxygen monitors confirmed results.*

* Results were attained at Labconco Corporation under controlled conditions. Actual results may vary.

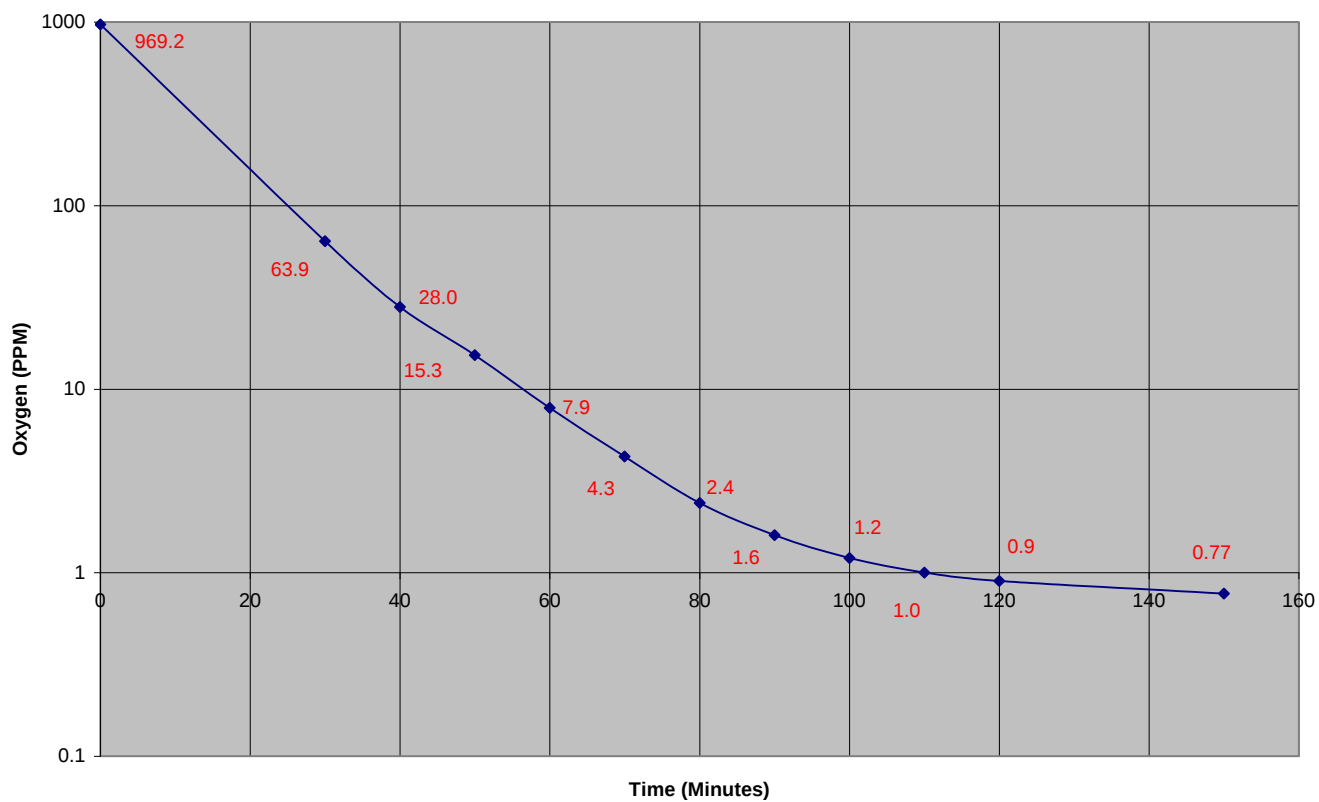
Protector CA (Stainless Steel) Moisture Removal with AtmosPure Re-Gen Gas Purifier



This chart shows moisture level decrease from 853.2 ppm to 1.0 ppm after 8905 minutes. Two separate calibrated moisture monitors confirmed results.*

* Results were attained at Labconco Corporation under controlled conditions. Actual results may vary.

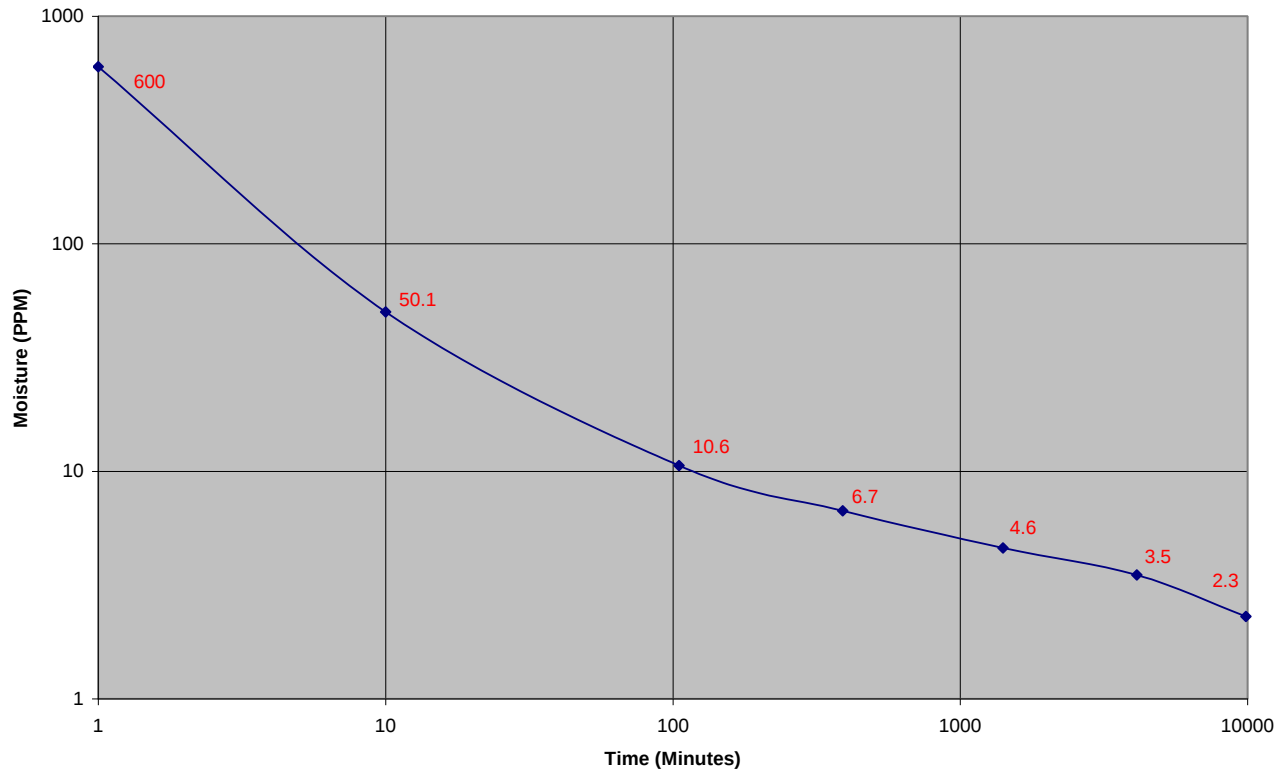
Protector CA (Fiberglass) Oxygen Removal with AtmosPure Re-Gen Gas Purifier



This chart shows oxygen level decrease from 969.2 ppm to 0.77 ppm after 150 minutes. Two separate calibrated oxygen monitors confirmed results.*

* Results were attained at Labconco Corporation under controlled conditions. Actual results may vary.

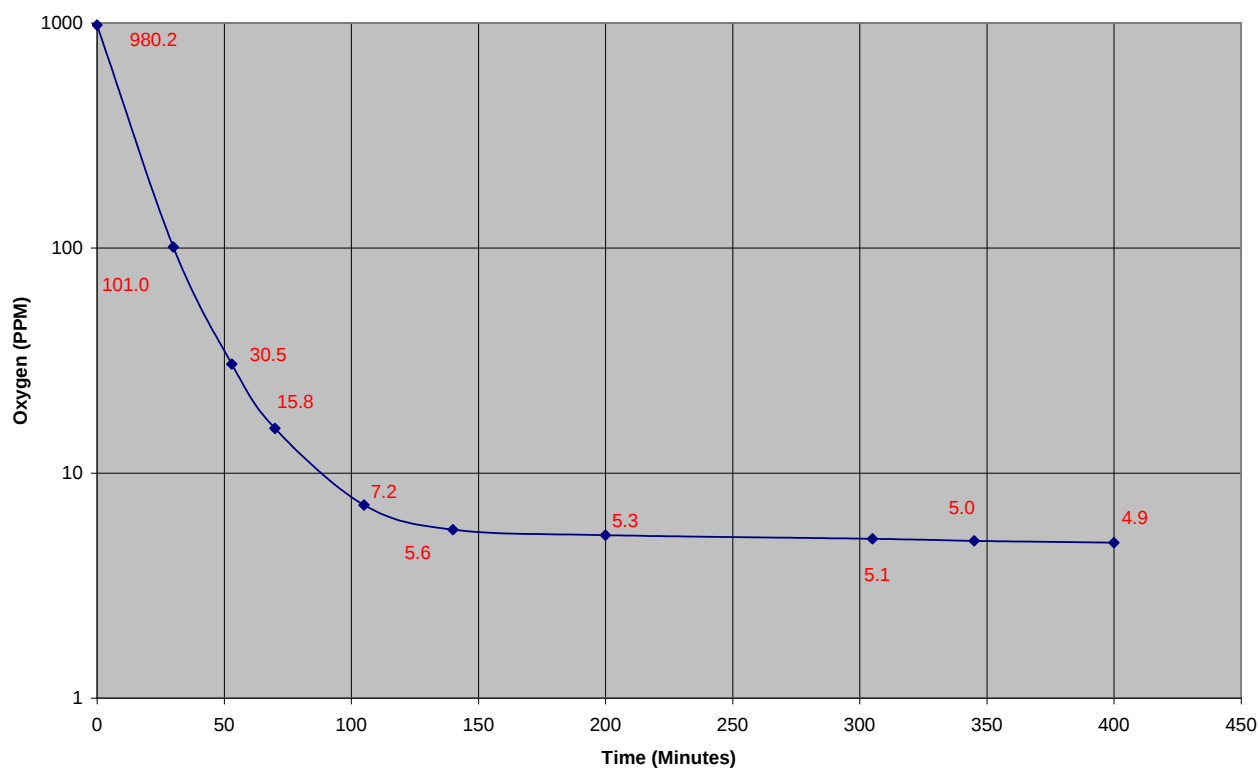
Protector CA (Fiberglass) Moisture Removal with AtmosPure Re-Gen Gas Purifier



This chart shows moisture level decrease from 600 ppm to 2.3 ppm after 9875 minutes. Two separate calibrated moisture monitors confirmed results.*

* Results were attained at Labconco Corporation under controlled conditions. Actual results may vary.

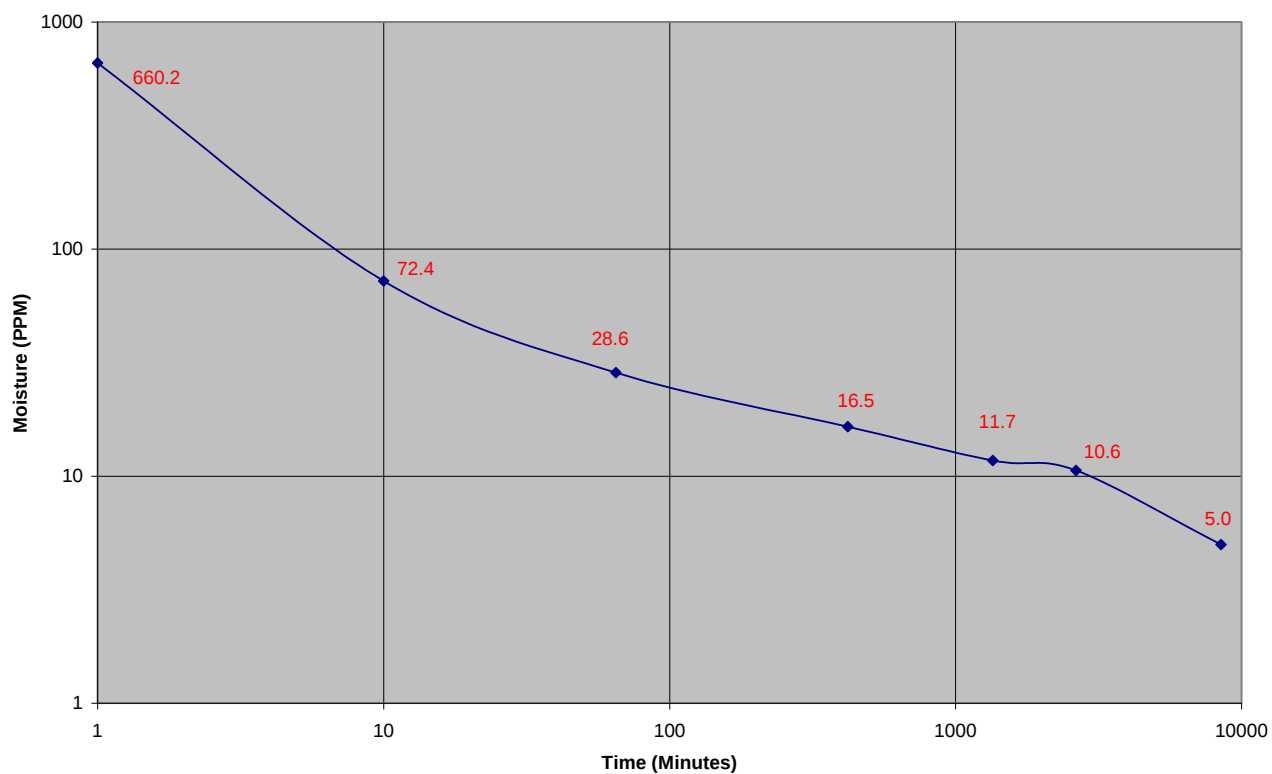
Precise CA (polyethylene) Oxygen Removal with AtmosPure Re-Gen Gas Purifier



This chart shows oxygen level decrease from 980.2 ppm to 4.9 ppm after 400 minutes. Two separate calibrated oxygen monitors confirmed results.*

* Results were attained at Labconco Corporation under controlled conditions. Actual results may vary.

Precise CA (polyethylene) Moisture Removal with AtmosPure Re-Gen Gas Purifier



This chart shows moisture level decrease from 660.2 ppm to 5.0 ppm after 8475 minutes. Two separate calibrated moisture monitors confirmed results.*

* Results were attained at Labconco Corporation under controlled conditions. Actual results may vary.

Appendix E: Conversions

Pressure Conversions

To From	mmHg	in.Hg	in.H ₂ O	ft.H ₂ O	atm	lb/in. ²	Kg/cm ²	kPa	bar
mmHg	1	.03937	.5353	.04461	.00132	.01934	.00136	.1333	.0013
in.Hg	25.40	1	13.60	1.133	.03342	.4912	.03453	3.387	.0339
in.H ₂ O	1.868	.07355	1	.08333	.00246	.03612	.00254	.2490	.0025
ft.H ₂ O	22.42	.8826	12	1	.02950	.4334	.03048	2.988	.0299
atm	760	29.92	406.8	33.90	1	14.70	1.033	101.3	1.013
lb/in. ²	51.71	2.036	27.69	2.307	.06805	1	.07031	6.895	.0689
Kg/cm ²	735.6	28.96	393.7	32.81	.9678	14.22	1	98.05	.981
kPa	7.500	.2953	4.016	.3347	.00987	.1451	.0102	1	.01
bar	750	29.53	401.6	33.47	.987	14.51	1.02	100	1

Flow Rate Conversions

To From	lit/sec	gal/min	ft ³ /sec	ft ³ /min	bbl/hr	bbl/day
lit/sec	1	15.85	0.03532	2.119	22.66	543.8
gal/min	0.06309	1	0.00223	0.1337	1.429	34.30
ft ³ /sec	28.32	448.8	1	60	641.1	1.54x10 ⁴
ft ³ /min	0.4719	7.481	0.01667	1	10.69	256.5
bbl/hr	0.04415	0.6997	0.00156	0.09359	1	24
bbl/day	0.00184	0.02917	6.50x10 ⁻⁵	0.00390	0.04167	1

Appendix F: References

Many excellent reference texts and booklets are currently available. The following is a brief listing:

Pharmaceutical Isolators, A Guide to their application design and control.
Pharmaceutical Press 2004, Editors: Midcalf, Phillips, Neiger, and Coles.

Isolation Technology, A Practical Guide, 2004 CRC Press, 2nd Edition,
www.crcpress.com

International Standard ISO 10648-2 Containment Enclosures

- Classification according to leak tightness and associated checking methods.

NIOSH Pocket Guide to Chemical Hazards

U.S. Dept of Health and Human Resources

Centers for Disease Control and Prevention

National Institute for Occupational Safety and Health

The Manipulation of Air Sensitive Compounds, by D.R. Shriver and
M.A. Drezdson; published by John Wiley and Sons.