



**Installation and
Operations Manual
Power+Energy
Hydrogen Purifier
Model 2100P Series**

POWER+ENERGY
Palladium Diffusion Hydrogen Purifiers

Important Notice

In order to maximize the hydrogen purifier's lifetime, keep the unit powered up and turn the hydrogen feed valve off when in normal use, this will keep the cell at operating temperature and you can have hydrogen on demand when needed. The purifier should not be cycled between operating temperature and room temperature more than 6 times per year without N₂ purging. A small amount of power (~60 watts) is required to keep the Pd cell at the operating temperature of ~400C.

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"Quality, Service & Innovation"

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Section

1

Introduction

Congratulations! You have purchased the most reliable device of its kind in the industry, the Power+Energy (P+E) hydrogen purifier. This manual will guide you through proper installation, operating, and maintenance procedures.

The P+E hydrogen purifier consists of a 316 L grade stainless steel cell, incorporating a proprietary palladium alloy tube as the diffusion element. Hydrogen gas is brought into contact with the inner surfaces of the palladium alloy tube which acts as a selective barrier, passing only atomic hydrogen through the tube wall, while excluding all other gases. Molecular hydrogen is adsorbed onto the surface where it is dissociated to become atomic hydrogen. The hydrogen atom shares its electron with the palladium metal lattice and diffuses through the lattice in a direction determined by the pressure gradient. The hydrogen atom recombines on the low pressure side of the membrane with another hydrogen atom and is desorbed generating an ultra pure hydrogen gas.



Figure 1. P+E Model 2100P Series Hydrogen Purifier

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Model 2100xP Series Hydrogen Purifier

Packing List

- One (1) shipping box should contain the following items:
- One P+E Model 2100P Hydrogen Purifier (Please see Figure 1 on page 1.)
- Installation and Operations Manual (this manual)
- “Hydrogen Purifier Test Certificate” document
- One (1) Power Cord

Specifications and Features

Gas Pressure and Specifications

Ultra pure hydrogen flow rate:

Model 2100SP	45 SLPM
Model 2100MP	30 SLPM
Model 2100KP	14 SLPM
Model 2100HP	6 SLPM

Maximum hydrogen feed gas inlet pressure 150 PSIG

Maximum nitrogen purge gas inlet pressure 150 PSIG

Dry Air inlet pressure:

Minimum	65 PSIG
Maximum	80 PSIG

Ultra pure hydrogen outlet pressure ≥ 0 PSIG

Minimum hydrogen feed gas purity ~99.95%

Ultra pure hydrogen output gas purity 99.9999999% at UPH flow > 4 SLPM

Hydrogen bleed outlet flow rate Typically 400 cc per minute at 150 PSIG inlet

Maximum gas temperature on any inlet line 50° C

Operations

Turning the power switch on brings the cell to operating temperature in approximately 30 minutes.

Purifier Connections

All tubing connections on the back panel are ¼" face seal fittings (VCR).

Instrument Air connection is for 5/32" polymer tubing

Leak Rate Specifications

Helium leak test < 10⁻⁹ scc/sec at 300 PSIG of He in Feed line.

Mechanical

Dimensions in inches L x W x H 10" x 10" x 8"

Weight: 15 lb

Clearance Area

Minimum distance to sides and back panel: 3.0 cm from sides and from fan on back panel

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Front Panel Indicators

The front panel of the 2100 contains a temperature controller with LED displays, two indicator lights, and one rocker switch that controls the ultra pure hydrogen flow.

The upper light is Yellow when lit and is labeled “OPEN.” This light is illuminated when the Hydrogen feed valve is opened through use of the front panel rocker switch. When the cell is below the operating temperature, the Hydrogen feed valve cannot be opened and this light will be off regardless of the rocker switch position.

The lower light is Green when lit and is labeled “STANDBY.” This LED is lit when the temperature of the cell is above the minimum operating temperature of the unit and it is ready to produce pure hydrogen.

The temperature controller displays the operating temperature of the purifier in the upper green number and the target temperature in the lower green number. Nominal operating temperature is 400 degrees C, but can vary between 395 and 410 as flow rates change. This display can be used to observe the heating of the unit when first powered up, and to monitor the temperature during normal operation. This unit is pre-set at the factory and settings should not be changed by the user. There is no need to use any of the temperature controller setting buttons.

Power (I/O) Switch

The power switch is located on the back panel. This switch turns the power to the purifier **On** and **Off**.

Hydrogen Feed Valve Switch

This switch is located on the front panel and controls the internal hydrogen feed valve.

Open light ‘ON’ indicates the hydrogen feed valve is open and the unit will provide ultra pure hydrogen on demand up to its maximum capacity.

Open light ‘OFF’ indicates the hydrogen feed valve is closed and no ultra pure hydrogen is being produced.

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Installation and Connections

Connecting The Power

The purifier operating voltage is marked on the rear panel, near the power cord of each unit.

The fuse is located just below the cord on the rear panel. Make sure the Hydrogen Feed Valve switch on the front panel is in the Standby position and the Power switch on the back panel of the purifier is in the Off (O) position. The female end of the cord is connected to the back panel of the purifier and the male end (supplied by user) of the cord to an appropriate power source. Be sure that the power cord and receptacle provide a good earth ground for the purifier.

The Model 2100Px hydrogen purifier is available in two different voltages:

Voltage

100/120 VAC 50/60 Hz

200/240 VAC 50/60 Hz

Fuses

(two) 8 Amp

(two) 5 Amp

Fittings

Ports on back panel terminate in 1/4" face seal fittings. Connect all fittings properly and verify that tight connections are made.

FITTINGS AND TUBING NOTE:

Best results are obtained and highest purity is maintained by using chemical or electro polished, low-carbon 316L grade stainless steel tubing and fittings for your UPH connections.

Back Panel Gas Connections

Bleed Hydrogen Vent Connection

Connect the 1/4" face seal fitting labeled **Bleed Hydrogen Vent** to an exhaust hood or other appropriate venting system for hydrogen gas and the impurities in the feed hydrogen gas. **This line should never be plugged or connected in such a way that backpressure may develop. Plugging the bleed Hydrogen Vent line will destroy the palladium cell and void the warranty.** The internal Tubular Flow Restrictor automatically sets the bleed rate of flow at the **Bleed Hydrogen Vent** port.

Hydrogen Feed Inlet Connection

Connect a **99.95%** pure hydrogen gas supply to the 1/4" face seal fitting labeled **Hydrogen Feed Inlet** on the back panel of the purifier. **The maximum pressure is 150 PSIG.**

Nitrogen Feed Inlet Connection

Connect a **clean dry nitrogen** gas supply to the 1/4" face seal fitting labeled **Nitrogen Inlet** on the back panel of the purifier. **The maximum pressure is 150 PSIG.**

Dry Air Inlet Connection

Connect a **clean dry air** or **nitrogen** gas supply to the 5/32" polymer tube connection labeled **Dry Air Inlet** on the back panel of the purifier. **The maximum pressure is 80 PSIG.** This inlet is used to power the air operated valves inside the unit and must be connected to a proper supply for operation of the unit.

Ventilation

For proper cabinet cooling ventilation of this equipment, a distance of 1.18 inch (3.0 cm) must be maintained from the sides of the purifier and 1.18 inch (3.0 cm) from the fan on the back panel to any other surface.

Pressure Requirements

The **Hydrogen Feed Inlet** line pressure **must be limited to 150 PSIG maximum.** The purifier must be connected as outlined in Chapter 4.

The **Nitrogen Feed Inlet** pressure **must be limited to 150 PSIG maximum,** and should be set to approximately one half of the hydrogen feed pressure.

The **Dry Air Inlet** pressure must be between 65 PSIG and 80 PSIG. A nominal setting of 75 PSIG is recommended. If the pressure falls below 65 PSIG, the valves may operate erratically or may not operate at all.

Exceeding the pressure limits will damage valves and/or palladium membranes.

Cautions

Reverse Pressurization

Hydrogen diffuses through palladium in a direction determined by the pressure gradient. To produce ultra pure hydrogen you must have a higher pressure on the hydrogen feed side of the palladium cell than on the Ultra Pure hydrogen side. Reverse pressurization occurs when the ultra pure hydrogen pressure exceeds the feed hydrogen pressure and a differential of greater than between 20 to 25 PSIG can damage the cells palladium tubing.

The pressure at the Ultra Pure Hydrogen Outlet port on the back panel of the hydrogen purifier ***should never exceed*** the pressure on the Hydrogen Feed Inlet port. **The feed pressure for the hydrogen to the cell should always be greater than or equal to Ultra Pure Hydrogen Outlet pressure. The feed pressure at the Nitrogen Feed Inlet port should always be greater than the Ultra Pure Hydrogen Outlet pressure.** The nitrogen is used to purge the palladium membranes when the hydrogen feed valve switch is off.

Reverse pressurizing the palladium cell to a differential pressure greater than between 20 to 25 PSIG will damage the palladium silver membrane in the purifier's diffusion cell and void the warranty.

Contaminants

The UPH cell will be damaged if the feed gas contains halogens, unsaturated hydrocarbons, iron salts, halides, lead, mercury, sulfur compounds, or zinc. These contaminants must be eliminated from the feed gas. A hydrogen feed gas purity of at least 99.95% is recommended.

The flow rate of UPH through the diffusion cell will be reduced if the palladium-silver alloy (PdAg) becomes coated with solvents, oils, organic compounds, grease, pipe compounds, lubricants, or detergents. Do not allow these types of contaminants to enter the cell.

Water / Oxygen

Oxygen

Hydrogen containing over 1,000 PPM of oxygen should never be allowed to enter the cell. Oxygen and hydrogen react exothermally on the surface of the PdAg alloy to form water. This may cause overheating and damage the diffusion cell. If the water vapor concentration builds up because the bleed rate is set too low, the water vapor may condense and form liquid water in the cell. Over time, this will cause embrittlement of the PdAg membrane.

Water

Hydrogen containing over 1,000 PPM of water should never be allowed to enter the cell.

Check Valve

An internal two-pound pressure UPH check valve is installed in-line with the Ultra Pure Hydrogen Outlet port on the back panel for two functions:

The check valve limits the amount of hydrogen that must back diffuse through the membrane when power is lost or when the unit is shutdown. When power fails, the internal hydrogen feed valve is shut automatically and the nitrogen valve is opened automatically. Ninety percent (90%) of the hydrogen in the cell will back diffuse through the membrane within 15 minutes.

The check valve prevents reverse pressurizing the cell from an external source. Care must be taken not to connect a gas cylinder to the Ultra Pure Hydrogen Outlet port on the back panel of the purifier.

Troubleshooting

Low Flow

A reduction in the Ultra Pure Hydrogen Outlet port flow rate indicates that:

The diffusion cell is contaminated

The pressure of the feed hydrogen has dropped.

The output pressure at the Ultra Pure Hydrogen Outlet port has increased.

Section

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Model 2100P Series Hydrogen Purifier Startup Procedures

Before starting up the Power+Energy hydrogen purifier, be sure to read the "*Cautions*" and "*Contaminants*" section of Chapter 4 pages 7 & 8.

Connect all gas lines at the back panel of the purifier as described in the *Back panel gas connection* section on page 8.

The Hydrogen Feed Valve switch should be in the Standby position, the Power (I/O) switch located on the back panel of the unit to the OFF position (O).

Verify that the proper line voltage as shown on the back panel under the Power (I/O) switch is applied to the back of the unit.

Start Up

Apply power by pressing the **Power (I/O)** switch on the back panel of the unit to the ON position (I).

When power is turned on and the Cell is below the operating temperature the **Standby light (GREEN)** will be off. The cell reaches the operating temperature about 30 minutes after the power is turned on. The **Standby light (GREEN)** will turn on when the cell is at temperature.

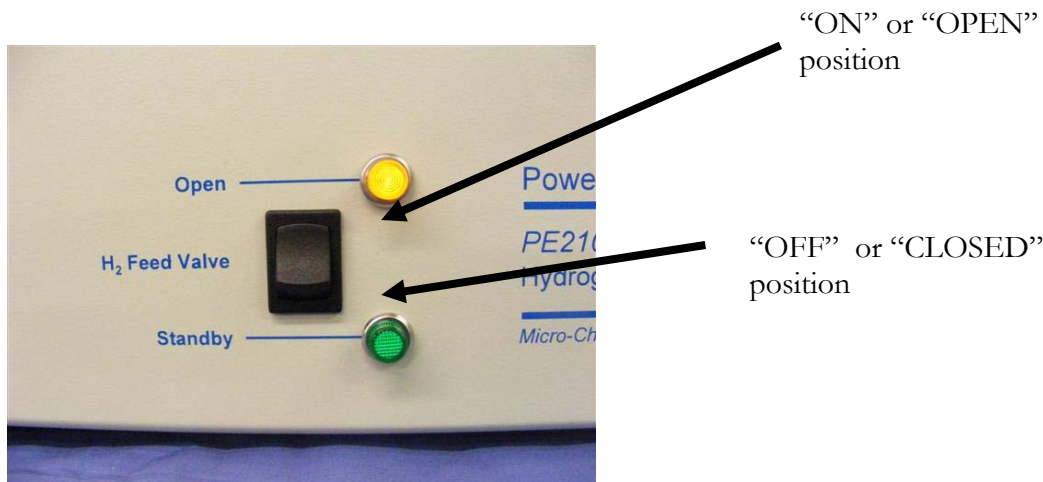
Pressing the Hydrogen Feed Valve switch to the **Open** position when the Standby light is lit will turn on the Open light. **The Hydrogen Feed Valve** can only be opened when the unit is at temperature. When the hydrogen feed valve is open (Open light On) ultra pure hydrogen will start to flow at the Ultra Pure Hydrogen Outlet port located on the back panel of the purifier within one minute.

Standby position

If the Hydrogen Feed Valve switch is in the off position the purifier will come up to operating temperature ~ 400 degrees Celsius, the Standby light will illuminate (**GREEN**) but the hydrogen feed valve will remain closed. In the Standby mode the purifier is ready to produce ultra pure hydrogen but will not until the Hydrogen Feed Valve switch is toggled to the Open position. It takes approximately one minute for the unit to produce hydrogen gas.

Open position

If the Hydrogen Feed Valve switch is in the Open position the cell will heat up to ~ 400 degrees Celsius, the **Standby light** will illuminate **GREEN (GREEN)** and the internal hydrogen feed valve will open, the purifier will start to produce ultra pure hydrogen. When the cell reaches the operating temperature of ~ 400 degrees Celsius the maximum flow rate will be available.



Shutdown Procedure

We recommend that the purifier be left in the Standby mode and **not turned off** while in normal use. Press the Hydrogen Feed Valve switch on the front panel of the purifier into the off position, the internal hydrogen feed valve will close and the cell will remain at operating temperature ready to produce ultra pure hydrogen when needed.

If you do not intend to use the purifier for seven (7) days, press the Hydrogen Feed Valve switch on the front panel of the purifier into the off position and press the Power (I/O) switch on the back panel to the off (O) position. This safely shuts the purifier off.

Power Loss

When power is lost the internal hydrogen feed valve closes and the nitrogen feed valve opens. The residual heat in the cell is sufficient to allow the ultra pure hydrogen in the cell and system to back diffuse safely through the palladium metal lattice and exit through the Bleed Hydrogen Vent line. An internal Tubular Flow Restrictor automatically sets the bleed rate of flow at the Bleed Hydrogen Vent port and limits the reverse pressure across the membrane. Nitrogen feed must be present to allow proper back diffusion of the cell and protect it from damage.

Model 2100 Hydrogen Purifier System Maintenance

Preventative Maintenance

Feed Hydrogen Purity

For reliable cell operation, the following feed hydrogen limits should be observed:

- Carbon Monoxide less than 50 ppm
- Carbon Dioxide less than 50 ppm
- Halogens/compounds less than 1 ppm
- Total Hydrocarbons less than 100 ppm
- Mercury/compounds less than 0.01 ppm
- Oxygen less than 1,000 ppm
- Sulfur/compounds less than 0.02 ppm
- Water vapor less than 1000 ppm

Fan

No lubrication required. There are no filters associated with the fans. However, the blades will accumulate dust after a long period of time. The fan blades and guard screen should be cleaned once a year with a brush and vacuum cleaner when the system is off. The fans may need to be cleaned more or less frequently, depending on the environment.

Troubleshooting the System

UPH Output Flow Decrease

UPH output flow is a function of the partial pressure in hydrogen of the feed gas. The most common cause of reduction of output flow is the presence of water vapor in the feed gas. The effect of water vapor in the gases is temporary. The UPH output flow rate will be restored when the input feed gas has been changed to proper purity levels. Another possible cause for reduced UPH output flow rate is contamination by certain materials. See the Contamination section of this manual for more details.

Symptoms That Require Cell Replacement

Heater Failure

Heater band failure, which keeps the cell from maintaining operating temperature at steady flow rates, may indicate that a cell replacement is required.

Degraded UPH output

Degraded UPH output flow rate due to contamination other than water on the feed side of the membrane may indicate that a cell replacement is required. Most reduced flow problems are due to excessive water vapor in the hydrogen feed gas. If CO or CO₂ is present in the hydrogen feed gas greater than list above then carbon may form on the membrane and decrease the UPH output.

Service

There are no user serviceable parts inside the unit. All service must be done at the factory or by authorized service representatives.

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7

Safety Precautions

DANGER!
Under no circumstances should attempts be made to circumvent compressed gas safety equipment.

Compressed gases and associated equipment are potentially dangerous; persons that have not been formally trained must not use them.

Risk of personal injury or damage to equipment may be avoided only by a strict adherence to all safety precautions.

This manual cannot replace formal training in compressed gas equipment safety principles and, accordingly, is intended only as a reminder to adequately trained personnel that already understand applicable safety practices.

WARNING!

Hydrogen

Hydrogen is combustible at concentrations of 4.0 % to 75.0 % in air

Hydrogen has an auto ignition temperature of 571 degrees C (844 degrees K or 1,060 degrees F)

Hydrogen detonates at concentrations between 18% and 59% in air.

Hydrogen can be ignited with an electrical discharge exceeding the energy equivalent to 200mA at 24 volts DC.

Hydrogen is nontoxic; hence OSHA PEL (TWA or C) are not listed. But hydrogen can act as an asphyxiant by displacing the necessary amount of oxygen required to support life.

Hazardous Materials

Hazardous materials must be managed properly. Hydrogen is classified as hazardous production materials (HPM) according to the Uniform Fire Code (UFC); all requirements of that code, where adopted, must be observed. These requirements, among others, include:

- Installation of suitable facility exhaust equipment, use of welded external piping connections, and installation of hazardous gas detectors.
- Operate the unit in a well-ventilated area equipped with hydrogen leak detector and alarm system, and a fire protection system that meets the criteria of NFPA 30.
- Never use cylinders of hydrogen in areas where flames, excessive heat, or sparks, may occur.
- Electrical equipment in the vicinity, such as fans and motors, must meet Class I, Div 1 standards. Utilize only explosion-proof equipment and spark-proof tools in areas where hydrogen is handled.
- Commonly used personal equipment for communication, such as cellular phones and beepers, are capable of producing electrical sparks and should not be used near hydrogen lines.
- Ground all equipment and lines used with hydrogen.
- Suitable equipment, such as flash arrestors in vent lines, is strongly recommended.
- Label all hydrogen lines with appropriately color-coded labels (ANSI Code: Black lettering on yellow background)

Avoid Serious Bodily Injury and Equipment Damage

Modification of equipment, failure to follow recommended procedures or circumvention of instructions in this manual can result in serious bodily injury and equipment damage.

Follow all instructions carefully; should a question arise, consult with an authorized Power+Energy Applications Engineer by calling Power+Energy, Inc. at (215) 942-4600, Monday-Friday from 8:00 a.m. to 5 p.m., U.S.A. EST.

Use Only Trained Personnel

Installation, operation, and maintenance of gas control equipment should be executed by trained personnel only.

All compressed gases are potentially hazardous and must be handled only by trained personnel.

Incorrect execution of ostensibly simple operations can cause fire, explosion, or atmospheric release of hazardous/toxic gas. An explosion or a leak may also cause costly contamination of process equipment from exposure of metal alkyls (typically used on MOCVD Tools) to atmospheric air.

Characteristics of Compressed Gases

Physical characteristics of compressed gases and approved compressed gas equipment handling techniques are described in the Compressed Gas Association's Handbook of Compressed Gases, 4th Edition, Van Nostrand Reinhold, NYC (1998). This useful book should be readily available for consultation at all facilities where compressed gases are used or stored.

Equipment Usage

Use of this equipment with other than intended gases (hydrogen, nitrogen and helium) may create potentially hazardous conditions. This equipment is designed to purify hydrogen gas from a liquefied source or from cylinders, only. Do not use this equipment with any other gas.

- **Unless otherwise designated, Power+Energy purifiers are rated for a maximum operating pressure of 150 psig.** An upstream process gas source pressure regulator and overpressure relief device must be installed when a potential exists for over-pressurization of the Power+Energy purifier.
- To minimize post-purification contamination and facilitate purging, the purifier should be installed as close as possible to the process tool. Typically, for MOCVD applications, the Power+Energy purifier is directly mounted **on** the tool.
- **DO NOT, under any circumstance, operate purifier without installation of the *flow restrictor* provided with the Power+Energy purifier. Operation of purifier without the flow restrictor voids the warranty and will cause failure of the purifier and contamination of the process lines.**
- **DO NOT operate the purifier with oxygen concentrations exceeding 1000 ppm. on average. Overheating of the cell and potential damage to the palladium membrane may result.**
- Avoid using hydrogen from petroleum refineries. **Sulfur-containing compounds or unsaturated hydrocarbons in the feed hydrogen will poison the surface of the palladium membrane.** If the flow rate drops and poisoning of the cell is suspected, contact Power+Energy, Inc. Applications Engineer at (215) 942-4600, Monday-Friday from 8 a.m. to 5 p.m. U.S.A. EST.
- Preferably use hydrogen that is free from compressor oils, grease, and lubricants. Mercury, iron, zinc, and lead particulates in hydrogen may cause irreparable damage to the palladium membrane. **Particulate filters must always be used in the hydrogen feed line and nitrogen feed line.** Always replace all components, fasteners, labels, and other items exactly as originally installed; don't modify any equipment without proper authorization from Power+Energy, Inc.
- Do not tamper with the purifier cell or the controller. Unauthorized repairs or modification may cause a hazardous situation and void the warranty.
- Store uninstalled equipment in a cool, dry, and secure place and verify that all ports are capped.
- Purifiers or controllers not in adequate operating condition must not be used. Do not attempt to use equipment that is not operating properly.
- Never attempt to defeat interlocks or other safety devices.
- Do not attempt to open manual valves, or otherwise allow air to contact the purifier, prior to installation. Valves must remain closed until installation is complete and all equipment has been suitably helium leak tested and purged.
- Material Safety Data Sheets for all gases and purification media used in the facility should be available for consultation by all concerned personnel. These data sheets are obtainable from gas suppliers.
- *Vent* all equipment of hydrogen prior to disassembly. Be aware that unexpected jet noise accompanying gas release can frighten workers and precipitate accidents. Accidental process gas release is more likely to occur during maintenance than during routine operation.

- Equipment used in hazardous gas service must be *purged* immediately prior to disassembly.
- Personnel working with hazardous gases or contaminated components must be provided with suitable protective gear.
- **Do NOT ATTEMPT any REPAIRS there are no user serviceable parts.**
Contact P&E customer service at (215) 942-4600 if you have any questions.

Power+Energy Warranty and Return Information

Limited warranty

P+E warrants that all products sold shall conform to the P+E's standard specification for products, subject to reasonable manufacturing tolerances, for a period of one year for purifier cells. This warranty covers the palladium cells against failure due to defects in materials and workmanship. **This warranty excludes damage resulting from Hydrogen Embrittlement.** This warranty does not extend to the process of manufacture nor to the quality of any other components, processes, facilities or equipment which are not supplied by P+E and in connection with which the product is to be used, and Purchaser shall hold P+E harmless from any suit, claim or damage, arising from or out of the use of this product. P+E shall not be responsible for work done, material furnished or repairs made by others unless agreed upon in writing, and reserves the right of doing or supervising any necessary repair work incident to putting products in proper operation. Purchaser agrees to use reasonable care in the operation and maintenance of products provided in accordance with instructions furnished by P+E. Standard components such as valves, fittings which are provided as an integral part of the cell, will be guaranteed to the extent of the warranty offered by that component's manufacturer.

There are no user serviceable parts in the palladium hydrogen purifier. Only P+E trained and authorized personnel should be allowed to service P+E equipment. **THIS WARRANTY IS VOID IF P+E EQUIPMENT IS SERVICED BY PERSONNEL NOT TRAINED AND NOT AUTHORIZED BY P+E.**

Palladium hydrogen purifiers must be used only by qualified personnel, in a controlled environment. Refer all questions to the Power+Energy operations manual or call our Customer service department at (215) 942-4600 Monday – Friday, 8:00 a.m. – 5:00 p.m., U.S.A. EST (e-mail info@purehydrogen.com).

Return Authorization and Repairs

If a fault develops, notify Power+Energy and provide us with a complete description of the problem, including the purifier Model Number and Serial Number. On receipt of this information, service or shipping instructions will be issued. **ONLY IF RETURN OF THE UNIT IS AUTHORIZED**, send it to us prepaid and repairs will be made at the factory. If the unit is not covered by warranty, or if it is determined that the fault is caused by misuse, repairs will be made at the expense of the customer. An estimate of the cost of these repairs will be submitted for approval prior to beginning any work.

Shipping damage

Each Power+Energy hydrogen purifier has been carefully tested and inspected before shipment. The purchaser should make visual and operational checks upon receipt. Any physical damage should be noted and a claim filed immediately with the carrier. Most carriers will not honor any claim made after 7-15 days from the shipping date. If the equipment is received in damaged condition, request an immediate inspection by the carrier employee.

Power+Energy will assist in ensuring a satisfactory settlement from the carrier. Upon receipt of the carrier damage/inspection reports, Power+Energy will arrange, at our option, for either equipment repair or replacement. Please read the section on Return Authorization and Repairs located on page 18.

If you have any questions or if we can be of further service, Customer Service can be reached at 215-942-4600 (fax: 215-942-9300) Mon – Fri, 8:00 a.m. – 5:00 p.m., U.S.A. EST. Or e-mail us at customerservice@purehydrogen.com

Appendix A

Model 2100P Series Hydrogen Purifier Front Panel



Figure 2. Model 2100 Hydrogen Purifier Front View

Model 2100P Series Hydrogen Purifier Rear Panel



Figure 3. Model 2100 Hydrogen Purifier Rear View

(Insert Back Cover)

