MATHESON TRI•GAS
ask. . .The Gas Professionals™

166 Keystone Drive
Montgomeryville, PA 18936
Telephone: 215-641-2700
Fax: 215-641-2714

Matheson Chrysalis™ Hydrogen Gas Generators
Model GEN-HYC300 and GEN-HYC600

I. SERVICE

General Service

A unit that is not functioning in a normal manner should be removed from service until such time that repairs or replacement can be made. Upon completion of repair, full testing should be performed to assure the user that the unit has been returned to its original operating parameters. To arrange for repair service, call Customer Service at 1-800-828-4313. **NO PRODUCT WILL BE RECEIVED BY MATHESON WITHOUT INDICATION OF GAS SERVICE AND WITHOUT PROPER RETURN MATERIAL AUTHORIZATION PROVIDED BY CUSTOMER SERVICE. (All repairs must be made by Matheson or an assigned and approved facility to maintain any warranties or guarantees).**

If the unit is under an applicable warranty, return the unit to Matheson for repair or replacement. To arrange for warranty service, call 1-800-828-4313. **NO PRODUCT WILL BE RECEIVED BY MATHESON WITHOUT INDICATION OF GAS SERVICE AND WITHOUT PROPER RETURN MATERIAL AUTHORIZATION PROVIDED BY CUSTOMER SERVICE.**

If advised by Customer Service to return the product to Matheson, prepare the product for shipment and write in large lettering the RMT number assigned by Customer Service on the outside of the box. Also, if required by Customer Service, supply the completed RMT form with the product. Make sure that the product is adequately packaged, in the original shipping container if possible, and shipped prepaid (Matheson will not accept COD freight) with a description of the observed deficiency to the attention of:

Matheson Tri-Gas
166 Keystone Drive
Montgomeryville, PA 18936
RMT Number (fill in RMT number assigned by Customer Service)

The user is expected to periodically inspect the product for leaks, loose or worn parts, and broken or non-functioning components and to address those situations immediately. If the user would require verbal assistance in ascertaining the potential of a problem with any Matheson product, contact the local Matheson branch for assistance or your Matheson Sales Representative.

II. LIMITED WARRANTY

This equipment is sold by Matheson Tri-Gas (Matheson) under the warranties set forth in the following paragraphs. Such warranties are extended only with respect to the purchase of this equipment directly from Matheson or Matheson's Authorized Agent as new merchandise and are extended to the first Buyer thereof other for than the purpose of resale.

For a period of one year from date of original delivery (ninety days in corrosive service) to Buyer or to Buyer's order, this equipment, is warranted to be free from functional defects in materials and workmanship and to conform to the description of this equipment contained in this manual and any accompanying labels and/or inserts, provided that this equipment is properly operated under the conditions of normal use and that regular and periodic maintenance and service is performed or replacements are made in accordance with the instructions provided. Expendable parts of this equipment are similarly warranted to be free from functional defects in materials and workmanship and to conform to the description of this equipment contained in this manual and any accompanying labels and/or inserts. The foregoing warranties shall not apply if the equipment has been repaired other than by Matheson or a service facility designated by Matheson, or if this equipment has not been operated and maintained in accordance with written instructions provided by Matheson, or has been altered by anyone other than Matheson, or if the equipment has been subject to abuse, misuse, negligence or accident.

Matheson's sole and exclusive obligation and the Buyer's sole and exclusive remedy under the above warranties is limited to repairing or replacing, free of charge, at Matheson's sole discretion, the equipment or part which is reported to be a problem to the local Matheson Branch Location, and which if so advised, is returned with a written statement of the observed deficiency, not later than seven days after the expiration of the applicable warranty, to the Matheson Gas Equipment Technology Center during normal business hours, transportation charges prepaid, and which, upon examination, is found to comply with the above warranties. Return trip transportation charges for the equipment or part shall be paid by the Buyer.

MATHESON SHALL NOT BE OTHERWISE LIABLE FOR ANY DAMAGES INCLUDING BUT NOT LIMITED TO INCIDENTAL DAMAGES, CONSEQUENTIAL DAMAGES, OR SPECIAL DAMAGES, WHETHER SUCH DAMAGES RESULT FROM NEGLIGENCE, BREACH OF WARRANTY OR OTHERWISE. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES THAT EXTEND BEYOND THE WARRANTIES HEREINABOVE SET FORTH. MATHESON MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE EQUIPMENT OR PARTS THEREOF. ACCEPTANCE OF THE EQUIPMENT BY THE FINAL BUYER INDICATES THE FINAL BUYER'S ACCEPTANCE OF ALL WARRANTIES AND LIMITATIONS SET FORTH.

III. USER RESPONSIBILITY

This equipment will perform in conformity with the description thereof contained in this manual and accompanying labels and/or inserts when installed, operated, maintained and repaired in accordance with the instructions provided. This equipment must be checked periodically, with the frequency of such inspections depending upon the scope of use. Damaged, worn or contaminated equipment should not be used. Parts that are broken, missing, plainly worn, distorted or contaminated should be replaced immediately. Should such repair or replacement become necessary, Matheson Tri-Gas recommends that a written request for service advice be made to the Matheson Equipment Engineering Group in Montgomeryville Pennsylvania or to the nearest Matheson Tri-Gas Branch location.

This equipment or any of its parts should not be altered without the prior written approval of Matheson Equipment Engineering Group. The user of this equipment shall have the sole responsibility for any malfunction that results from improper use, faulty maintenance, damage, improper repair or alteration by anyone other than Matheson Tri-Gas or a service facility designated by Matheson Tri-Gas. Further, the ultimate user of the equipment is responsible for the training and safe operation of the equipment by personnel in his/her employ.

Safety Symbols

SHOCK HAZARD

GENERAL ALARM

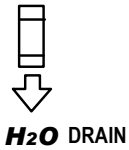
REMOTE ALARM

DO NOT BLOCK

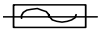
HYDROGEN RELIEF

FILL WATER

HYDROGEN PRODUCT



WATER DRAIN



250VAC 10A TYPE F

Conventions

This Installation, Operation & Maintenance Guide uses the following conventions to alert you to information that will help you operate the Chrysalis Hydrogen Generator correctly and safely.

WARNING

The Warning symbol calls attention to a procedure, practice or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a Warning symbol until the indicated conditions are fully understood and met.

CAUTION

The Caution symbol calls attention to an operating procedure, practice or the like, which, if not correctly performed or adhered to, could result in damage or destruction of a part or the entire product. Do not proceed beyond a Caution symbol until the indicated conditions are fully understood and met.

Chrysalis Hydrogen Generator

Installation, Operation & Maintenance Guide

Table of Contents

1.0 Introduction

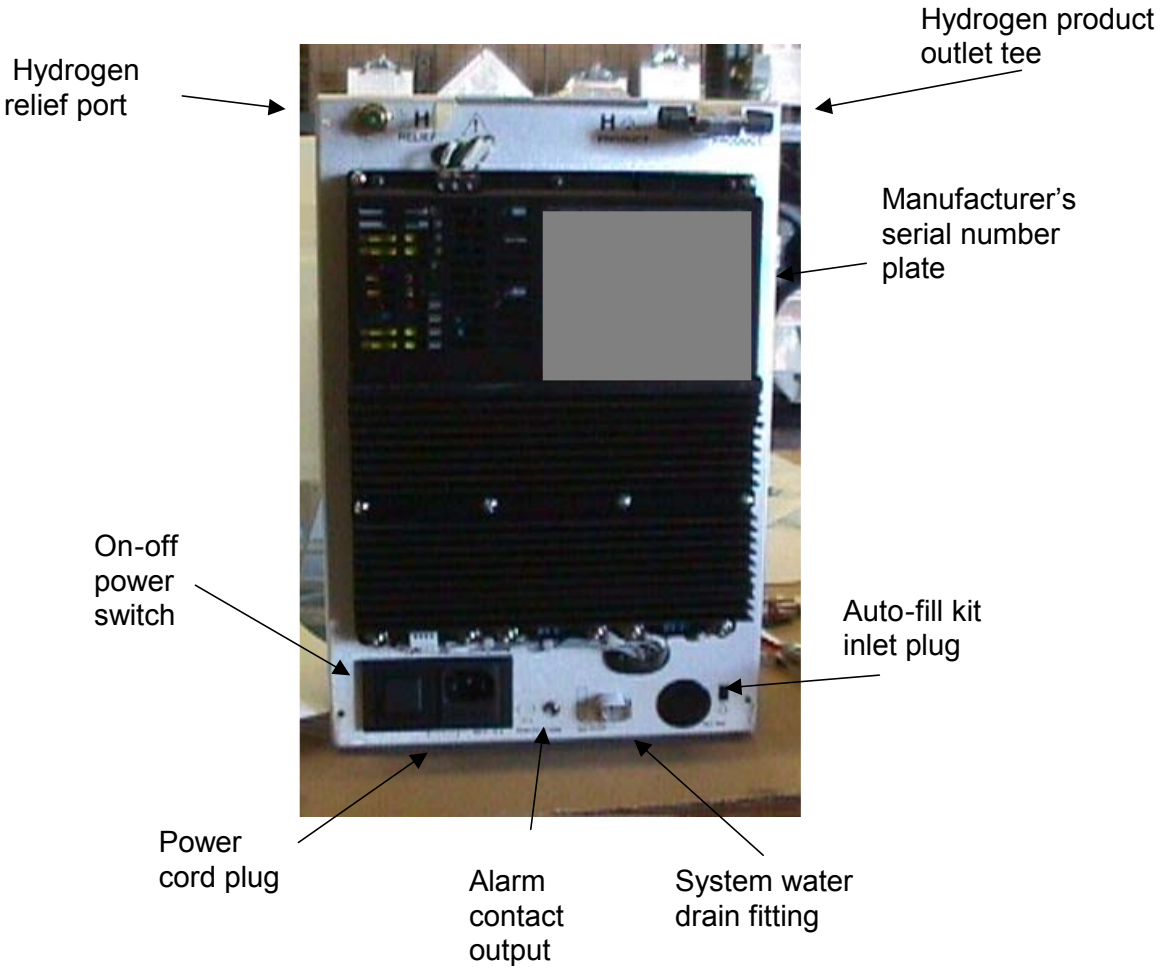
The Chrysalis Hydrogen Generator has been designed by Matheson Tri-Gas to meet the exacting hydrogen needs of today's modern laboratory. The Chrysalis Hydrogen Generator combines several important advantages for state-of-the-art analytical techniques:

- The purest hydrogen available from any laboratory hydrogen generator
- 200 psig delivery pressure for fast GC fuel and carrier gas supply
- Palladium membrane purifier for maintenance-free gas purification
- Small footprint (only 9" wide) conserves bench space
- No caustic or other hazardous materials contained in the system
- Easy to fill with built in DI water fill funnel, or optional auto fill kit
- User friendly electronic control panel with both English and metric units
- No routine service required
- Internal and system leak warning
- Remote alarm output contacts

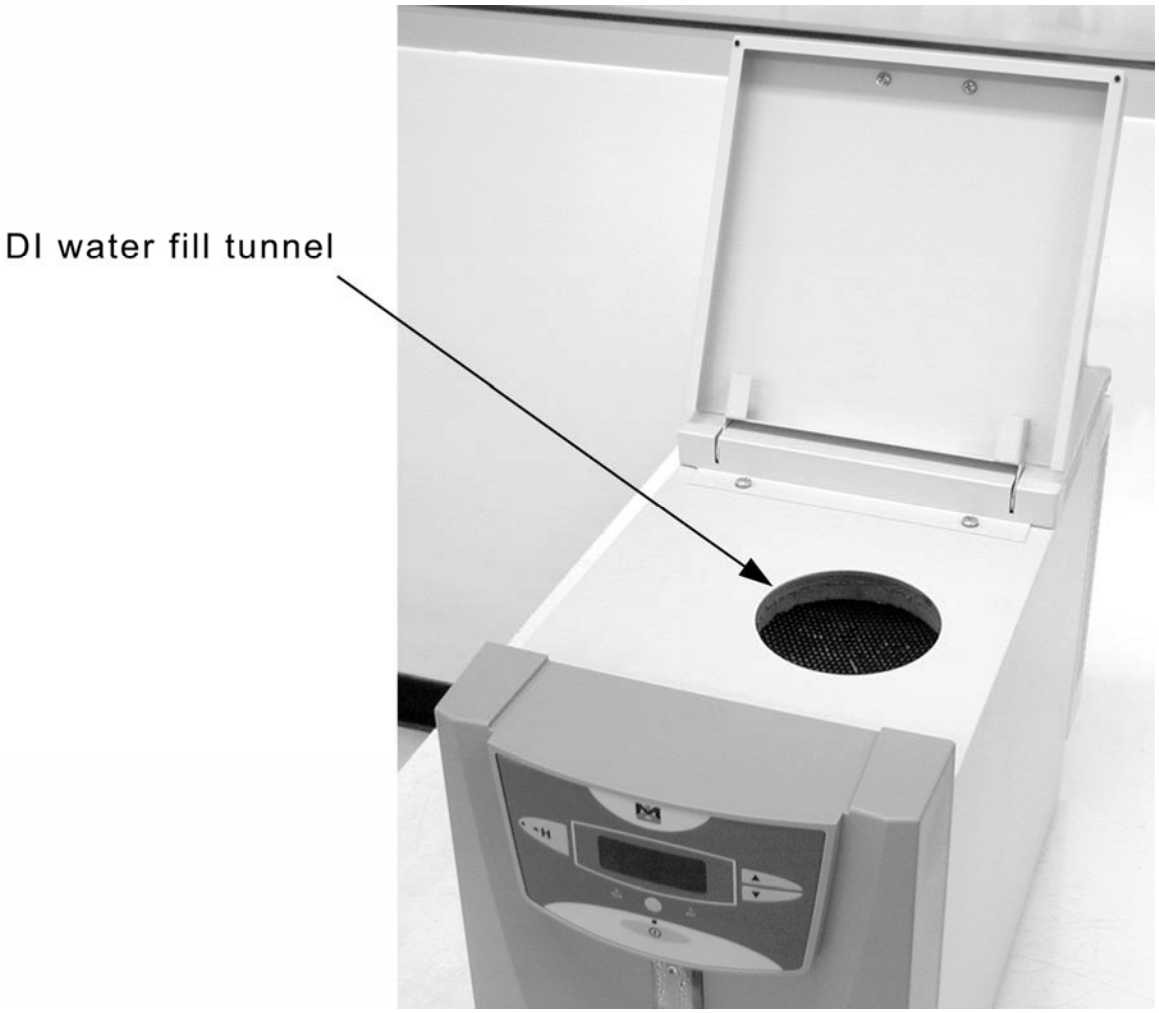
This instruction manual is written for the Chrysalis 300 and 600 cc/minute Hydrogen Generators only.

Chrysalis Hydrogen Generator Front Panel View

Chrysalis Hydrogen Generator Rear Panel View



Chrysalis Hydrogen Generator Top View



1.1 General Information

The Chrysalis Hydrogen Generator produces a continuous stream of ultra high purity hydrogen gas to automatically maintain a user selected downstream pressure when connected to a suitable power source and fed with a suitable quality of deionized water. The systems are designed to deliver hydrogen at a variable flow rate (up to the full unit capacity) to maintain the user input downstream pressure up to the full rated flow rate of the unit. The Chrysalis Hydrogen Generator is suitable for use in laboratories and light industrial environments and is non-hazardous for transportation purposes.

CAUTION

It should be noted that the Chrysalis Hydrogen Generator must be installed and running within 6 months of shipment from the manufacturer to ensure the optimum efficiency of the Proton Exchange Membrane cell. A copy of the serial number identification plate attached to the back of the Chrysalis Hydrogen Generator is shown below. The serial number contains an embedded date code, which is the date of manufacture of the system. The date of manufacture is in format "mm/yy" (example underlined below). If the manufacture date code is more than six months prior to the date of startup of your system, please contact your supplier for instructions.

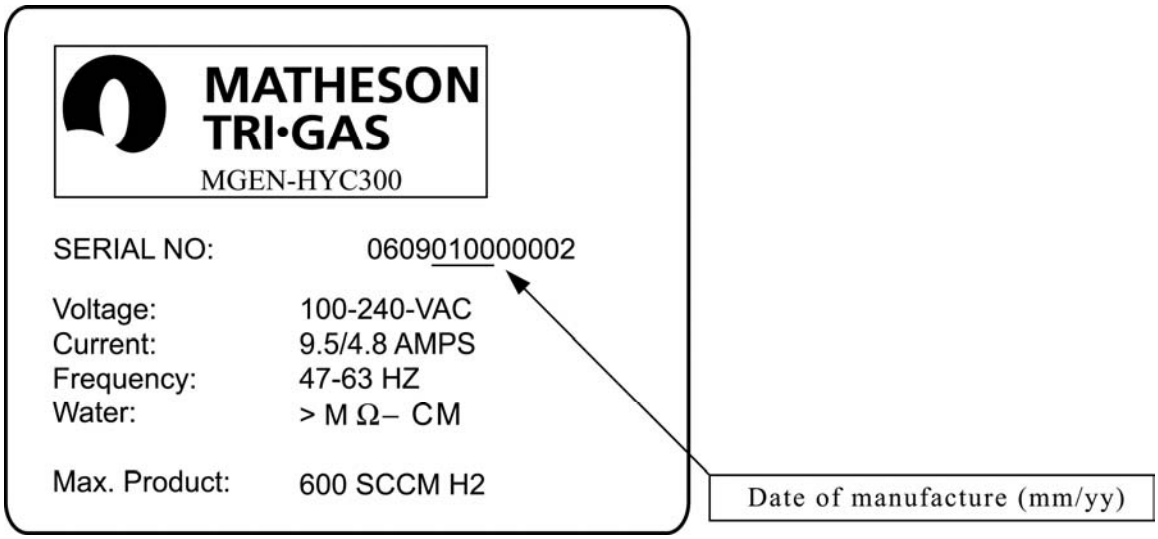


Figure 1.1 Serial Number Identification Plate

CAUTION

There are no user serviceable parts in the Chrysalis Hydrogen Generator. Any interference with the internal parts will void the manufacturer's warranty.

CAUTION

If the Chrysalis Hydrogen Generator must be shipped for any reason, you must drain all the water from the DI water tank, remove the deionizer bag, and seal the water tank inlet with plastic wrap. The unit must be properly packed and shipped in an upright position.

1.2 Technical Specifications

Table 1-1: Technical Specifications

Model Number:	**GEN-HYC300 GEN-HYC300-AF (with auto fill option)**	**GEN-HYC600 GEN-HYC600-AF (with auto fill option)**
H_2 Production Capacity:	0 - 300 sccm H_2	0 - 600 sccm H_2
Water Consumption (approximate):	1.7 Liters per 24 hour day	3.3 Liters per 24 hour day
Power Consumption:	<1000 watts	<1200 watts
Delivery Pressure, psig (barg)	30-200 psig (1 - 14 barg) @ 3% FSO	
Deionized Water Feed Specification:	1 meg-ohm/cm^2 (1 microSiemen) or better quality deionized water; >10 psi DI water feed pressure required for auto fill option	
Cell Active Area:	0.03 ft^2 active area	
System Type:	Liquid anode feed, pumped	
Power:	100-240 VAC, 47/63 Hz	
Dimensions (W x D x H):	9” x 20” x 14½” (23 cm x 51cm x 37cm)	
Weight:	< 50 lbs (23 kg)	
Min/Max Ambient Temperature:	50°F / 95°F (10°C / 35°C)	
Maximum Ambient Humidity:	80% RH	
Control:	Adjustable setpoint. Remote alarm connector. Keypad parameter adjustment.	
Display:	Pressure, water level, power, generating, status (fault#)	
Shutdown Conditions:	Poor water quality, low water level, cell voltage, purifier temperature, loss of cabinet ventilation	
Warning Conditions:	Internal or external leakage, detected by time to reach setpoint	
Product Purity:	<1 ppm oxygen, <1 ppm moisture, <1 ppb hydrocarbons /halocarbons, balance hydrogen	

1.3 Key Features

- Start-up system check
- User selectable delivery pressure, displayed in psig or kpa
- Easy fill funnel for DI water addition (and optional auto fill kit)
- Easy view water level indicator
- Water low level alarm and empty shutoff
- Flow indicator
- Conductivity sensor/alarm
- Automatic pressure sensing
- Automatic pressure sensing leak test with audible alarm and indicator
- Safety shut down on loss of cabinet ventilation
- Remote alarm contacts

2.0 Safety Information

Unsafe conditions may result if the Chrysalis Hydrogen Generator it is operated by untrained personnel. Do not operate the generator until the information contained in this document has been read and understood by all personnel concerned.

WARNING

The Chrysalis Hydrogen Generator produces ultra high purity hydrogen into pressurized downstream equipment, primarily for research and analytical purposes. Because hydrogen is a highly flammable gas, users must exercise adequate precautions to ensure that hydrogen is not allowed to accumulate, causing a flammability hazard. If you are unfamiliar with hydrogen safety, please contact Matheson Tri-Gas for a Hydrogen Material Safety Data Sheet (MSDS), which contains more detailed hydrogen safety precautions. In addition to its flammability danger, the collection of hydrogen can displace oxygen, thereby creating a risk of asphyxiation. Adequate ventilation, checking of pipe and tubing connections for leak tightness, and appropriate use of hoods are important safety precautions. In addition to the pressurized hydrogen product, the Chrysalis Hydrogen Generator also produces a small flow of byproduct oxygen at just over atmospheric pressure, which is vented from an outlet in the top of the internal water tank and swept from the cabinet with the cooling air.

WARNING

Chrysalis Hydrogen Generators produce hydrogen at the rate at which it is being utilized by the laboratory equipment, thereby keeping flammable gas inventory at the lowest level possible. Nonetheless, it is critical to ensure the leak-tightness of all product hydrogen supply system lines to minimize the risk of a hydrogen leak and potential ignition. Additionally, it is essential to keep the generator away from excessive heat and flames.

The power switch and electrical disconnect (removable cord set) are located at the back of the unit and must be accessible at all times during operation of the generator.

All personnel handling, using or maintaining this generator must employ safe working practices and observe all relevant local health and safety regulations.

3.0 Unpacking and Preparing for Installation

3.1 Unpacking the Generator

Depending on optional equipment installed, your Chrysalis Hydrogen Generator weighs between 40 and 50 lbs (18-23 kgs).

Enclosed with the generator is a polypropylene bag containing a variety of parts, including:

- The male plug for the remote alarm contact system
- A spare fuse for the power supply
- A drain plug male fitting for the system water drain

CAUTION

It is important to lift your Chrysalis Hydrogen Generator carefully out of its shipping box.

- Remove the Chrysalis Hydrogen Generator from the box carefully by lifting it straight up while grasping underneath the generator (see Figure 3.1).
- Unpack the generator and retain the shipping and packing materials in case it is necessary to ship it in the future.
- When lifting or moving your Chrysalis Hydrogen Generator, keep in an upright position and grasp underneath from front to back (see Figure 3.2).
- Open lid and remove the seal and foam insert as shown in Figure 3.3.
- Drain the water from the Chrysalis unit using the drain plug provided.
- Refill the Chrysalis Hydrogen Generator with fresh DI water through the funnel on top of the unit according to specifications in Table 1-1.

CAUTION

Before filling the generator with deionized water, always check the quality of the deionized water and ensure that it meets or exceeds the deionized water feed specification in the Technical Specifications table (Section 1.2).

Figure 3.2 Proper Holding and Lifting Technique

Figure 3.1 Lifting the Generator out of the shipping box

Figure 3.3 Remove Seal and Foam Insert

3.2 Preparing for Installation

- Locate the generator indoors in a clean environment with ventilation exceeding 0.6 m^3/min (22 ft^3/min).
- Protect from external contact with water.
- Keep well away from static electricity and flames.
- Install on a level site (+/- 3° required).
- Keep the front of unit clear.
- Allow minimum clearance of 5” at the rear and on the right hand side of the generator in order to reach the power switch and removable cord set and for ventilation purposes.
- Ensure compliance with necessary ambient temperature and humidity conditions (see Specifications in Section 1.2).
- The power switch and electrical disconnect (removable cord set) are located at the back of the unit and must be accessible at all times during operation of the generator. Do not position the unit so that it is difficult to access the disconnecting device.

Recommended Location Conditions for your Chrysalis Hydrogen Generator

Temperature: 50°F - 95°F
Relative Humidity: <80%
Variation from Level: +/- 3º
DI Water Supply: >1 meg-ohm/cm^2 (<1 µSiemen)
AC Power: 110-240 VAC, 50-60 Hz (≤ ± 10%)
Over Voltage Category: (II)
Pollution Degree: (2)
Ventilation: > 0.6 m³/min

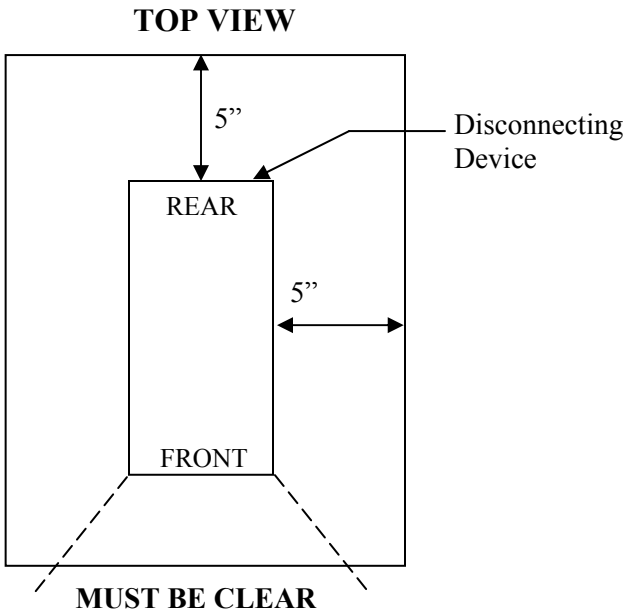


Figure 3.4 Location Conditions

4.0 Installation Procedure

Locate the generator in the position it will normally be situated. We recommend that the generator be placed as close to the gas application as possible. Place the generator in its designated position, keeping in mind the continuing need for access to controls, water fill inlets, gas outlets, and power and control wiring. Also ensure that the designated location is level and complies with the ventilation, spacing, and access requirements as shown in Section 1.2 – Technical Specifications and Section 3.2. – Preparing for Installation.

4.1 Mechanical Setup

1. The Chrysalis Hydrogen Generator comes equipped with a 1/8" compression tee on the generator. Determine the side of the generator to which you will connect the hydrogen supply system tubing.
2. Remove the appropriate fitting cap from the hydrogen supply tee on the back of the generator.
3. Ensure that the 1/8" supply line used for connection is rated for 200 psig.
4. Remove the seal from the mouth of the water inlet funnel.
5. Ensure that the water drain plug is not in place in the lower rear of the generator.
6. For manual fill generators, obtain a supply of the required quality of deionized water (see Section 1.2 – Technical Specifications), and fill the generator tank with DI water until the water level in the sight glass level is between the full and empty watermarks.
7. For generators with the auto fill option, connect the water supply tubing to the barbed connection fitting for the generator water inlet (located on the back of the generator).
8. Do not connect the hydrogen supply system tubing to the generator until the supply system layout has been finalized, leak checked, and purged with inert gas to remove oxygen. After leak checking, purge the hydrogen supply tubing with nitrogen or helium for at least 15 minutes.
9. Connect the gas supply system tubing to one side of the hydrogen gas supply tee in the back of the generator.
10. It is recommended that the hydrogen relief port located on the back of the generator be plumbed to a vent stack or hood. The relief valve is equipped with a quick connect fitting designed to be plumbed with 1/8" OD soft copper or polypropylene tubing.

4.2 Electrical Startup

11. Ensure that there is a good fuse (250 VAC, 10A, Type F) in the power supply fuse drawer (located under the cord set female fitting).
12. Plug the generator into the electric outlet, and switch the power on using the power switch on the back of the power supply.
13. Ensure that the electrical supply is properly grounded and voltage corresponds with the generator rating plate. **Note**: **Do not bypass ground pin.**
14. When power is applied to the generator, it will automatically go through a system self-check. All of the LED's will illuminate and then blank.
15. The firmware revision number (format x.xx) will be shown in the numerical display for one second and then the display will blank.
16. The default pressure setpoint will be displayed in the numerical display, and the LED will illuminate above the psig indicator indicating which scale is in use. The scale in use can be changed from psi to kpa using the "kpa/psi SELECT KEY" prior to initiating generation (using the "START" key).
17. Adjust the pressure setpoint to the desired level using the "PRESSURE ADJUST" up or down arrow keys and the numerical display.

18. Press the “START/STOP” key to initiate startup.
19. During the startup sequence, the palladium diffuser purification system in the unit will heat to operating temperature. During the heat up period, the digital pressure display will display scrolling bars, indicating that the unit is warming up, and not yet supplying hydrogen. The scrolling will speed up as the diffuser nears operating temperature. From a cold startup, the heat up period will be approximately one hour or less, depending on input voltage.
20. Once the diffuser reaches operating temperature, the unit will begin to generate hydrogen and will pressurize internally to the desired pressure setpoint, which will appear on the LED display indicating that the unit is ready to supply, and the “READY” light will flash on the Flow key.
21. Press the “FLOW” key to begin hydrogen delivery. The “READY” light will illuminate continuously and the “GENERATING” indicator LED will flash at a rate proportional to the gas production rate.
22. The digital display panel will continue to display the actual hydrogen supply system pressure.
23. Recommended cord set:

	US	**EUROPEAN**
PART NUMBER	Belden 17758	Belden 2111H

Figure 4.1 Digital Display Panel

5.0 Operating

5.1 Steady State Operation

Once the generator has begun to supply hydrogen to the supply system, it will automatically maintain the pressure setpoint +/- 3% of full scale (approximately +/- 6 psi) at all times. The setpoint can be adjusted at any time using the "PRESSURE ADJUST" keys as follows:

- Press down on either the up or down arrow "PRESSURE ADJUST" key until the display flashes.
- Continue to hold down the "PRESSURE ADJUST" key until desired setpoint is displayed.
- Release the "PRESSURE ADJUST" key and the generator will adjust to the desired pressure.

To ensure that the hydrogen generator runs continuously and to prevent alarm conditions from occurring, regularly check the following:

- Water quality
- Water level
- Numeric pressure display panel for delivery pressure or error codes

5.2 Adjusting the Units Displayed

On startup of the Chrysalis Hydrogen Generator, the default pressure setpoint will be displayed in the numerical display and the LED will illuminate over the psig scale to indicate that the units displayed are psig. Using the "kpa/psi SELECT KEY" prior to initiating generation may change the scale in use (using the "START" key). After the generator is operating, the units displayed can no longer be changed until the generator is restarted.

5.3 Shutdown Procedure

Under normal circumstances, no special procedures are required for shutdown of the Chrysalis Hydrogen Generator. Simply use the electronic controls as follows:

Standby Mode - To stop hydrogen delivery, but maintain internal hydrogen pressure within the generator for instant restart:

- Press the "FLOW" switch to cease hydrogen delivery.

This procedure will cycle generation to maintain internal hydrogen pressure within the generator, and will maintain all internal systems in a hot condition, ready to deliver hydrogen instantly. The digital display panel will continue to display the system internal hydrogen pressure. To restart hydrogen delivery, simply depress the "FLOW" switch to open the hydrogen delivery valve.

Normal Shutdown - To cease hydrogen flow and shut down all internal generation and purification systems:

- Press the "START/STOP" key to shut down the generator.

This procedure will shut down generation and purification. The generator will self-depressurize instantly by opening the normally open (power to close) hydrogen vent valve located in the rear of the generator. All power to the generation and purification systems will cease (although there will continue to be power applied to the power supply). The digital display panel will display Error Code E-00, which is the code for a manual shutdown.

To clear the error code and reinitiate hydrogen production, simply press the "START/STOP" key again. This will re-apply power to the generation and purification systems and initiate the startup sequence. If the purifier has cooled below the required operation temperature, the digital pressure display will display scrolling bars, indicating that the unit is warming up. The scrolling will speed up as the diffuser nears operating temperature. Once the purifier reaches operating temperature, the unit will begin to generate hydrogen and will pressurize internally to the desired pressure setpoint, which will appear on the LED display indicating that the unit is ready to supply, and the "READY" light will flash on the "FLOW" key. Push the "FLOW" key to begin hydrogen delivery. The "READY" light will illuminate continuously and the "GENERATING" indicator LED will flash at a rate proportional to the hydrogen production rate.

Emergency Shutdown - To power down the system entirely and depressurize the generator internal piping:

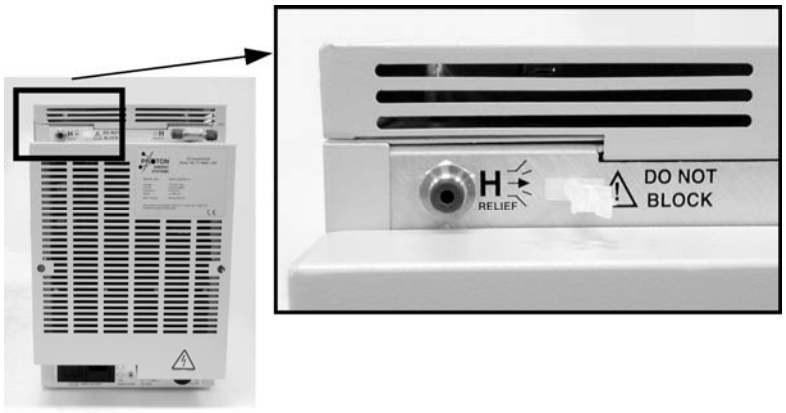
- Shut off the power using the power switch in the back of the generator or pull the plug.

This procedure will cease generation and hydrogen flow, and will remove all power from all system components. The generator will self-depressurize instantly by opening the normally open (power to close) hydrogen vent valve located in the rear of the generator. To restart, plug in the unit and follow the instructions for Electrical Startup (Section 4.2).

5.4 Unplanned Shutdowns

If power to the generator is lost by shutdown of the power at the wall outlet or by electrical blackout, hydrogen generation will cease and the unit will shut down. When electricity becomes available again, the water pump will automatically restart and begin to circulate water to re-establish purity, the numerical display will display the default pressure setpoint (in units of psig), but hydrogen generation will not begin automatically. To restart hydrogen generation, simply press the "START/STOP" key to initiate the startup process.

Figure 5.1 Chrysalis H_2 Relief Port



5.5 Errors During Startup or Operation

Table 5-1: Error Codes

Code	Description	System impact	Default Limit
E 00	Manual Shutdown	Shutdown	N/A
E 01	Cell Voltage High	Shutdown	> 5 Volts (GEN-HYC300); > 10 volts (GEN-HYC600)
E 02	Poor Water Quality	Shutdown	< 1 Megohm -cm
E 03	Water Tank Empty	Shutdown	< Empty Level
E 04	Pressure Is Over Maximum	Shutdown	Setpoint + 25 psi
LEAK	System Leak Detected (leak inside generator)	Warning	20 Minutes at Max Generation Rate (Flow Valve Closed)
E 06	Diffuser Temperature High	Shutdown	> 325°C
E 07	Water Quality Sensor Failed	Shutdown	Water Quality Sensor is OPEN
LEAK	Product Leak Detected (leak outside of generator)	Warning	20 Minutes at Max Generation Rate (Flow Valve Open)
E 09	Diffuser Temperature Low	Shutdown	< 225°C
FILL	Water Tank Level is Low	Warning	< Low Level
E 11	Diffuser Thermocouple Failed	Shutdown	Thermocouple is OPEN
E 12	Fan Error	Shutdown	Low fan flow

6.0 Maintenance

6.1 Leak Detection

The Chrysalis Hydrogen Generator is designed to signal the possibility of hydrogen leaks through the inability to maintain the desired system pressure. If the Chrysalis Generator is unable to achieve or maintain the desired system pressure, the word “LEAh” (leak) will appear in the numerical display read out, and an audible alarm will be triggered. Leaks may occur either inside or outside of the Chrysalis Hydrogen Generator. The status of the generator when the leak signal is triggered can assist in locating the leak either inside or external to the Chrysalis unit. If the generator is delivering gas at the time that the “LEAh” (leak) signal is triggered, then the leak is most likely to be in the system plumbing downstream of the Chrysalis unit. If the “LEAh” (leak) signal is triggered when the generator is in standby mode (pressurized, but not delivering gas), then the leak is likely to be inside the generator. The leak should be remedied as soon as possible after it is detected.

Note: All internal connections to the generator are automatically checked on a continuous basis. All external connections to the generator should be leak checked prior to operation.

6.2 Water Level and Quality

The Chrysalis Hydrogen Generator is available in a manual fill or an auto fill model. Manual fill systems must be filled with deionized water using the fill funnel located under the top cover. Be aware that there are two interconnected tanks inside the Chrysalis generator. Fill the funnel slowly to allow the water level time to stabilize. If the funnel is filled too quickly, the indicated water level may drop as water flows into the second tank.

Chrysalis Generators equipped with the auto fill option (models GEN-HYC300-AF and GEN-HYC600-AF) are filled automatically using a deionized water system plumbed to the auto fill barb fitting in the back of the generator. The auto fill option requires >10 psig minimum DI water supply pressure to operate satisfactorily.

To ensure continuous operation with manual fill systems, regularly check the water level and refill as necessary to maintain the water level between the high and low water marks. If the water level falls below the low water level mark, the word “FILL” will be displayed periodically on the numerical display with an accompanying audible tone until water is added to the generator. If the water level is allowed to drop further, below the level required for satisfactory operation, the Chrysalis Hydrogen Generator will shut down the generation and display error code ‘E-03 – Water Tank Empty’ on the digital pressure display.

CAUTION Before filling the generator with deionized water, always check the quality of the deionized water and ensure that it meets or exceeds the deionized water feed specification in the Technical Specifications table (Section 1.2).

The Chrysalis Hydrogen Generator has a built-in conductivity meter which helps to protect the electrochemical cell from damage due to substandard quality deionized water. If the conductivity meter detects a water problem, the digital pressure display will display the error code ‘E-02 – Poor Water Quality’.

Figure 6.1 Water Level

6.3 Replacing Water

If it becomes necessary to replace the water in the hydrogen generator due to poor water quality, first switch off the unit and disconnect the power. Then drain the water using the system water drain fitting on the back of the system. The drain valve opens when the male drain valve fitting (supplied in the polypropylene bag of parts) is inserted into the drain valve. If desired, you can attach a length of hose to the male drain valve fitting before inserting it into the drain valve – the required tubing is 3/8" OD, ¼" ID. The Chrysalis Generator contains approximately 2 liters (just over 2 quarts) of water. Never refill the generator with contaminated water that has been drained from the generator.

After draining the generator, refill it with clean deionized water meeting the feed specification in the Technical Specifications table (Section 1.2).

6.4 Deionizer Bag

The Chrysalis Hydrogen Generator is equipped with a resin deionizer bag (part number BAG-0221-XX) that attaches with a nylon tie to the water fill funnel splash screen and hangs in the water container. The deionizer resin scavenges any remaining ions from the water and helps to stop the water conductivity from rising during operation.

The bag should be replaced:

- If the conductivity is rising to alarm level when the same quality water is being used consistently.
- At least every six months.

Replacement bags are available from your generator supplier or Matheson Tri-Gas.

To install a new deionizer bag:

1. Remove the exhausted deionizer bag by lifting straight up on the nylon tie – this will cause the water fill funnel splash screen to pop out of the funnel.
2. Remove the tie from the splash screen and discard the old deionizer bag.
3. Thread the nylon tie from the new deionizer bag through the splash screen.
4. Reinsert the fill funnel splash screen in place – it will snap into place.

6.5 Gas Purification

The Chrysalis Hydrogen Generator uses a maintenance-free palladium membrane purification device to remove water and other contaminants from the hydrogen produced in the Proton Exchange Membrane electrolytic cell. The device contains a heated palladium membrane, which absorbs and transmits only hydrogen, and rejects all other gases. The use of the palladium membrane purifier in the Chrysalis Hydrogen Generator provides several user advantages:

- It produces the purest hydrogen available from a commercial laboratory hydrogen generator
- It requires no maintenance, replacement, or scheduled service

6.6 Spare Parts

There is no routine service required for your Chrysalis Generator other than the routine replacement of the deionizer resin bag. These bags are available from your generator supplier or Matheson Tri-Gas (part number BAG-0221-XX).

6.7 Cleaning the Generator

Clean only the outside of the generator.

When cleaning the outside of the generator, use a damp sponge or soft cloth and a mild soap solution.

CAUTION **Do not use abrasive cleaners on the generator**.

7.0 Alarm Contact Output

The Chrysalis Hydrogen Generator is equipped with a set of normally open dry alarm contacts to trigger an external alarm in case of any shutdown or warning condition. The alarm contacts close on any alarm condition (warning or shutdown) and may be wired to trigger an external (remote) alarm or warning light. The alarm contacts have a maximum capacity of 12V/1 amp (2 VA). The alarm contacts are located internal to the system and accessed with a mini phono jack located in the rear bottom center of the cabinet. The cabinet is equipped with a mini phono jack (female contacts), and a mini phono plug (male contacts) is enclosed in the poly bag of parts packed with the generator.

The phone jack is wired to provide isolated contacts. The phono plug should be wired for isolated contacts to prevent shock.

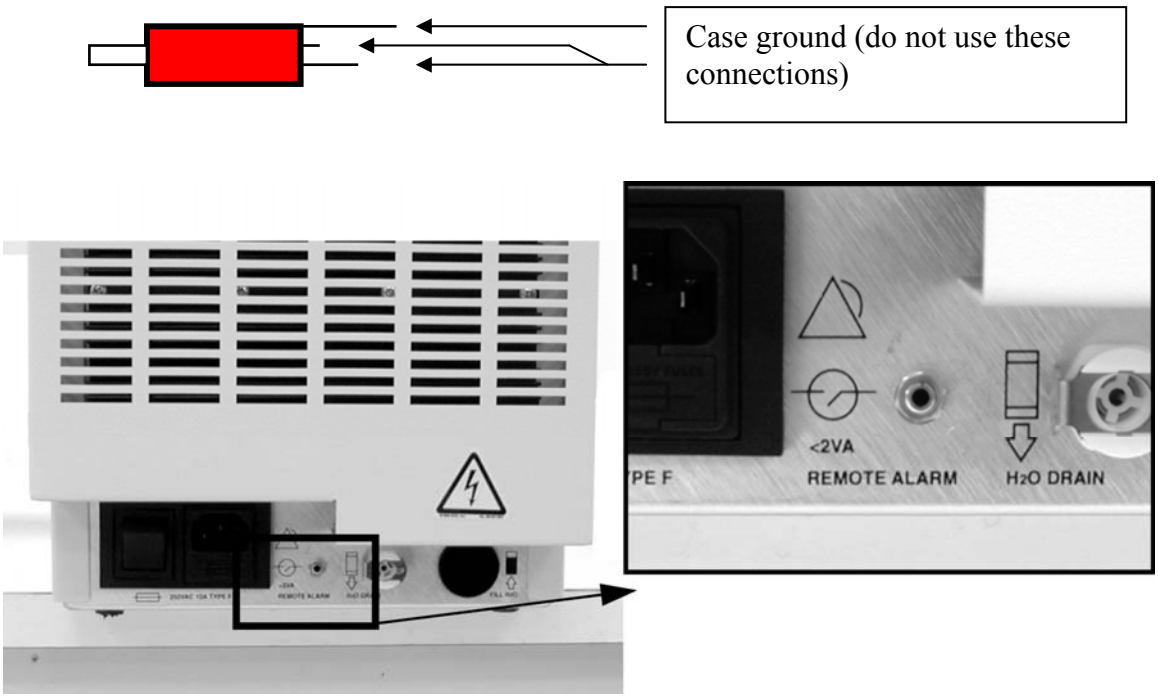


Figure 7.1 Alarm Output Contacts