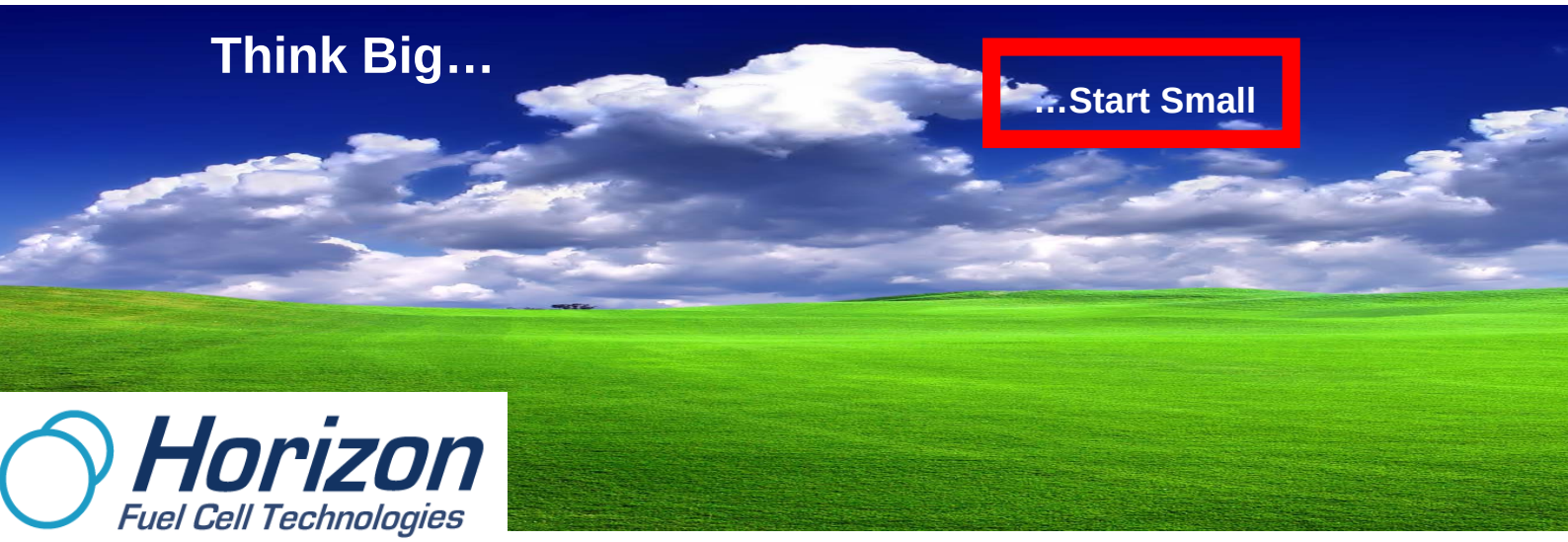
H-12 Fuel Cell Stack

User Manual

V1.2
Updated 11 September 2008



OVERVIEW OF THE STACK

Thank you for choosing our fuel cell stack. The Horizon 12W fuel cell stack is an air-cooled, light weight and compact fuel cell stack.

Please read all instructions carefully prior to product use and keep this manual for future reference.

Further copies can be obtained from Horizon Fuel Cell Technologies or by emailing support@horizonfuelcell.com

Please refer to the Horizon website for latest information
www.horizonfuelcell.com

Specifications and descriptions in this document were in effect at the time of publication. Horizon Fuel Cell Technologies reserves the right to change specifications, product appearance or to discontinue products at any time.

Information on the stack warranty can be found on the warranty card that comes with this stack system.

IMPORTANT

In order for the warranty to come into effect the stack must be registered on the Horizon Warranty Page at:

www.horizonfuelcell.com/warranty.htm

Do not attempt, under any circumstance, to disassemble or inappropriately tamper with the fuel cell. There will be no returns, refunds or exchanges should disassembly or tampering occur. If you have questions or need help with regards to the fuel cell and its technology contact - support@horizonfuelcell.com.

Table of Contents

1. Terminology

PEM fuel cell: a PEM (Proton Exchange Membrane) fuel cell is a device that converts hydrogen and oxygen into water and electricity.

Reactants: reactant is a material used to start a chemical reaction. In the fuel cell the reactants are air and hydrogen by which the electricity will be generated.

Humidification: humidity that the fuel cells need for running.

Blower: supply air to the fuel cells and meanwhile decrease the temperature in the stack.

Mass flow per minute: the total amount of the hydrogen flow to the fuel cell every minute，which the hydrogen supply can be calculated.

HFCT: Horizon Fuel Cell Technologies

2. Stack and System Component Information

1. Stack

It includes a plurality of plate-like fuel cells arranged along an axis generally parallel to cell thickness with electrically conductive separator plates between each pair of cells.

2. **Pressure Regulator**

While this is connected with the carbon wrapped compressed cylinder, the cylinder can be charged or exhausted as required.

3. Single Refueling Adapter

While this is connected between the Hydrogen source and the Hydrogen canister, the canister can be charged as required.

4. Hydrogen Canister

This is the Hydrogen container and supplier for the stack. While the canister is charged, the start-up pressure should be over 4 MPa and the charged pressure should be between 2.5-3 MPa.

5. Plug

If the tube of the purge valve is plugged, the efficiency of Hydrogen will higher while the stack is providing lower power than standard.

6. Tube

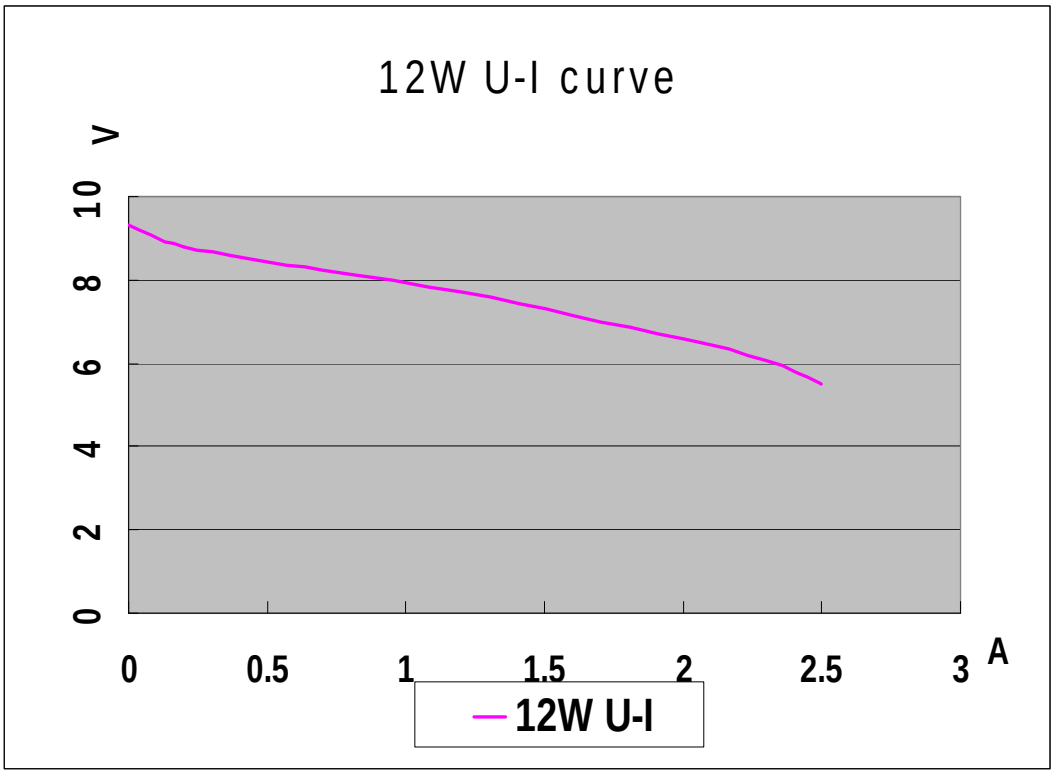
Connected between the pressure regulator and the stack, between the stack and the purge valve and between the purge valve to a place away from the stack.

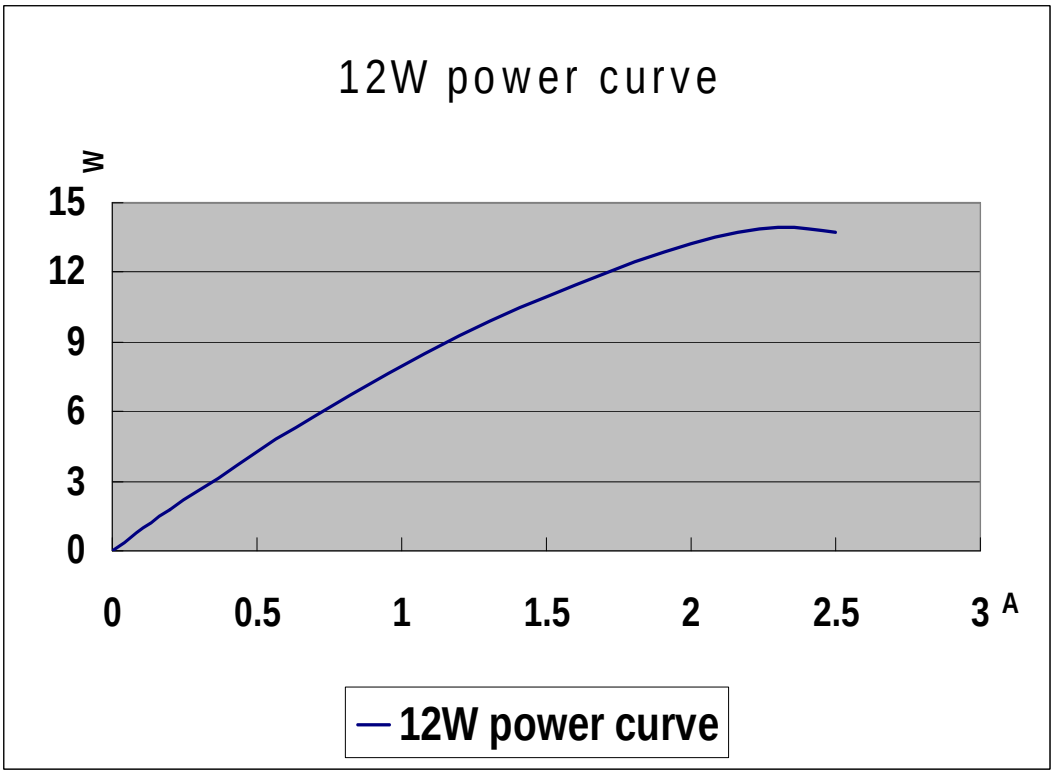
3. TECHNICAL SPECIFICATIONS

Type of fuel cell	PEM
Number of cells	11
Rated power	12W
Peak power	13W
DC voltage	6.6V
Blower voltage	5V
Reactants	Hydrogen and Air
External temperature	10 to 30ºC
Stack operation temperature	45 to 50ºC
Max. Stack temperature	55 ºC
Composition	99.909% DRY H2
H2 Pressure	2.9-4 PSI
Humidification	Self-Humidified
Cooling	Air (integrated cooling fan)
Weight (with fan & casing)	225 grams
Dimensions	7.6cm x 5.6cm x 4.7cm
Flow rate at max output	180 ml/min of H2
Start up time	Immediate
Efficiency of stack	45% at full power

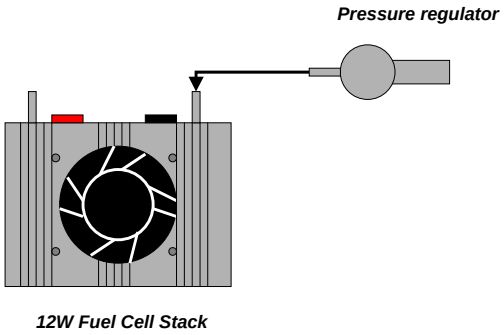
*The flow rate may change with the power output

4. System Power Curves





5. System Set-Up
5.1 Operating Instructions



Step 1: use the tube to connect the pressure regulator to the fuel cell gas input, either port works

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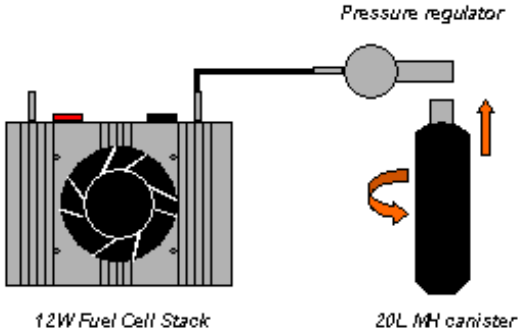

Step 2: Screw the canister all the way into the regulator to the end. You will see the blower is running now

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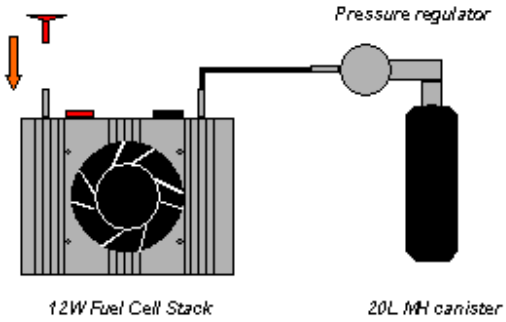
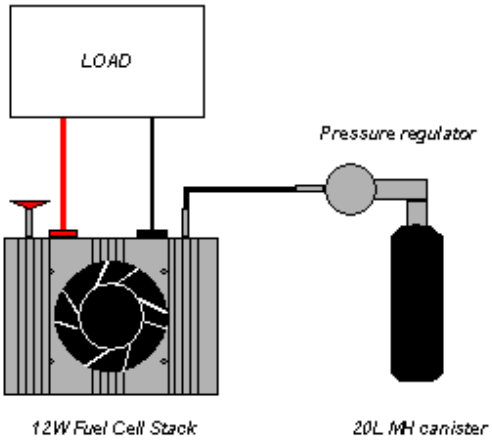
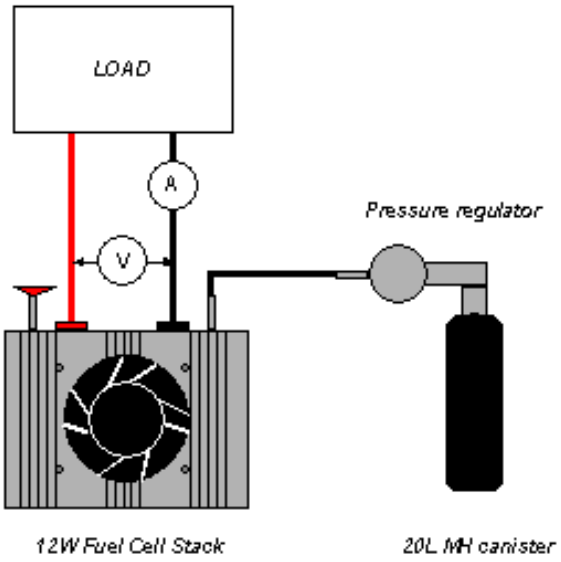


Step 3: To obtain higher efficiency, you can seal the H2 gas output with a pin.



Step 4: Now the fuel cell system is ready to use.
Please connect the load to the fuel cell system and enjoy the experience with clean energy!

5.2 Simplified Drawings of HFCT Measurement Stand



Power=V x A

6. Storage and Re-Use

When finished operating the stack please place it back in the supplied air tight container. Place a small container of water inside the container in order to keep the stack from getting too dry.

The stack should be stored at room temperature in a dry area.

If the stack is un-used for a long period of time (months):

1. Rejuvenate by injecting water into the stack:
2. Connect a short section of hosing to the gas port marked "**H2 in**" and another one to the"**H2 out**" port.
3. Fill a syringe with pure water (distilled) and connect it to the hose attached to the "**H2 in**" port.
4. Inject pure water into the stack until you see water coming out of the hose connected to the "**H2 out**" port. Keep the water inside the stack for about 5 minutes. Now disconnect the syringe, and leave the water in the two hoses.

Note:

Please make sure you have purged the water out of the stack thoroughly before use. This is done by connecting the H2 supply to the stack, without a load attached, and purging the stack thoroughly (ie. letting hydrogen flow through the stack to remove water and other contaminants).

WARNING: Using the fuel cell stack with water inside can irreparably damage it!

WARNING: Disconnect the hydrogen supply completely if the fuel cell is not in operation for more than 4 hours. Since hydrogen gas can leak into the fuel cell and destroy some of the parts.

Tip: *To keep the stack humidified once you have finished using it, we strongly recommend you connect a small hose filled with water to both "H2 in" and "H2 out" ports.*

7. Trouble Shooting

If the system shuts down by itself check the following details:

1. Make sure you have connected all wires according to the diagram.
2. Make sure the external voltage is 12V -15V.
3. Make sure you have a hydrogen supply.
4. Make sure the load is below 12W, because the controller will protect the stack from drawing too much current.
5. Check whether the fuel cell temperature is below 67ºC, the system will shut off if it is above 67ºC.

If the stack initially has lower performance than expected:

1. Turn it on and off and gradually add a resistor load.
2. The hydrogen supply set-up should strictly follow the guidance in this manual. Ranges outside this may make the system volatile and even dangerous.
3. If a power level below the specified output is experienced this maybe due to insufficient hydrogen supply at a high power output. If the hydrogen supply set up causes too high pressure at low power and too low pressure of hydrogen at high power, results in a very dangerous at situation at lower power outputs and causes fuel starvation at high power outputs.
4. We suggest:
    a. Setting a wide range pressure regulator at output. The range should be in the region of 50PSI.
    b. Add a high flow rate, low pressure regulator as the second stage pressure regulator close to the fuel cell, to reduce pressure at lower power outputs.