MyH2 300

Hydrogen stored simple

User and instructions manual

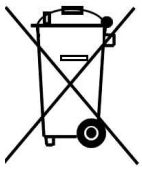

WARNING: FIRE OR EXPLOSION HAZARD

PLEASE READ AND FOLLOW THIS MANUAL WITH CARE PRIOR TO INSTALLATION AND USE
Failure to strictly follow safety warnings could result in serious injury, death or property damage:
- Please operate outdoor or in vented indoor room or with open windows within a suggested temperature of 15-55°C.
- Do not store the device or use gasoline or other flammable vapours and liquids in the vicinity of this or any other appliance.
- Installation and service must be performed by a qualified installer, service agency or the gas supplier.
- The storage in metal hydrides canisters must be used only by qualified personnel previously trained for that purpose and who is familiar with the operating instructions for this system of accumulation.

Designed & manufactured by H2planet in Italy
H2planet by Hydro2Power SRL
Viale Montegrappa 23/A, 20069 Vaprio d'Adda (MI)
ITALY

Metal hydrides tank canister
Storable fuel: H2 –ultrapure hydrogen, minimum purity degree 5.0 (99.999%)
Maximum desorption H2: 5Nl/min (ONLY during warming-up of the cylinder wall)
Operating temperature Range: 0-55°C
SPECIFIC USE FOR DOMESTIC USE ONLY UNDER EXTERNAL INSTRUCTION (optimal temperature 20°C)

Designed and manufactured in compliance with international standards:
ISO 16111

CE 

DISCLAIMER: all the informations, pictures and schemes contained in this manual may be varying according to new products releases and versions as well as new improvements over performances, components and regulations. External features and colours might be thus changing depending also on suppliers of single components composing the product in its entire appearance.

1 Scope of manual

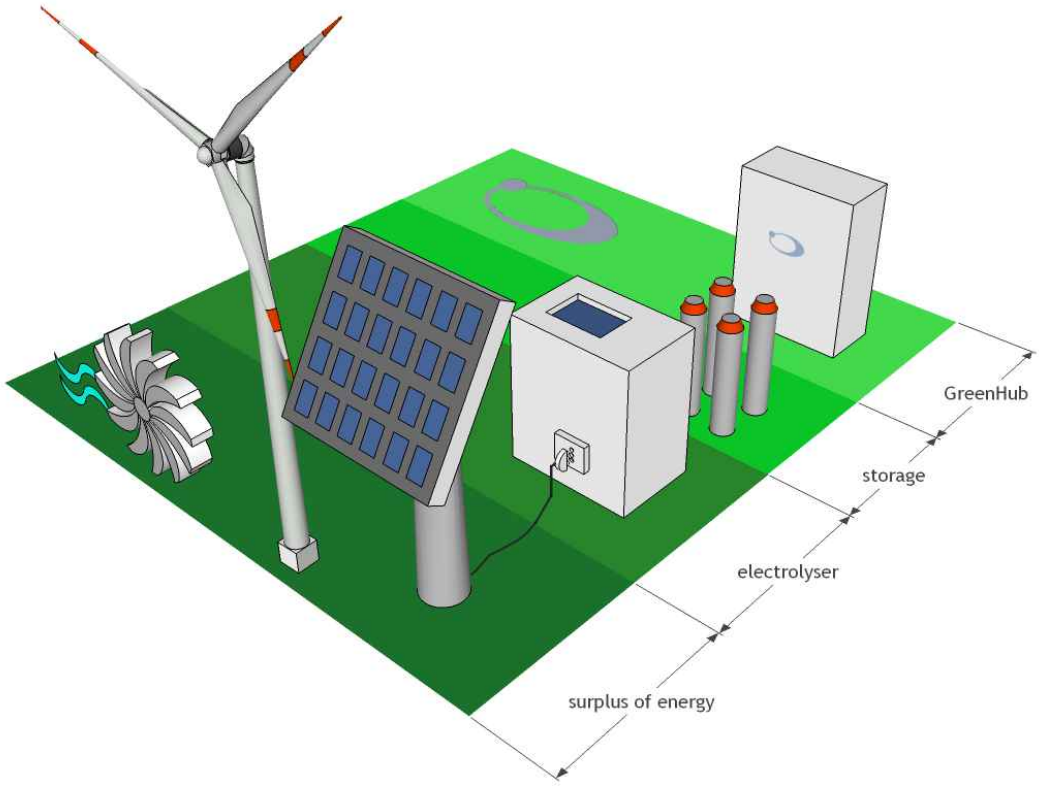
Congratulations! You have purchased the ultimate H2 metal hydrides storage system made by H2planet, which is specialized in hydrogen and fuel cell applications and gives you the possibility to approach the hydrogen era in a simple and sure way. Hydrogen made simple!

This manual gives instructions for the correct use for proper absorption, desorption and general use of the canister.

With MyH2 you can store pure gaseous hydrogen fuel as much as technology nowadays allows, and you can also supply hydrogen to compatible H2planet GreenBox and GreenHub fuel cell gensets, generating electricity in respect of environment and sustainable development. This system works with relative low pressure and this is the biggest and most significant advantage of this technology.

2 Hydrogen chain by H2panet

MyH2 canisters can be supplied with hydrogen produced by electrolysis process. An entire carbon-free and pollution free process that can be easily installed thanks to the amazing HYnONE H2planet proposal **just needing water and renewable sources of energy** as main ingredients!



Enquire your local H2planet dealer or to greenhub@h2planet.eu for further information about the most suitable hydrogen on-site production option for your generator and specific needs.

3 Technical data

Model: MyH2 300

Manufacturer and Distributor: Hydro2Power S.R.L.; 20069 Vaprio d'Adda (Milano)

Model	MyH2 300
Nominal Capacity	27 g (0.3 Nm3) hydrogen
Alloy hydride	model AB2
Internal volume of cylinder	0.5 litres
System mass	2.2 kg
Maximum operating pressure	30 bar
Ultimate test pressure	300 bar
Maximum recharge pressure	30 bar (static)
Minimum temperature of cooling during refills	10° C
Maximum operating temperature	65° C

MyH2 metal hydrides canister includes:

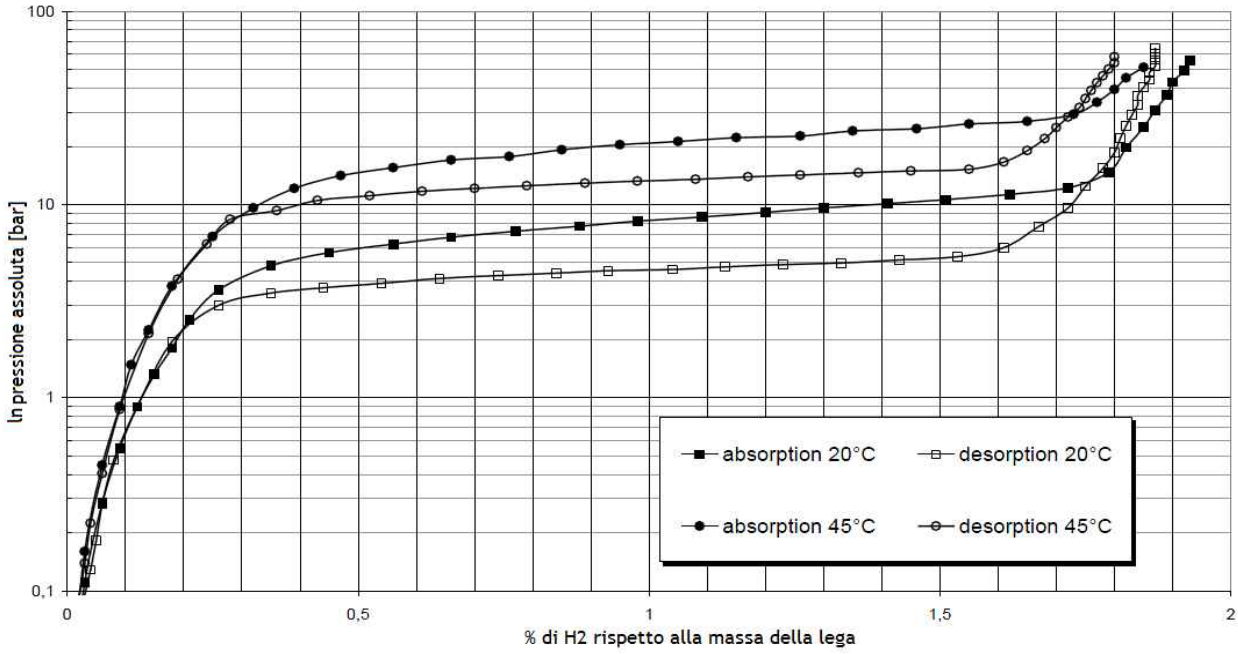
- 1 aluminium storage cylider certified according to the TPED (Transportable Pressure Equipment Directive 99/36/UE)
- 1 adjustable valve
- 1 Swagelok quick-connector compatible with H2planet GreenBox and GreenHub quick connection kit

MyH2 300 canister is compatible with following H2planet generators: GreenBox 100.

GreenBox

3.1 PCT curve

PCT curve shows the relation between internal pressure and the quantity of absorbed hydrogen (expressed in percentage rate of alloy's mass in the system). In dynamic conditions during the absorption or desorption, the respective curve deviates significantly from this equilibrium curve. It depends on chosen parameters of cooling/heating, especially depending on external temperature in which the canister operates. Please find below some examples of PCT curves in absorption and desorption for two different values of temperature. You can note how the increase of temperature leads the increasing of equilibrium pressure.



4 Important!

The management, storage, transportation and use of this metal hydrides canister must be performed in compliance with local laws and technical regulations. The system must be used only by adequately trained and qualified staff and personnel. MyH2 300 modules are pressure vessels, manufactured, tested and certified according to the TPED (Transportable Pressure Equipment Directive) 99/36/UE. Please pay special attention to the operating process in order to operate the system storage in metal hydrides only within the allowed working parameters (see technical data).

5 Care and safety

Do not open and unscrew the canister's valve on top of canister because the metal alloy in the pressure tank could immediately ignite when in contact with air/oxygen generating flames.
Heating tank with hot water higher than 55°C without constant monitoring of the pressure is strictly forbidden. Please use compatible H2planet pressure manometer only for this purpose (enquire your reseller/agent for this).
Refilling canister with a maximum operating pressure higher than 30 bar is strictly forbidden. Note this even might happen refilling the canister with a pressure above or below 30 bar and/or leaving the tank in warm environment conditions. Please always double check the refilling pressure is within 30 bar and refilling temperature is set between 15°C and 25°C by the mean of a cool water basin.
In order to have an efficient storage capacity and active material in the tank fill the tank only with high quality hydrogen 99.999% (also called quality of hydrogen 5.0).
Use the tank in a ventilated area!
Keep away from children!
Keep away from ignition sources – no smoking!

When hydrogen concentration reaches a value between 4% and 77%, the mixture of hydrogen and oxygen can explode. Metal hydrides tank shall be placed in a vented room. It is highly recommended to monitor the hydrogen concentration by an apposite hydrogen sensor.

6 Measures in case of accident

Take a look at the Material Safety Data Sheets!
No oxygen, no air, no CO, shall be introduced in the tank during the recharge. If any other element gets in the tank, stop immediately the recharge and empty the tank. If temperature of the shell increases, cool the system immediately. Get away from the danger area and, if it is possible only without risks, cool the tank from distance as long as firemen arrive.

7 Product Description

MyH2 300 is a low pressure refillable hydrogen tank. Metal powder is contained inside the tank which absorbs hydrogen into the chemical matrix. When the charge is complete, hydrogen stored in the tank can be used in a very safe and suitable way for hydrogen fuel-cells.
This is a reversible technology because the tank can be continuously refilled and discharged following a simple procedure showed in the next chapter. MyH2 300 can be used, for instance, in order to supply a fuel cell and then to generate electrical power which can be produced without dangerous emissions. Hydrogen molecule features higher energy density of all existing fuels, higher than petrol density or other gases' density. The disadvantage is that the hydrogen is the lightest element in the world. Metal hydrides technology exalts the advantages (high energy density) and hides disadvantages (high pressure required for the storage). In order to achieve the best performances and lifespan of MyH2, ultra pure hydrogen must be used to recharge the tank with maximum purity degree (recommended 5.0, 99.999%). Hydrogen with worse quality reduces storage capacity and lifetime of the powder inside the tank and thus life expectancy of product. If the capacity of absorption/desorption decreases more of 20%, it is recommended to contact H2planet staff to renew the system according to our extraordinary maintenance procedures.

8 Use of metal hydrides tank

In this chapter the procedure of recharge and discharge will be illustrated of the tank. Pay attention on the wall cylinder temperature in these phases. Recharging/refilling process is highly exothermic, and thus cooling the cylinder with a cold water bath (10-15°C) is necessary and mandatorial. Discharge process instead is very endothermic; cylinder wall cools down very quickly. It is recommended to heat the cylinder in a hot water bath (maximum 40-55°C) to guarantee a proper flow to the appliances such as fuel-cell generators or other. Fuel-cells are particularly sensible to flow sudden decrease and drop and this could turn to damages to fuel-cell membranes and components with loss of original performances of devices.

8.1 Charging procedure

1. Place metal hydrides canister in a comfortable position to connect it to the hydrogen source, like an H2planet compatible electrolyzer (Hy-Flow or Hy-PEM XP recommended) or high pressure cylinder with proper pressure regulator on top, obviously in full compliance with maximum refilling operative pressure of 30bar. Do not work in difficult or

uncomfortable conditions and with short hoses. Please always double check with soap and water solution the connection on your hydrogen high pressure cylinders be properly done.

2. Open the black/metal knob on top of the valve by turning it counter-clockwise.

3. Purge air/hydrogen quantities out of hose connected to hydrogen source by the mean of a compatible original H2planet refilling kit/H2planet Hy-Flow or Hy-PEM XP connection kit or with comptabile Swagelok QC4 connectors. Please push on top of stem-male quick connection kit for a few seconds according to relevant instructions in order to purge possible contaminating gases such as air/nitrogen or other. You will hear a pressure coming out of hose.

4. Connect the hydrogen source by the mean of the compatible original H2planet refilling kit/H2planet Hy-Flow or Hy-PEM XP connection kit or with compatible Swagelok QC4 connectors with a pressure between 5 and 11bar maximum.

5. Gently drop the cylinder in a water basin with cool water (10-15°C) in horizontal position by taking care of the connection with hose on top of canister avoiding any possible narrowing of hose or bent hose.

6. Where applicable, progressively increase the pressure, within 30 bar maximum. Do not exceed the limit of 30 bars for refilling because it may cause explosion. The cartridge will begin to warm up due to the increase of internal pressure.

7. In order to fully charge the cartridge keep temperature of water as much constant as possible as it will tend to progressively warm up along with cylinder filling. Add more cold water at 10-12 ° C (not less) if needed always keeping the canister in horizontal position by paying attention to not move it or disconnect it. Keep temperature in cylinder below 65°C. If temperature is above 65°C you should reduce the flow rate of charging or stop loading.

8. After 25-30 minutes the cartridge will be charged if the cartridge is refilled through standard industrial cylinders. In the case of charging by the mean of H2planet compatible HyFlow or HyPEM XP electrolyzers wait until the flow of hydrogen decreases to 10-20cc/min and following relevant electrolyzers' user & instructions manual. You can also verify the completion of the refilling process by touching the canister removed from the water basin and by controlling temperature of the water. In case water temperature is the same of the canister and the canister is reasonably cold the canister has been successfully recharged and refilled ready to use.

9. Disconnect quick connection kit from the cylinder by pulling up the female ring on top of the cartridge by holding it firmly and pulling. Do not force the connection, pull up the male. In case of difficulty in extracting call our technical staff. Close the black/metal knob by turning it in clockwise for safe transportation and movement of MyH2 metal hydrides canister.

8.2 Desorption procedure

BEFORE ANY USE WITH FUEL-CELL GENSET OR OTHER APPLIANCES PLEASE CHECK THE INTERNAL PRESSURE OF THE CANISTER AND ENSURE OPERATIVE PRESSURE RANGE IS COMPATIBLE WITH YOUR APPLIANCE. THIS IS ESPECIALLY TRUE IN CASE YOU REFILL THE METAL HYDRIDES CANISTERS THROUGH A COMPRESSED CYLINDER WITH PRESSURE HIGHER THAN 15bar. IN CASE OF NEED USE A PRESSURE REGULATOR TO REGULATE THE PRESSURIZED HYDROGEN RELEASED BY MYH2 CANISTER TO THE DESIRED VALUES. Note that H2planet Hy-PEM XP compatible electrolysers already refill the MyH2 canisters in the appropriate range of pressure in order to feed compatible fuel-cell gensets such as those of GreenBox and GreenHub series (max 10,5bar). In this case you obviously do not need any extra pressure regulator in the middle.

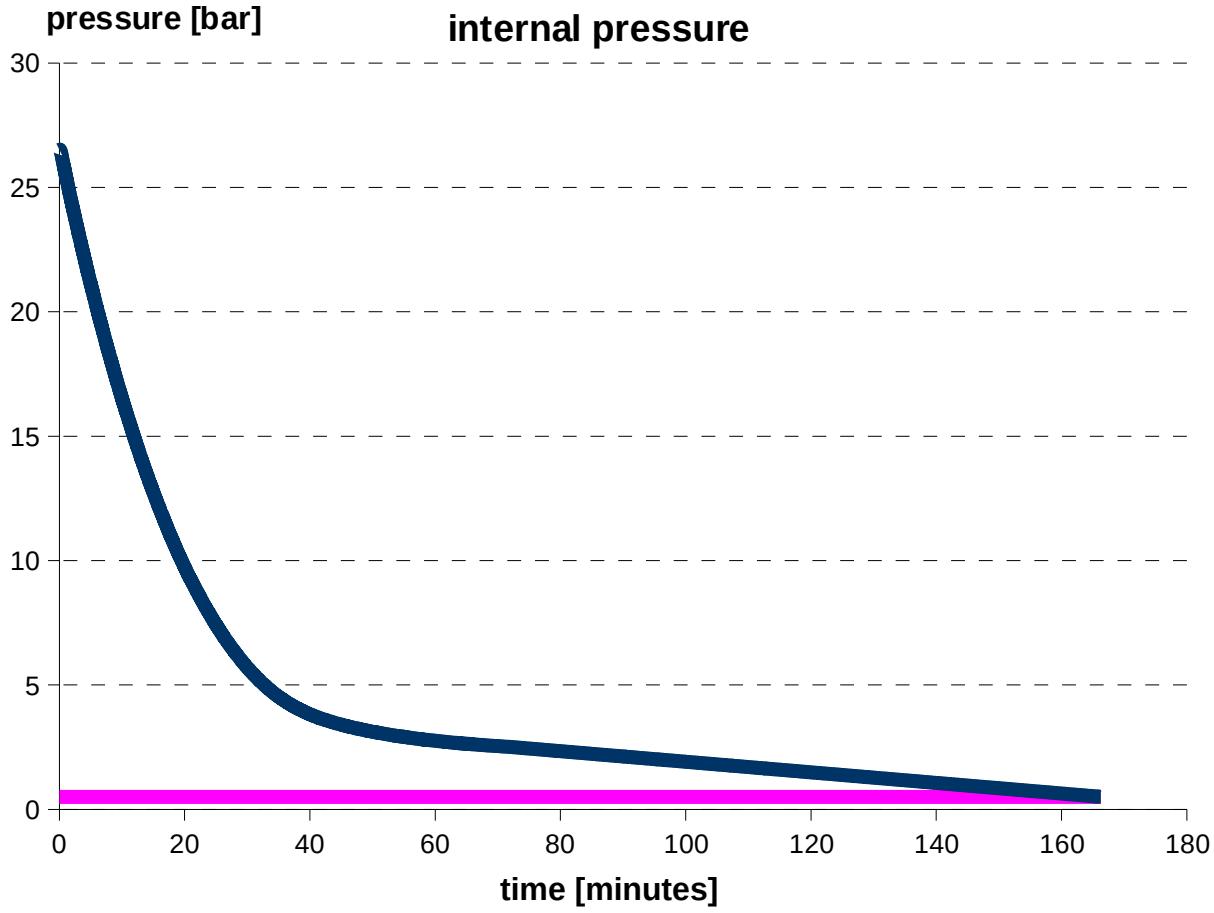
1. Connect supply-kit equipped by H2planet, connecting one tip with male to the female quick connection placed on the tank by pushing the male until a click is heard and other end to the user device (for instance directly to the GreenHub fuel cell generator if previously refilled through compatible Hy-PEM XP electrolyser, see picture below) or to an external pressure regulator between the user device and MyH2 in case you refilled MyH2 at higher pressure than 15bar (e.g. compressed industrial cylinders up to maximum 30bar refilling pressure).
2. Open the black knob on the valve by turning it counter-clockwise.
3. Open/turn on on the hydrogen user. When the tank starts to supply the hydrogen, it is very important to heat cylinder wall with hot air or with a hot water bath (maximum 55°C). For the best desorption performances of MyH2 coupled with a compatible H2planet GreenBox or GreenHub genset, it's warmly recommended to place the MyH2 cylinder in front of fan blowers at roughly 3-5 cm from gensets (e.g. on the backside of GreenHub).

4. Turn off the device and close the black knob on the valve by turning it clockwise.

8.3 Desorption curve

Discharge behaviour depends on charging pressure, shell temperature and hydrogen flow requested. The internal pressure starts from the charging pressure value. Below, an example of

discharge at fresh air (without convection on cylinder walls) and with hydrogen request of 2 normal liters per minute.



9 Requirements for the transport / delivery status

9.1 Requirements for the transport

According to TPED certification of internal modules, commercial transportation is carried out under the classification of dangerous goods of class 2.1 and A 3468 (hydrogen in a metal hydride). The system of accumulation in metal hydrides may be shipped like hydrogen. For the transport is recommended to fill the storage system in metal hydrides to a maximum of 75% of the rated capacity of hydrogen. Metal hydrides cartridges must be shipped only with protection devices and locked valves!

9.2 Delivery status

According to the UN3468 and international standards for hydrogen in metal hydrides canisters H2lanet SRL ships the storage system in metal hydrides in a pre-activated state and partly loaded (about 50% - 75%). The transportation of the storage systems like metal hydrides canister must be shipped with a closed valve and with proper protection devices.

9.3 Identification plates of the storage system in metal hydrides

The following identification tags are applied to metal hydride storage devices, they must not be removed and shall be replaced if damaged or unreadable (available on request, enquire H2planet).

Pressure vessels certified according to TPED:

- Identification plate
- UN 3468 (during transport).

Metal hydrides tanks loaded with hydrogen or with an alloy activated must also be provided with this marker (for operation, storage and transport):

- Danger marker "Flammable gas" (flame black or white on red or orange background)
- Red strap larger than 5 cm (RAL 3000) for the "flammable gas" mark

10 Care and Maintenance

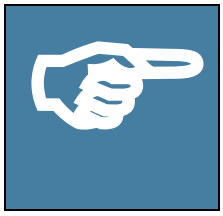
It is very important to follow the standards of maintenance illustrated in chapter "Care and safety". First of all, it is necessary to charge the tank with ultra pure hydrogen at least purity grade 5.0 (99.999%) to keep performances. Then temperature and pressure need to respect the aforementioned values. Finally, check always the pressure rate (below 30 bar) and temperature of the cold water bath (below 10°C). Viceversa, during the discharge of the tank check that temperature of cylinder wall never exceeds 65°C; the increase of internal pressure can lead to serious structural damages and to explosion of cylinder.

10.1 Cooling / heating

In case of water is used as a refrigerant and/or heating factor, it is highly recommended to add antifreeze and anticorrosive in order to avoid the freezing of the water.

11 Disclaimer

These statements reflect the current state of knowledge about our products and do not guarantee their characteristics. H2planet provides information regarding the dangers which may occur using this material, but this does not imply any responsibility for the completeness of such information.
H2planet disclaims all liability for damages of any kind which can occur in consequence to the unproper use of this material. Compliance with the laws and local regulations and technical regulations is the sole responsibility of each individual user.



Recommendations:

Always keep the device MyH2 300 in dry and ventilated place (possibly protected by appropriate outdoor shed). Avoid storing in a place exposed to heat. **Avoid water drops might be leaking or penetrating during refill procedures** with cool water in basin.

Contacts:
For any doubt contact our high skilled and professional staff by calling 02.9098.9883 or writing an e-mail to staff@h2planet.eu .