



DASH C-series

Solid-State Hydrogen Storage Modules

The safest hydrogen storage on the planet



What are DASH C-series Hydrogen Storage Modules?

We are at the forefront of driving the shift towards a low-carbon future, placing our emphasis on the significance of green hydrogen as a pivotal energy carrier. Our proficiency is centered on creating secure hydrogen storage solutions, collaborating with clients globally to help them achieve their climate goals.

Harnessing the power of renewable sources like wind, water, and solar energy, we employ electrolysis to divide water into green hydrogen. These hydrogen molecules are subsequently safely ensconced within the heart of our DASH C-series Hydrogen Storage Modules, within a resilient metal mesh structure.

Our metal hydrides exhibit unmatched durability, enduring for decades without substantial degradation. They epitomize the most reliable and secure approach to storing hydrogen. When energy demand arises, we retrieve hydrogen from storage, transforming it back into electricity and heat, or employing it directly in industrial processes.

DASH C-series Hydrogen Storage Modules are delivered as containerized modules to be used as single systems or to be integrated into bigger hydrogen solutions.

Whether it is for energy storage, industrial, Power-to-X, ammonia production, or other applications, our technology will enable you to store large quantities of hydrogen in a safe, dense and effective manner, wherever you need it and for as long as you need it.

How does it work?

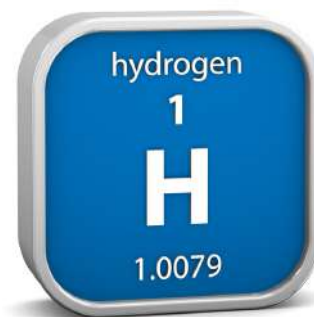
DASH Hydrogen Storage Modules are solid-state hydrogen storage systems, in which hydrogen is stored in the solid, atomic form within a special metallic structure. They excel through excellent safety properties, a very high volumetric density, and a long lifetime.

The materials used in the storage system are non-toxic and easy to handle. They are processed and containerized in optimized pressure vessels named stacks. The composition of our metal hydrides does not contain any scarce materials and they are 100% recyclable.

In our advanced in-house lab we constantly develop our solutions to become even more efficient and able to work optimally in different climates - both cold and hot - with a focus on rapid flow rates at ambient temperatures.

The systems can be operated fully passively without active heating or cooling. However, the flow rates (in and out) of the storage modules can be increased using active thermal management.

No ATEX zone is introduced around the hydrogen storages, which facilitates many projects and applications.



How is it constructed ?

DASH C-series Hydrogen Storage Modules are constructed using three main parts:

1. DASH M45 Hydrogen Storage Modules
2. Thermal Management
3. Container

Altogether, they form a complete containerized storage system.

Containerized DASH Hydrogen Storage Modules integrates the storage modules into a container to build a complete Plug & Play system with thermal management, H₂ sensors, and ventilation. A solution ready for deployment.

Containerized DASH *Hydrogen Storage C-series Module*

1 DASH Hydrogen Storage Modules



2 Thermal Management



3 Container

By doing the design in a modular way, we have been able to create four different versions of the containerized DASH C-series Hydrogen Storage Modules to fulfil the requirements of various projects.

Being modular also enable us to combine several modules to create bigger solutions. For instance, stacking three modules makes it possible to store 540 kg hydrogen on a footprint of only 15 square meters, without the need for a compressor.



DASH Hydrogen Storage Applications

In collaboration with a hydrogen source — such as an electrolyzer or green hydrogen delivery — GRZ's DASH C-series Hydrogen Storage Modules effectively store substantial amounts of hydrogen, ensuring its safety for utilization in various downstream applications.

Typical applications are:

- Buffer storage after electrolyzer
- Buffer storage before compressor
- Long term storage for back-up
- Compact and safe hydrogen storage at steel, glass, and ceramic industries
- Large-scale buffer storage in e-fuel production sites as methanol and ammonia
- Safe hydrogen storage in hydrogen refuelling stations
- Summer to winter storage of hydrogen used for power and heat generation

... or any other applications where clean hydrogen is needed on demand and storage is required.

DASH Hydrogen Storage: Key Features & Benefits



Dense and compact hydrogen storage

Our containerized modules store up to 180 kg of hydrogen on the very small footprint of a 20ft ISO container without the need for compression.



Longevity and cycle stability

The technology based on metal hydrides is extremely cycle resistant and enables a service life of 30 years or longer as the storage technology is based on a fully reversible process. The entire capacity specified can be used without limitations.



Safety without compromises - by design

Our proven and patented solid-state hydrogen storage technology leads to excellent safety properties allowing for the installation in almost any environment, even inside buildings.



Zero-emission - Environmentally friendly energy storage

The environmental footprint is greatly reduced thanks to the lower amount of grey energy linked with production, high system recycling percentage, and long lifetime of our systems.



Low noise level

Can be placed anywhere as it generates very limited noise in the containerized version.



Low pressure levels, no compressor required

The system works at a low pressure (under 45 bar(g)) and there is no need for a hydrogen compressor. This leads to significantly lower OPEX and prevents additional consequent costs, e.g., for noise insulation or unplanned outages. It also gives the possibility to refill the storage using a tube trailer – without the need for a compressor locally.



Swiss made quality product

Our DASH Hydrogen Storage modules are developed by our engineers and manufactured in Switzerland.

DASH Hydrogen Storage compared to Compressed Gas Storage

Compared to energy storage with compression and high-pressure storage, our technology has the following advantages:

- Extremely safe due to low pressure and the inherent physical properties
- Same footprint as hydrogen stored at 1000 bar(g)
- Less demanding for obtaining permits due to higher safety
- No need for expensive and complicated hydrogen compression
- No OPEX for the operation of the compressor
- Less requirement for recertification of storage due to lower pressure
- Up to double as long lifetime as the high-pressure storage systems
- No self discharge of hydrogen over time






Metal hydride density compared to other hydrogen energy storage technologies




Energy content of 1 kg. hydrogen is 33.33 kWh (LHV)	Volumetric size for 1 kg. hydrogen
Metal Hydride	6.5 litre
Pressure (atmospheric)	11'944 litre
Pressure (200 bar)	50 litre
Pressure (700 bar)	23.8 litre
Liquid (-253 degrees Celsius)	13.8 litre
Liquid Organic Hydrogen Carrier (LOHC)	17.2 litre
Methanol	6.9 litre

4 standard DASH C-series Storage Modules available




DASH C45

 45 kg. hydrogen storage
 Weight 5.8 tons
 10ft-ISO Container




DASH C90

 90 kg. hydrogen storage
 Weight 9.4 tons
 10ft-ISO Container

DASH C135

 135 kg. hydrogen storage
 Weight 14.0 tons
 20ft-ISO Container

DASH C180

 180 kg. hydrogen storage
 Weight 17.5 tons
 20ft-ISO Container

Common Technical Specifications

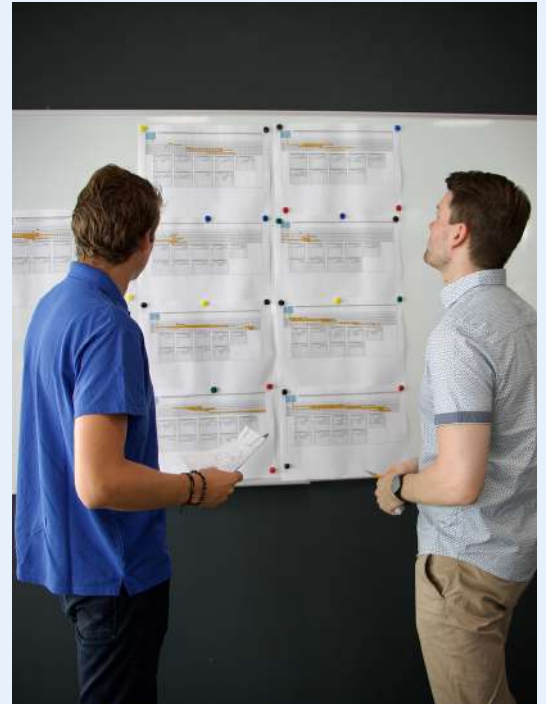
DASH Storage	Unit	C45	C90	C135	C180
Storage capacity	kg H ₂	45	90	135	180
Maximum charge flow (at 20°C)	kg H ₂ /hour	2	4	8	8
Maximum discharge flow (at 20°C)	kg H ₂ /hour	2	4	8	8
Refuelling pressure	bar(g)	30 to 45			
Discharging pressure	bar(g)	1 to 15			
Hydrogen supply purity	%	99.995			
Hydrogen outlet purity	%	99.995			
Noise	dB(A)	< 70 at 10 meters			
Electrical interface	V AC	1 phase 230	3-phase 400		
Ambient temperature	°C	-10 to 45			
Expected service life	years	> 30			
ATEX zones		Only at exhaust of vent lines			

Options

The DASH C-series can be expanded with the following options:

- In-stream hydrogen temperature sensor
- Bi directional mass flow meter
- Fire and smoke detector
- Lightning protection for container

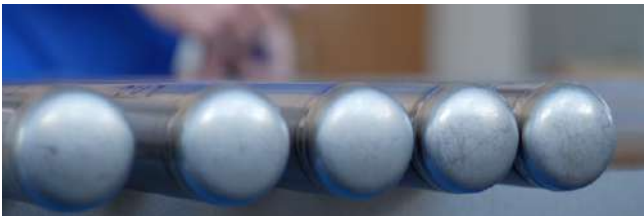
To ensure long-time flawless operation of the system, we do offer technical support, on-site support as well as spare parts.



Compliance

The DASH C-series Hydrogen Storage modules are CE certified according to the following directives:

- ATEX-Directive 2014/34/EU
- Pressure Equipment Directive 2014/68 / EU
- Machinery Directive 2006/42 / EC
- Low Voltage Directive 2014/35/EU





GRZ Technologies

GRZ Technologies was founded in 2017 as a spin-off from the Swiss Federal Institute of Technology in Lausanne. The company's pioneering technology is the result of several decades of research and development in the field of hydrogen, dating back to the early 1990'. GRZ's core competence is metal hydrides, which are used to manufacture different dense and safe hydrogen solutions, such as hydrogen storage systems, hydrogen-based power-to-power systems, and thermal hydrogen compressors. The latest development is our methanation solution UPSOM – which enables the conversion of raw biogas to nearly 100% synthetic methane, thus almost doubling the output of ordinary biogas.

Our team includes specialists from all relevant areas such as materials science, mechanical and thermal engineering, software design, and project management. We operate our own materials laboratory and are continuously advancing our technology. Thanks to new, innovative approaches, combined with many years of experience, we are setting new standards in the field of hydrogen technology.

The vision of GRZ Technologies is to enable a world fuelled by renewable energy – day and night, summer and winter. In order to achieve this, we must replace fossil-based energy systems with safe, cost-efficient, and sustainable energy solutions where hydrogen is an important energy carrier in the equation. The introduction of a new, environmentally friendly energy system is a global challenge. Cooperation across countries and continents is crucial. GRZ therefore works together with organizations across the globe to battle these global challenges together. Our partners include Hyundai Motor Company, the Fischer group, Auto AG, Gaznat, and Messer Gas, among others.

Contact us now and join the clean energy transition;

sales@grz-technologies.com

www.grz-technologies.com

+41 26 475 20 11

Route du la Plaine 47, CH-1580 Avenches, Switzerland

