



DASH M-series

Solid-State Hydrogen Storage Modules

The safest hydrogen storage on the planet





We are at the very heart of the ongoing energy transition – in which we are progressing towards a net-zero and fully renewable energy system. For this transition, hydrogen plays a key role as a clean renewable energy carrier.

What are DASH Hydrogen Storage Modules?

We play a crucial role in the transition to a low-carbon future by focusing on green hydrogen as a vital energy carrier. Our expertise lies in the development of safe hydrogen storage systems, assisting customers worldwide in meeting their climate objectives.

Using renewable energy from wind, water, or solar power, water is split into green hydrogen via electrolysis and these hydrogen molecules are then securely absorbed within a metal mesh structure at the core of our DASH Hydrogen Storage Modules.

Our metal hydrides offer unparalleled longevity, lasting for decades without any significant losses of performance. They represent the most dependable and safest means of hydrogen storage. When energy is required, we extract hydrogen from the storage, converting it back into electricity and heat, or consuming it directly in industrial applications.

DASH Hydrogen Storage Modules are delivered as stand-alone modules (M-series), to be used as stand-alone storage or to be integrated into bigger hydrogen solutions.

Whether it is for energy storage, industrial applications, 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?

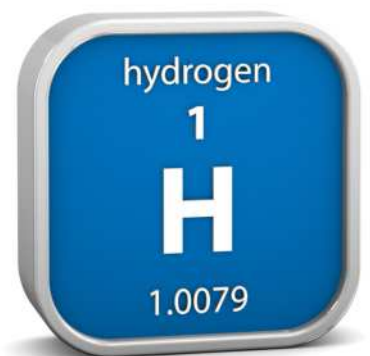
DASH Hydrogen Storage Modules are solid-state hydrogen storage systems in which hydrogen is stored in the solid atomic form within a special metallic structure. They feature excellent safety properties, a very high volumetric density, and a long lifetime.

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.

Around the hydrogen storages, no ATEX zone is required, facilitating many projects and applications.



How is it Built ?

DASH Hydrogen Storage Modules are built using two main parts:

1. Stainless steel tubes
2. GRZ proprietary metal hydrides with high absorption capacity

Altogether, they form a complete storage system called a cell, which is then combined into a stack.

The storage system can be interconnected to form unified bigger storages up to several tons of usable storage capacity.

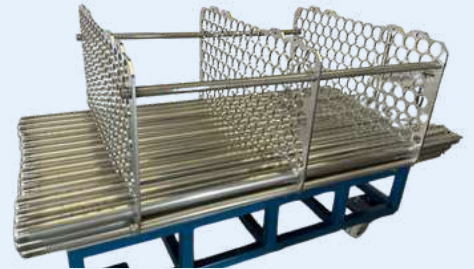
As options we can include in-line temperature measurement, mass flow-meter sensors as well as pressure transmitters - all depending on your requirements.

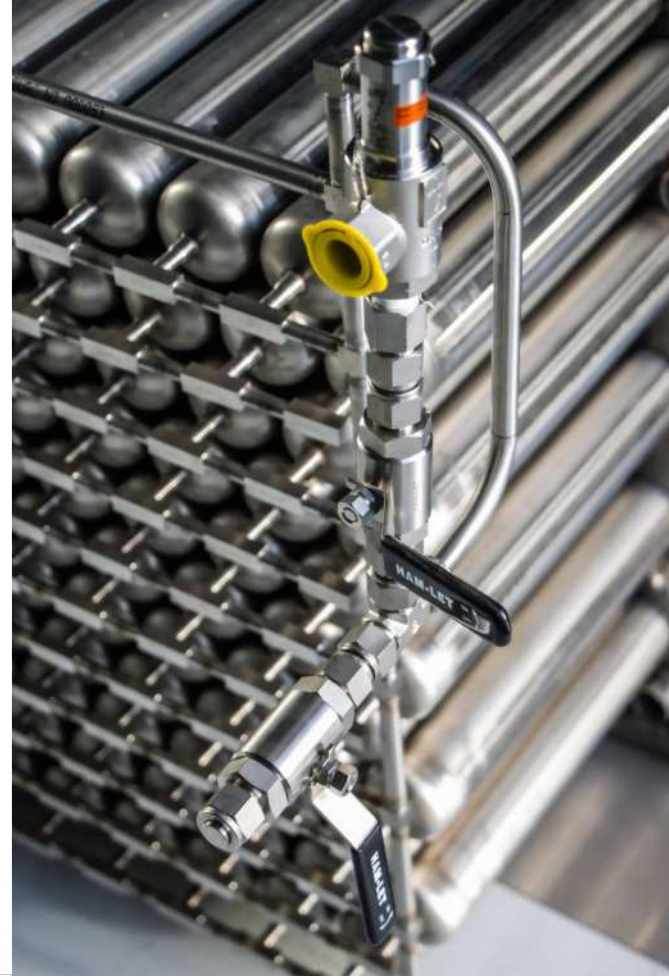
DASH M45 Hydrogen Storage Module

1 Metal Hydrides



2 Stainless Steel Tubes





DASH Hydrogen Storage Applications

Together with a hydrogen source, for example an electrolyzer or green hydrogen delivered to site, GRZ's DASH Hydrogen Storage Modules securely store large quantities of hydrogen to be used in multiple 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 modules store up to 45 kg of hydrogen within 1.5 m³ without the need for compression. This corresponds to 20 kg H₂/m³.



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 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 twice the lifetime of 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°C)	13.8 litre
Liquid Organic Hydrogen Carrier (LOHC)	17.2 litre
Methanol	6.9 litre

2 standard DASH M-Series Storage Modules available

DASH M3

 3 kg hydrogen storage

 Weight 250 kg

 Dimensions (LxWxH)
1051 x 651 x 217 mm



DASH M45

 45 kg hydrogen storage

 Weight 3450 kg

 Dimensions (LxWxH)
2000 x 1090 x 680 mm



Common Technical Specifications

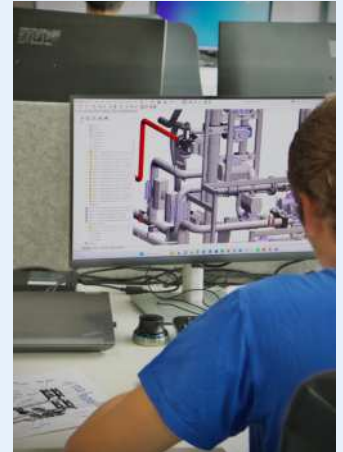
DASH Storage	Unit	M3	M45
Storage capacity	kg H ₂	3	45
Maximum charge flow (at 10°C)	kg H ₂ /hour	0.13	2.0
Maximum discharge flow (at 20°C)	kg H ₂ /hour	0.12	1.2
Maximum discharge flow (at 70 °C)	kg H ₂ /hour	0.29	2.9
Recommended charging pressure	bar(g)	30 to 45	
Discharging pressure	bar(g)	1 to 45	
ATEX zones		None	
Noise emissions		None	
Recommended Hydrogen supply purity	%	99.995	
Hydrogen outlet purity	%	99.995	
External cooling / heating requirements		None	
Operating temperature (external cooling and heating applied)	°C	-10 to 95	
Admissible ambient temperature	°C	-5 to 40	
Expected service life	years	> 30	

Options

The M-series can be expanded with the following options:

- Pressure transmitter
- In-stream hydrogen temperature sensor
- Bi directional mass flow meter

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

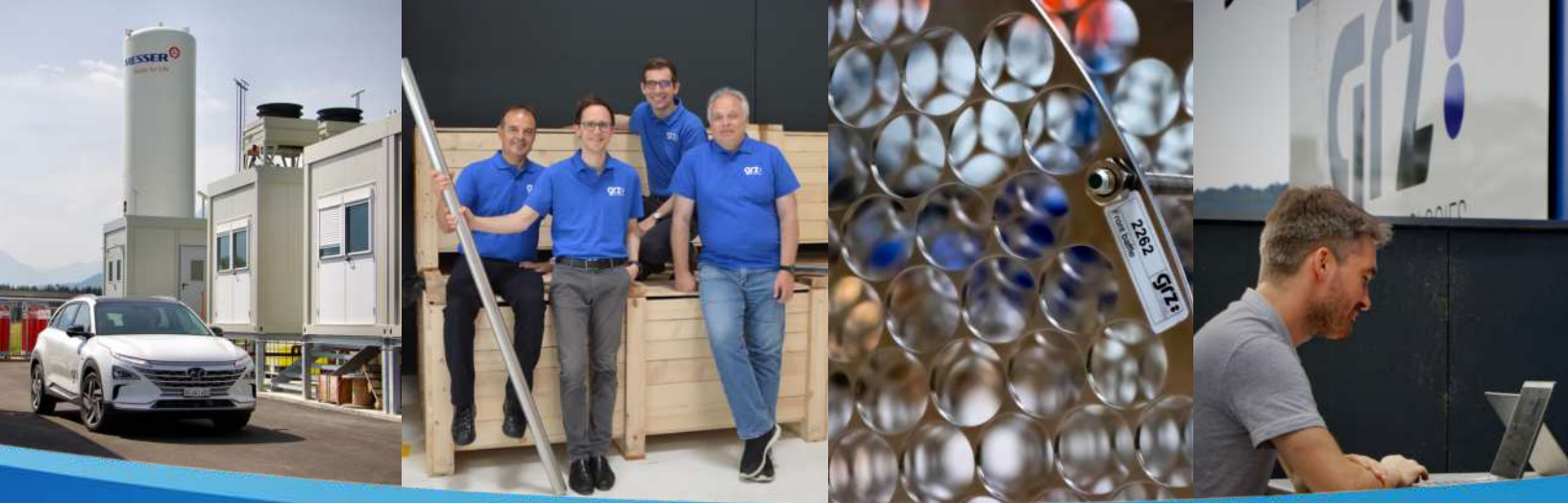


Compliance

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

- ATEX-Directive 2014/34/EU
- Pressure Equipment Directive 2014/68/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 1990s. 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, AMPO, Sabanci, Susten, Auto AG, Gaznat and Messer Gas, among others.



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