



# Hydrogen Energy Solutions

DESIGN | ENGINEERING | MANUFACTURING | PROJECT MANAGEMENT | INSTALL | COMMISSIONING | TRAINING | LIFECYCLE MAINTENANCE

**TOGETHER WE CAN BUILD  
A CLEAN ENERGY FUTURE**



[www.ChartIndustries.com/Hydrogen](http://www.ChartIndustries.com/Hydrogen)

# Make operations safe, easy and reliable

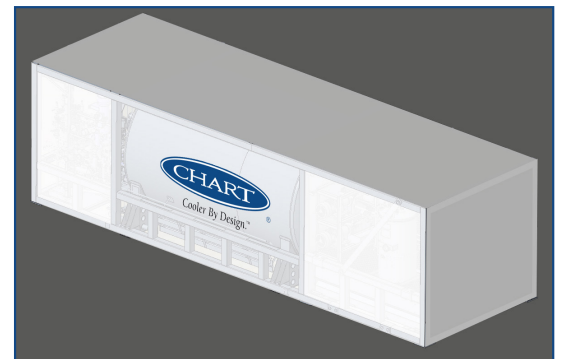
## Engineered Bulk Storage for Liquid Hydrogen

Chart's proven hydrogen experience and expertise gives you the assurance of meeting the most stringent code and measurement standards. Our engineered bulk storage solutions substantially reduce commissioning, compliance and safety risks. Chart designs, constructs and tests all of our equipment to meet your site-specific regulations as well as NFPA, ASME, PED and other local codes and regulations for each geography.

- Chart is the leader with 50+ years of experience in design, manufacture, test and assembly of liquid hydrogen storage equipment in our global facilities
- FCEV fuel stations, FC forklift fueling, liquefaction, aerospace and industrial applications
- More than 800 LH<sub>2</sub> bulk tanks built
- Complete line of liquid hydrogen storage tanks – Project references up to 172,000 US gallons (650 m<sup>3</sup>)
- Engineering expertise for unique applications

## Integrated Solutions

- LH<sub>2</sub> fueling station development for FCEVs
- Liquefier product developments
- Integrated vaporization, compression and controls for trailer filling operations
- Modular designs for reduced installation costs
- On-board liquid fuel tanks for trucks, buses, etc.
- Mobile and containerized fuel stations and supply systems
- 25+ years of experience providing LNG stations



LH<sub>2</sub> Station for FCEVs



HLH<sub>2</sub> Vehicle Tank Systems

## Brazed Aluminum Heat Exchangers (BAHX)



- Compact & efficient performance
- Custom engineered to meet customer's thermal and hydraulic performance requirements
- Proprietary in-house high performance simulation software results in optimal configurations
- Products offered with all recognized applicable national design codes and Chart holds all major international quality accreditation
- High-end fin technology with lowest pressure drops for an energy-efficient liquefaction process
- Lowest leakage rates by cutting-edge brazing and welding technology means maximum safety and allows installation in vacuum coldboxes for liquefaction of hydrogen

## Liquid Hydrogen Storage Tanks & Trailers

**Aerospace:** Progression on the aerospace case study design yields a necessity to marry design pressure, storage capacity, and total weight of the tank to create a shippable unit. In addition, large cryogenic lines are needed to support the high flows needed to transfer to the 2<sup>nd</sup> stage of the rocket. Chart undertook the design of a special pressure building unit for the LH<sub>2</sub> system to eliminate the need for a pump transfer of hydrogen.

- Designed cryogenic ground storage vessel built to maximum capacity, fully piped and plumbed
- Completed project in 12 months
- Tanks designed and manufactured at Chart's facilities in the U.S., Europe and Asia
- Referenced customers include United Launch Alliance (ULA) and Satish Dhawan Space Centre



Largest Shop Built LH<sub>2</sub> Tank

**Hydrogen Transports:** Chart's liquid hydrogen trailers are designed specifically for transporting liquid hydrogen over the road and meet the requirements of local transportation codes and regulations.

- Lowest NER with longest holding times
- Tandem design for minimizing long haul distribution costs, while providing a size "in market" with the ability to maneuver at stations in urban settings
- Jumbo designs for long distances
- Manufacturing of hydrogen transport equipment in Theodore, AL and Goch, Germany
- Multiple transport options, each optimized for the local road regulations up to 17,600 US gallons (4.5 MT)



LH<sub>2</sub> Trailers

## Metering Systems for Hydrogen Gas Trailers

Flowcom® Flow Metering Systems provide significant benefits for fleet managers and drivers. Our flow meter system for hydrogen gas covers an absolute pressure range from 435 to 3,045 psi (30 to 210 bar) and increases precision to reliably comply with your local standards and measurement requirements. Developed to run for more than 15 years, the system's internal data memory can store the deliveries that can be transferred to your data systems by Bluetooth® wireless technology. The Flowcom flow metering system is simple, convenient and safe to operate.



# Positioned to Address the Entire Hydrogen Value Chain



**LIQUEFACTION**



**DISTRIBUTION**



**STORAGE**



**END-USE**



Engineered for Efficiency – Built to Last



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