



HLH2 Liquid Hydrogen Vehicle Fueling Systems

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

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



www.ChartIndustries.com/Hydrogen

Liquid Hydrogen is the Future for Heavy Haul Vehicles

Since 1990, Chart has led the way in Liquid Natural Gas (HLNG) vehicle tank engineering and manufacturing, and we have utilized our cryogenic expertise to work to develop the same state-of-the-art fuel systems for liquid hydrogen-powered vehicles.

With more than 50,000 LNG vehicle fuel tanks supplied and powering natural gas vehicles globally, Chart is bringing the same vision and solution expertise to Liquid Hydrogen (HLH2) on-board fueling systems.

- Hydrogen burns clean when mixed with oxygen in a fuel cell, the only tailpipe emission is water vapor.
- One kilogram of hydrogen can deliver the equivalent driving range as 3.8 liters (1 US gallon) of diesel.
- Fuel Cell Electric Vehicles (FCEVs) provide significantly higher energy density than Battery Electric Vehicles (BEVs) and storing the hydrogen fuel as a liquid on-board further extends the FCEV range by > 15%.
- Chart's cryogenic vehicle tanks (HLH2 and HLNG) have a similar envelope and mounting approach as diesel tanks.
- HLH2 onboard fuel tanks require less space and weight than using compressed hydrogen (H70).
- Liquid hydrogen refueling operations can be done in the same time frame as fueling traditional diesel vehicles (10 – 15 minutes from empty to full).

Hydrogen Storage Comparison

Chart has a proven track record in cryogenic liquid hydrogen storage with hundreds of tanks in service around the world for FCEV fuel stations, FC forklift fueling, liquefaction, aerospace and many industrial applications.

| Storage | Weight Efficiency | Space | Fill Speed | Holding Time | Fuel System Cost | Fuel Infrastructure Cost | Standards & Regulations | Ideal Applications |
|------------|-------------------|-------|------------|--------------|------------------|--------------------------|-------------------------|--|
| H35 | ✓ | - | - | ✓✓✓ | \$\$ | \$\$ | ✓✓ | Medium duty, shorter time between fueling |
| H70 | ✓ | ✓ | - | ✓✓✓ | \$\$\$ | \$\$\$ | ✓ | Lighter duty, shorter time between fueling |
| LH2 (sLH2) | ✓✓ | ✓✓ | ✓ | ✓ | \$\$ | \$ | ✓ | Heavy duty, longer time between fueling |
| CcH2 | ✓✓ | ✓✓ | ✓ | ✓✓ | \$\$\$ | \$\$\$ | - | Heavy duty, longer time between fueling and possible idle time |

Multi-tank HLH2 systems can be installed where a single tank cannot accommodate all the required storage capacity. Tanks can be interconnected to ensure proper functioning (filling, venting, fuel withdrawal, etc.) and simplify operations.

Product Highlights

- Ultra-compact design maximizes available storage capacity.
- One hose filling process means less time to connect and faster fill rates.
- No on-board pump required.
- Twin tank system provides > 1280 km (800 miles) driving range.
- Total product lifecycle support.



Chart launched our on-board horizontal liquid hydrogen (HLH2) fuel system at the ACT Expo 2021



Chart Excellence in Liquid Hydrogen for Vehicles:

- Engineering and manufacturing centers in the US and Europe combine to provide the highest quality HLH2 tank.
- Designed and built to absorb the rigors of heavy duty trucking with proven safety and reliability.
- Designed and tested in accordance with national and international standards including DOT and ASME.
- Chart is investing in and developing the infrastructure across the value chain to drive the transition to a hydrogen economy.



Testing Chart's onboard liquid hydrogen vehicle fuel system (HLH2) with fuel cell at our New Prague, MN (USA) hydrogen test facility.

Liquid Hydrogen Fuel Dispenser

Chart's DynaFlow is the benchmark for LNG vehicle fueling and we've applied the same expertise to develop a dispenser for delivering hydrogen to trucks and other heavy goods vehicles. As you'd expect from Chart, ergonomic design affords maximum safety, comfort and reliability.



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