

# LNG/L-CNG FUELLING SYSTEMS





## **Introduction**

Our roads and ports are becoming increasingly busy as the global population grows and more of us urbanize. A range of vehicles and fuels, including liquefied – and compressed natural gas (LNG/CNG), will be needed to meet increasing demand for transport while at the same time the world seeks to reduce emissions.

Cryonorm believes that natural gas (LNG/CNG) should form a bigger part of the transport energy mix as a lower-carbon fuel, alongside developments in vehicle efficiency, biofuels, hydrogen and electric mobility.

Used in trucks delivering goods, LNG has the potential to offer fuel cost savings when compared to conventional diesel. It also reduces Sulphur emissions, particulates and nitrogen oxides, and helps reduce greenhouse gas emissions from production to use.

Burning LNG/CNG in spark-ignited engines is quieter than burning diesel in combustion engines. It means LNG-fueled trucks can operate longer under noise restrictions, for example when delivering to supermarkets in residential areas.

Cryonorm focus is cryogenic systems, the growing marked potential for gas fueled vehicles is our main driver to develop and marked a standard range of L-CNG fuelling stations.

## **Cryonorm Systems**

Cryonorm Systems, based close to Amsterdam, The Netherlands, is a leading designer and supplier of Tailor Made Cryogenic Systems and vaporizers.

The LNG systems are developed to meet the international standards as well as the applicable regulations. All systems are certified by third party inspection agencies.

The company employs engineers, production and services staff, having a long background in cryogenic LNG Systems, air separation systems and industrial gas installations.

Cryonorm history building cryogenic installations and vaporizers goes back to 1969.

Our construction facilities cover 8.000 m<sup>2</sup> with skilled production workers, executing the manufacturing in direct supervision of the design engineers.

The in-house engineering and construction under direct supervision, allows us not only to deliver a high quality product, but this equally at a competitive price.



## **Cryonorm Systems LNG/LCNG Vehicle Fuelling Stations**

Cryonorm L-CNG vehicle fuelling stations are designed to safely and reliably fuel all current available natural gas fuelled vehicles (NGV) running on either compressed natural gas (CNG) or on liquefied natural gas (LNG).

On the LNG filling stations a selection could be made “cold-LNG” or “saturated-LNG”.

Rather than saturating the fresh supplied LNG in the storage tank, we will only saturate the required quantity required by our proprietary designed Saturation on the Fly system.

Optionally our stations can be extended with “LCNG” for smaller trucks and cars.

The Cryonorm station size ranges from small to large scale with single or multiple dispensers. All stations are available as private or public owned, with or without OIML-MID custody approved transfer.

Cryonorm provides a proven design, full turnkey package including engineering, manufacturing, installation, commissioning and service & maintenance.

Following special features are available:

- Saturation on the Fly.
- Cooling on the Fly.
- LNG bulk conditioning.
- BOG handling systems such as compression, liquefaction, power or cogeneration.
- Modular standardized design.
- Single-hose filling system or dual hose filling system on all dispensers.
- Vertical or horizontal LNG storage tanks available in all sizes and pressures.
- Dispenser(s) on islands or integrated inside the station building.
- Fully automated operation with remote control access.
- MID/OIML R117-1 approval by notified body.
- Underground vacuum insulated piping systems from pump unit to dispensers.
- Connection to any MID-certified Point Of Sales (POS) with standard IFSF communication protocol.
- 2-sided truck fuelling position with dual-display in case dispensers are installed on islands.
- Payment terminal with card reader and receipt printer.
- Fuel selection “cold LNG” or “saturated LNG”.
- Re-locatable, mobile, containerized or permanent building mounted station options.
- Combination-station possibilities with ship bunkering, regasification and LCNG.
- Fast-filling: entire fuelling process, including card payment, completed in less than 7 minutes.
- Operate in ambient temperatures down to -40°C.

The latest Cryonorm technology offers a filling station with maximum accuracy, reliability and safety in combination with a very low boil off rate.

Cryonorm filling stations include all required components, such as storage tanks, pumps, control systems, all required safety devices, dispensers, air compressors, nitrogen generators, BOG handling systems and, if applicable, LCNG equipment.

Cryonorm understands the criticality of our customers' operations and the economic impact of any down time or lack of efficiency.

For installation and commissioning of our systems, Cryonorm has its own service team in-house. This group of experts is in charge of coordinating turnkey projects on site, optimizing the site work and the station's functional reliability.

Training is also our priority, using a team of dedicated experts that will train your operators or truck drivers on the critical aspects of both the filling station and the natural gas, ensuring a safe and efficient operation.

Full after sales services is provided by Cryonorm, consisting of: service, maintenance, help desk, spare parts and future station modifications/upgrading if dictated by the industry.

### **Cryonorm “standard” stations**

All the critical LNG processing and control equipment will be standard installed in a dedicated single building unit connected directly next to the LNG storage tank area.

The reason why Cryonorm has standardized its design to this single-unit building, is to reduce construction time and testing on site, for esthetic reasons and for protection of sensitive equipment against weather conditions and vandalism.

Furthermore the station building could be locked for unauthorized persons.

Cryonorm standard stations are:

#### **1. LNG Permanent Vehicle Fuelling Station**

The permanent LNG filling stations are unmanned and public accessible, LNG storage tank volumes on the station could vary according client wish or strategical choice.

Dispenser quantity varies from single unit to multi units and are installed on filling-islands accessible by truck from both sides with operator displays also on both sides.

Special attention will be made to ergonomic and architectural design of the station however keeping filling time, the local regulations and the specifications in mind.

Underground LNG and vapor return pipelines between the station pump building and the dispensers will be double walled vacuum insulated with required leak detection systems.







## 2. Fully shop manufactured LNG Vehicle Fuelling station

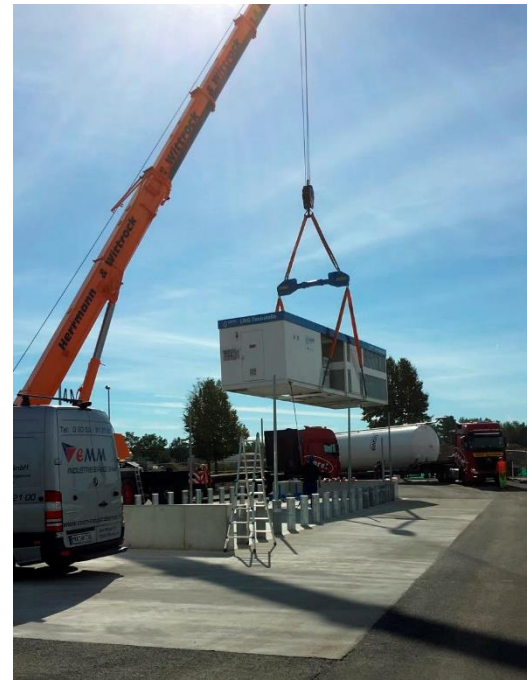
The modular LNG filling stations are unmanned and public accessible, LNG storage tank volumes on the station could vary according client wish or strategical choice.

Dispensers, pump and control system are installed inside the skid module with a maximum of two LNG dispensers or one LNG and one CNG dispenser. This design is the perfect solution for green field stations.

This fully shop manufactured design enables site mechanical completion in one week and full operational plant in two weeks.

The LNG processing, dispensing and control unit will all be installed in one single prefabricated building unit.

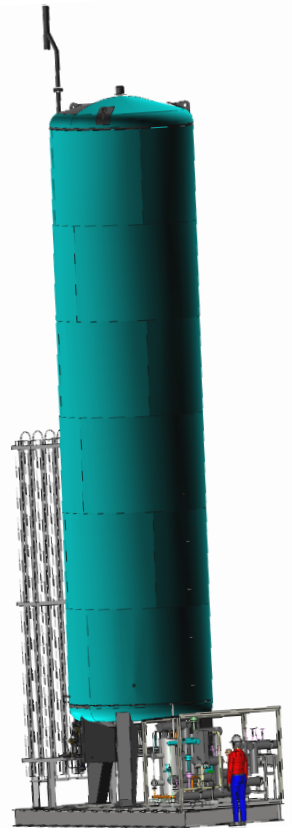
The LNG tank and the vaporizer are the only two self-standing units next to the building unit.



For installing LNG on existing plot, for instance fuelling station, Cryonorm offers design with LNG tank, pump and saturation vaporizer on a skid – required plot area less than 20 m<sup>2</sup>.

Dispenser(s) can be installed on island and control unit need to be installed in the safe zone close to the tank skid.

Rather than with a fixed LNG storage tank, Cryonorm can also offer stations that work with exchangeable LNG storage tank as per picture below showing a 20ft LNG container that can either be exchanged or re-filled at site.



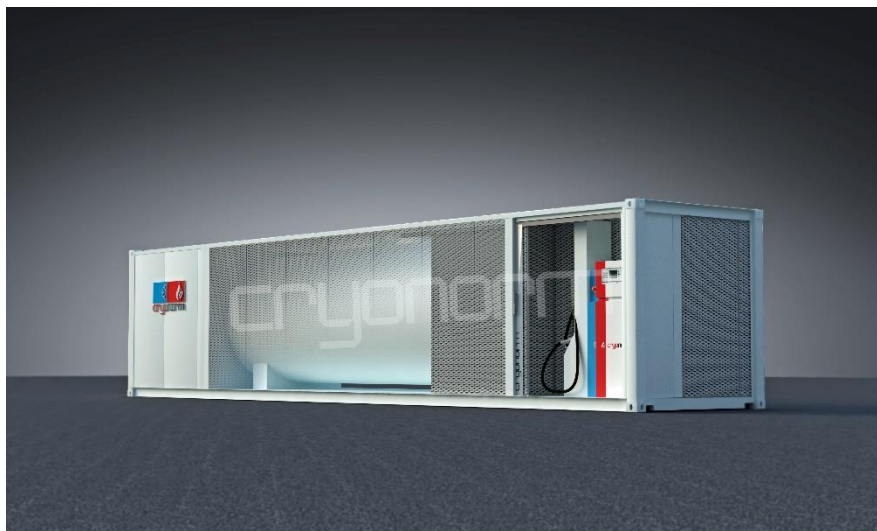
### 3. LNG Mobile filling station

The mobile filling station concept is mounted on a 40 foot container frame which includes all necessary components for filling LNG fueled vehicles.

Of course the station unit is suitable to fill all current available truck types with saturated or cold LNG and the unit will be MID approved by Dutch NMi.

Inside the 40 foot frame the following main essential items will be installed:

- Horizontal 12 m<sup>3</sup> vacuum insulated storage tank.
- LNG pump equipment.
- Saturation on the fly vaporizer and heat exchanger.
- Cooling on the fly, bulk cooling and BOG handling.
- Single LNG dispenser.
- Control panel.
- Payment terminal.





#### 4. L-CNG add-on to a LNG fuelling station

Most of Cryonorm LNG filling stations could be provided with the L-CNG possibility as an add-on or if required a dedicated L-CNG without LNG dispensing could be offered.

Just like all the other standard Cryonorm stations, the looks, the building and the noise reduction of the high pressure pump equipment is very important.

The additional essential required L-CNG equipment additional to the LNG station includes:

- High pressure LNG pumping system.
- High pressure LNG vaporization system.
- CNG odorization.
- CNG Buffer with 3-bank filling possibility.
- CNG dispensing, multi or single dispensers. Dispensers for trucks or personal vehicles with single or dual hose possibilities.
- Compression, odorization and buffering up to 300 barg allowing fast-fill at 200 barg.



#### 5. LNG for ships add-on to a LNG fuelling station

For stations located close to (inland) waterways, Cryonorm offers the option for LNG fuelling point close to the quay.





# SMALL SCALE LNG PLANTS & SYSTEMS



Marine fuel

LNG/L-CNG  
fueling



Liquefaction



Marine bunkering



Regas



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