

LNG LOADING EQUIPMENT



LNG Industry asked several companies to discuss some topics regarding LNG loading equipment.

Frederic Pelletier, Customer Engineering Development, Tokyo Boeki Global Technologies Ltd

Frederic Pelletier graduated with a PhD in Robotics in 1985. Since then, he has managed R&D projects, along with engineering tasks in the defence industry, steel mill, and loading systems businesses. He joined Tokyo Boeki Global Technologies' (TB Global Technologies) headquarters, located in Tokyo, in 2019, where he oversees New Products Development activities.

His main field of expertise is the transfer of liquefied gases, ranging from hydrogen (-253°C) to ammonia (-33°C), with a special focus on LNG (-163°C).

Giovanni Marino, Director of Marketing & Sales, Zipfluid

As Global Sales & Marketing Director of Zipfluid Srl, Giovanni Marino is responsible for developing the new markets and the expansion of the business network. Giovanni graduated in Economics and holds a Master's in International Marketing. He joined Zipfluid Srl in 2020 after leading the worldwide expansion of a mechanical company producing tailored made solutions for the beverage industry for 15 years.

Q1. What factors are considered when deciding on the type of loading equipment for a project?

Frederic Pelletier, TB Global Technologies

The fit-for-purpose equipment is defined after the consideration of different parameters, such as:

- 'Geometrical' data: Jetty or floating LNG (FLNG) loading module characteristics, size of the different LNG carriers to be offloaded, free space behind the loading equipment, etc.
- 'Metoccean' conditions: Tide, wind speed, relative motions of the moored LNG carrier, etc.
- 'Process' data: Required flowrate, allowable pressure drop, working pressure, etc.
- 'Clients' preferred accessories': Hydraulic or manual coupler, upper swivel of triple swivel assembly motorised or not.

Giovanni Marino, Zipfluid

Several crucial factors come into play: the temperature of the fluid, its physical state, i.e. the extremely low temperature, hence the development by evaporation of large volumes of gas from

small quantities of liquid and the tendency for cold vapours to accumulate in the lower layers of the environment.

The layout of the site and any space constraints influence the choice of loading equipment. In case of a wider loading area to be covered, a longer loading arm is needed. In case of rear and side loading, a more flexible loading arm is needed.

Compliance with safety regulations and standards is paramount in selecting loading equipment. It is very important to mention that loading arms are safer than the hoses since they have a breakage rate of 1/10.

Flexibility and versatility in loading/unloading different type of trailers is considered. Budget and cost considerations in the long run are also considered to evaluate the investment.

Q2. How can the right loading solution improve cost-efficiency, and overall efficiency of the LNG process?

Frederic Pelletier, TB Global Technologies

Delivering equipment which fulfils a client's requirements makes sure that LNG terminal operability is respected. Loading equipment is a crucial part of the LNG chain, and any



discrepancies between its desired and actual performance could badly affect the efficiency of the complete process.

Giovanni Marino, Zipfluid

Overall, selecting the LNG loading station for LNG operations can yield significant cost savings, ensures efficient and safe transfer of LNG between storage tanks, trailers, and terminals, minimises risks, reduces insurance costs, and enhances operational performance across the entire LNG value chain, from production and transportation to distribution and regasification.

Optimised loading operations minimise downtime and reduce the risk of spills or accidents, thereby improving overall efficiency and avoiding costly delays. As a result, operators can reduce wastage and improve cost-efficiency by maximising the amount of LNG delivered to customers.

Loading arms that can adapt to varying trailer sizes, loading rates, and terminal configurations allows for efficient utilisation of resources and infrastructure, thereby optimising operational costs.

Implementing loading arms with advanced safety features and compliance with industry standards minimises the risk of accidents, injuries, and regulatory penalties. Safety measures – such as emergency shutdown systems, leak detection systems, and automatic monitoring – enhance operational reliability and ensure compliance with stringent safety regulations, ultimately reducing operational risks and associated costs (e.g. insurance).

Loading arms with robust design, low maintenance requirements, and extended lifecycle help to reduce maintenance costs and downtime associated with equipment failures or repairs. Regular maintenance and preventive measures prolong the lifespan of loading equipment, minimising the need for costly replacements and upgrades over time.

Utilising energy-efficient loading solutions and processes helps reduce energy consumption and operational costs associated with LNG production and transportation. Energy-saving features – such as cooling systems – contribute to lower operating expenses and improved cost-efficiency throughout the LNG supply chain.

Integration of loading equipment with advanced automation, control systems, and data analytics enhances supply chain visibility and co-ordination, resulting in cost savings and operational efficiency improvements.

Q3. Can LNG loading equipment help reduce emissions from the LNG operations?

TB Global Technologies

Loading equipment must follow the motions of the LNG carrier while remaining tight, without overloading her manifold. The word 'tight' applies for liquid and vapour phases of the natural gas, and also has to be considered not only for the equipment itself, but for its connection – permanent or on-demand like the coupler – to the transfer piping. This answers the question for what can be called the 'intrinsic fugitive' emissions. A secondary aspect of emissions reduction could be considered as the loading equipment contributes low carbon dioxide (CO₂) emissions and a very small pressure drop of the loading equipment could

participate to the pump's electric consumption limitation, which stops CO₂ emissions increasing.

Giovanni Marino, Zipfluid

LNG loading equipment can play a significant role in reducing emissions from LNG operations by minimising fugitive emissions, optimising handling processes, monitoring, and controlling emissions, adopting energy-efficient technologies, exploring alternative fuels, and ensuring regulatory compliance. By incorporating these measures into LNG loading operations, operators can mitigate environmental impact and contribute to a more sustainable energy future.

Loading arms, metering skids, couplings, and break-away valves are designed to minimise fugitive emissions during transfer operations. Tight sealing mechanisms, vapour recovery systems, and leak detection technologies help capture and control emissions.

This equipment incorporates features that optimise handling processes, such as controlled loading rates, pressure management systems, and vapour balancing techniques. These measures reduce the venting of LNG vapours and minimise energy losses, resulting in lower emissions and improved environmental performance.

Compliance with stringent environmental regulations and emission standards is facilitated using advanced LNG loading arms and metering skids that meet or exceeds regulatory requirements. By adhering to emissions limits and adopting best practices in emissions control, operators can mitigate environmental risks and demonstrate their commitment to sustainability.

Q4. Do you expect there to be an increase in future demand for LNG loading equipment in a particular LNG application or facility? (e.g. fuelling stations, LNG bunkering operations, etc.)

TB Global Technologies

On the path towards clean energy, LNG is the best candidate to ensure a smooth and affordable transition for that vital energy supply paradigm change, as it is a well-known product and because main infrastructures are existing. One of the most visible effects is the increasing demand for both small scale LNG loading equipment and for LNG bunkering systems.

Giovanni Marino, Zipfluid

Several factors contribute to these potential changes. Different sources of natural gas, different liquefaction temperatures, advancements in LNG processing technologies, such as liquefaction techniques, purification methods, stricter emissions standards, and environmental regulations, can result in variations in LNG loading equipment.

New LNG trucks are developed to meet evolving industry requirements.

Loading equipment may need to accommodate these variations by adjusting operating parameters, such as flow rates, temperatures, and pressure settings, to ensure safe, flexible, and optimal loading and unloading processes of LNG.

TB-NIIGATA




CONTRIBUTING TO ENERGY TRANSFER

Loading Arm Manufacturer Trusted for 70 Years from Japan

Visit us www.tbgttech.co.jp/en/



TB Global Technologies Ltd.

 **TOKYO BOEKI GROUP**



Q5. As LNG becomes more popular and new gas sources are utilised, will this require changes in how loading equipment is used?

TB Global Technologies

The main changes being seen are the increasing demand for FLNG and FSRUs, which are faster to develop and to install along with requiring lower CAPEX than classical LNG import or export terminals. Loading equipment shall then be upgraded to accommodate the more severe offshore conditions of use for both LNG transfer operations and for maintenance simplification, due to specific offshore space and lifting equipment limitations.

Giovanni Marino, Zipfluid

Several factors contribute to these potential changes. Different sources of natural gas can result in variations in LNG composition, different liquefaction temperatures, new LNG carriers being developed to meet evolving industry requirements, advancements in LNG processing technologies (such as liquefaction techniques and purification methods), stricter emissions standards and environmental regulations, and flexibility and adaptability to accommodate changes in LNG production volumes.

Loading equipment may need to accommodate these variations by adjusting operating parameters, such as flow rates, temperatures, and pressure settings, to ensure safe, flexible, and optimal loading and unloading processes of LNG.

Q6. Detail the process behind one of your most popular loading equipment solutions.

Giovanni Marino, Zipfluid

The LNG loading arm provides a critical link in the LNG supply chain, enabling the safe and efficient transfer of LNG between storage facilities and LNG trucks or LNG rails. Its robust design, advanced safety features, and precise control capabilities ensure reliable performance and compliance with stringent industry standards and regulations.

Cryoload® by Zipfluid, its LNG loading station, consists of a rigid but easy to manoeuvre by a single operator arm to transfer LNG, with six swivel joints that allow for flexible movement in multiple directions and a rigid arm to recover the boil-off gas (the BOG arm). It is used to load/unload cryogenic liquids (i.e. LNG) to road/rail tankers. The loading station can be optimised for lateral and rear loading. It is easy to use by a single operator, has a long range of loading in rear and side configuration, self-compact balancing system, and special insulated handles for cryogenic application.

Zipfluid swivel joints are equipped with backup seals, leakage detection, and with seals in ultra-high molecular weight PE for high reliability. Zipfluid swivel joints offer minimum rotation resistance for easy operation and are equipped with replaceable product seals and bearing module to offer a very easy maintenance.

During LNG transfer operations, vapour recovery arms capture and process LNG vapours to minimise emissions, ensure compliance with environmental regulations, and return them to

the storage tank or vapour handling system for reliquefaction or disposal.

Throughout the loading process, operators monitor loading arm operations and parameters using integrated control panels, remote monitoring systems, and safety instrumentation.

Alarms and shutdown mechanisms are in place to respond to any deviations from normal operating conditions or safety concerns.

Regular maintenance, inspection, and testing of the LNG loading arm are essential to ensure its continued reliability and safety. Scheduled maintenance tasks include lubrication of swivel joints, inspection of seals and connections, and testing of safety systems to identify and address any potential issues proactively.

Q7. Outline a short case study on the use of LNG loading equipment at a recent LNG project.

Giovanni Marino, Zipfluid

HIGAS LNG terminal is a project located in the Port of Oristano, Sardinia, Italy, designed to receive, stock, and transfer LNG to individual citizens, companies, and as fuel for trucks and ferries in Sardegna Island. The terminal has capacity to load up to 8000 LNG trucks per year (equivalent to 180 000 tpy), via two truck loading bays equipped with two Cryoload by Zipfluid LNG loading stations, for onward distribution to smaller LNG satellite stations. HIGAS distributes LNG via road tankers both directly to industrial users converting to cleaner and cheaper fuels, and to gas distributions companies across the island.

LNG is stored in six horizontal low-pressure cryogenic tanks, which gives high availability to meet customer demand. The facility is further complemented by connection to a natural gas pipeline system that will allow natural gas to be distributed to local industry.

The mission was to transfer this cryogenic liquid from HIGAS LNG terminal onto an LNG tank truck from the rear or from the side connection coping with a significant difference related to dimensions considering that there is not a unique standard for trucks. Safety was also paramount due to the requirement imposed by fire department.

Zipfluid has engineered, designed, manufactured, and tested the first LNG loading station installed in Italy. It invested 5000-man hours to get this project done.

The cryogenic loading skid complies with: Machinery Dir. 2006/42/EC, PED: Pressure Equipment Dir. 2014/68/EU, ATEX: Explosive Atmosphere Directive 2014/34/EU.

The cryogenic loading skid is designed and tested according to ISO 16904, EN1474, OCIMF

The main technical specifications of the cryogenic loading skid are:

- Design temperature: -200°C (+65°C).
- Design pressure: 18 bar.
- Flow rate: 60 – 100 m³/h.

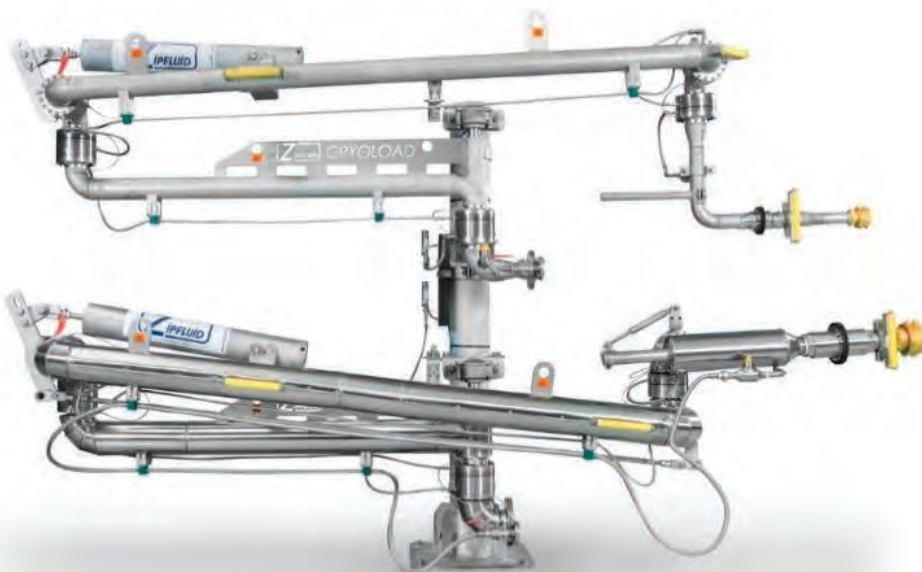
The company is proud of the result accomplished: to successfully and reliably meet the very stringent requirements of the customer and fire brigade and help the energy transition granting transport of LNG to remote areas by truck. **LNG**

CRYOLOAD by ZIPFLUID

Cryogenic Loading Station

LA700 Series - CRYOLOAD Low Temperature – High Reliability

Our LA700 Series – Cryogenic Loading Station – Is used to load / unload cryogenic liquids (i.e. LNG) to road / rail tankers. The loading station can be optimized for lateral and rear loading.



Compliant With:

- Machinery Dir. 2006/42/EC
- PED: Pressure Equipment Dir. 2014/68/EU.
- ATEX: Explosive Atmosphere Directive 2014/34/EU.

Design & Tested according to:

- ISO 16904
- EN1474.
- OCIMF

Main Technical specifications:

- Design temperature: -200° / +65°C
- Design pressure: 40 bar
- Test pressure: 60 bar

PLUS

Swivel Joint with
BackupSeals –
Material: Ultra High
Molecular Weigh PE

HIGHER RELIABILITY



Added Values – Why use our CRYOLOAD?

- Easy to use by a single operator
- Long range of loading in rear and side configuration
- Self-compact balancing system
- Special insulated handles for cryogenic application
- Swivel joints with backup seals and leakage detection for high reliability
- Swivel joints with seals in Ultra High Molecular Weigh PE for high reliability
- Swivel joints with minimum rotation resistance for easy operation.
- Swivel joints with replaceable product seals and bearing module.
- Very easy maintenance
- Italian technology and quality for long life service
- Authorized services all over the world for installation and maintenance.

Please feel free to contact us at info@zipfluid.it

Made in Italy

ZIPFLUID[®]
Fluid Transfer Systems