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Loading and unloading of liquefied natural gas (LNG) tank wagons and containers

Chargement et déchargement de wagons-citernes et conteneurs de gaz naturel liquéfié (GNL)

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Foreword

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Loading and unloading of liquefied natural gas (LNG) tank wagons and containers

1 Scope

This document provides requirements and recommendations for the design, construction and operation of newly installed liquefied natural gas (LNG) railway loading and unloading facilities for use on onshore LNG terminals, LNG satellite plants, handling LNG tank wagons or tank containers engaged in international trade.

The designated boundary limits of this document are between the LNG terminal's inlet/outlet piping headers at the beginning of the rail loading or unloading area and the rail track area used for LNG tank wagons and containers. It is applicable to all rail loading bays, weighbridge(s) and related subsystems.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 16903, *Petroleum and natural gas industries — Characteristics of LNG, influencing the design, and material selection*

EN 1473:2021, *Installation and equipment for liquefied natural gas — Design of onshore installations*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
ageing
gradual change in the molecular composition of *LNG* (3.8) throughout the supply chain caused by differential evaporation because LNG has components with different boiling points

3.2
boil-off gas
BOG
natural gas (3.11) resulting from slow evaporation of *LNG* (3.8) at its equilibrium state or rapid evaporation of LNG, also called flashing, inside equipment

3.3
control room
core functional entity, and its associated physical structure, where operators are stationed to carry out centralized control, monitoring and administrative responsibilities

[SOURCE: ISO 11064-1:2000, 3.2]

3.4
emergency release coupling
ERC
device to provide a means of quick release of LNG transfer system when such action is required only as an emergency measure

[SOURCE: ISO/TR 17177:2015, 2.1.4]

3.5
ESD
emergency shutdown
system that safely and effectively stops the whole plant or individual units to minimize incident escalation

[SOURCE: ISO 20257-1:2020, 3.1.15, modified — "emergency shutdown" has been changed from a preferred term to an admitted term.]

3.6
flare
system to ignite the vapour on a safe location in a controlled manner

3.7
impounding basin
area defined at the site for collecting any accidental spill of hydrocarbons

3.8
LNG
liquefied natural gas
colourless and odourless cryogenic fluid in the liquid state at normal pressure composed predominantly of methane which can contain minor quantities of ethane, propane, butane, nitrogen, or other components normally found in *natural gas* (3.11)

Note 1 to entry: LNG is designated as “UN 1972” by United Nations.

[SOURCE: ISO 16903:2015, 3.3, modified — Note 1 to entry has been added.]

3.9
LNG tank wagon
railway goods wagon with a tank and loading or discharge arrangement for the transport of permanently mounted *LNG* (3.8)

3.10
LNG tank container
mobile tank for the transport of *LNG* (3.8) that may be mounted on railway wagons and may also be loaded or unloaded while mounted

3.11
natural gas
NG
complex gaseous mixture of hydrocarbons, primarily methane, but generally including ethane, propane and higher hydrocarbons, and some non-combustible gases such as nitrogen and carbon dioxide

[SOURCE: ISO 14532:2014, 2.1.1.1, modified — "includes" has been changed to "including"; note 1 to entry has been removed.]

3.12
quick connect disconnect coupler
QCDC
manual or hydraulic mechanical device used to connect the *transfer system* (3.14) to the *LNG tank wagon* (3.9) or *container* (3.10)

[SOURCE: ISO 16904:2016, 3.39, modified — "cargo manifold" has been changed to "LNG tank wagon or container"; "without employing bolts" at the end of the definition has been removed.]

3.13
transfer
loading or unloading operation

3.14
transfer system
flexible (hose) or rigid (articulated arm) system used for transferring *LNG* (3.8) between the terminal and *LNG tank wagon* (3.9) or *container* (3.10)

Note 1 to entry: It can be referred to as a “loading arm or loading hose” or “unloading arm or unloading hose”.

4 Equipment design

4.1 LNG tank wagon

It is presupposed that the LNG tank wagon is designed, homologated, tested and equipped according to the requirements of dangerous goods transport of the national regulatory body following the UN transport recommendations (orange book, e.g. RID for Europe and MED) and that regular inspections and maintenance are performed according to the applicable laws and regulations for dangerous goods applicable for LNG UN1972.

The dimensions of an LNG tank wagon shall be chosen in a way that payload and tank volume are corresponding when loaded with LNG.

LNG tank wagons shall be equipped with cabinets on both sides of the wagon which contain the operating valves and connections. These cabinets should be executed to work as drip trays.

4.2 LNG tank container

It is presupposed that the LNG tank container is designed, tested and equipped according to the requirements of IMO-IMDG or requirements of the valid national regulatory body following the UN transport recommendations (orange book, e.g. RID for Europe and MED) and that regular inspections and maintenance shall be performed according to the applicable laws and regulations for dangerous goods mandatory for LNG UN1972.

The dimensions of a tank container shall be chosen in a way that payload and tank volume are corresponding when loaded with LNG.

Tank containers shall be equipped with cabinets which contain the operating valves and connections. These shall be provided on the side or at the face of the tank container. These cabinets should be executed to work as drip trays.

4.3 Tanks for LNG tank wagons and tank containers

Tanks for the transport of LNG shall provide the following connections:

— product connection liquid phase;

— product connection vapour phase;

— drive away protection;

— electric earthing connecting point;

— air connection, if pneumatic valves are used for the LNG tank wagon.

Tanks shall provide the following equipment:

— overpressure protection valve;

— thermal relief valves on lines between block valves;

— closing installation for first closure valves in case the wagon moves.

It can be useful to provide a regasification or pressurizing circuit to speed up the discharge in case no external source of pressure is available.

The tank of the wagon or container shall be insulated to minimize boil-off gas during possible transportation time as it reduces the thermal ingress from the environment and thus significantly reduces the associated safety risks.

NOTE Information on the design of vacuum insulated tanks is given in the ISO 20421 series.

The tank shall be designed in order to withstand liquid nitrogen (for commissioning) temperatures on the low range and up to +50 °C on the high range.

The manufacturer of the tank shall provide for its appropriate operation:

— approval of the tank by a surveying institute including calculation of the shell;

— operating manual including a description of the tank;

— loading data sheet of initial filling, holding time and payload;

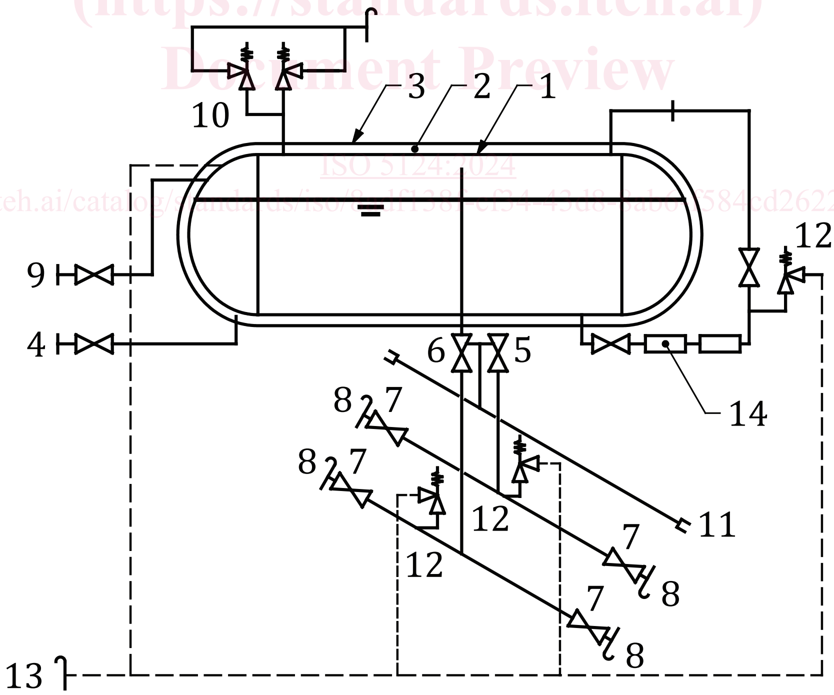
— loading data sheet of initial pressure and holding time;

— flow schemes;

— information about spare parts.

Loading of an LNG tank wagon or container can be controlled by scales or by using level-check valves (if level-loading) to prevent overloading.

The basic layout of tanks for LNG tank wagons or tank containers is shown in Figure 1 and Figure 2. Examples of an LNG tank wagon and an LNG tank container are given in Figure 3 and Figure 4.

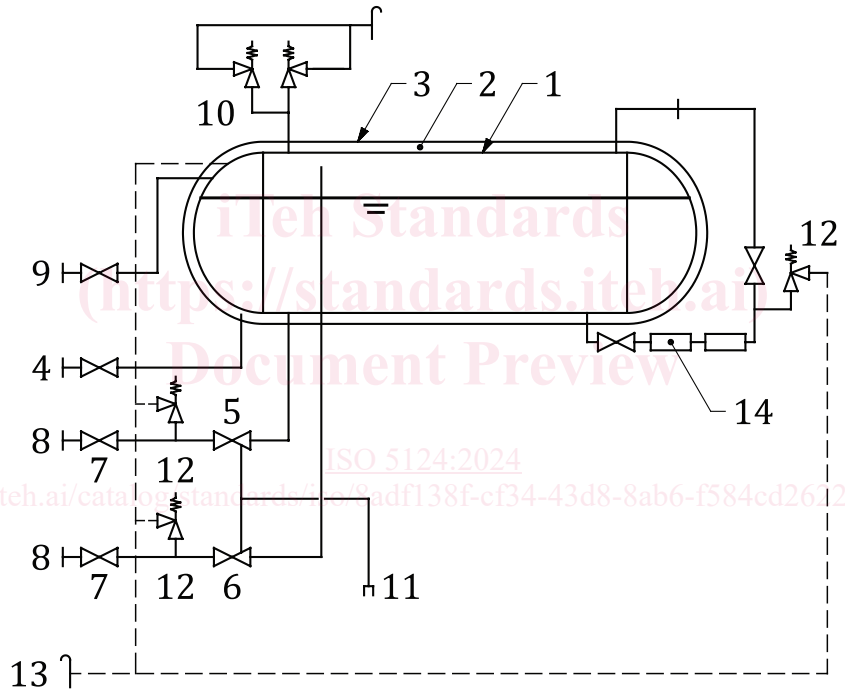


Key

⊢	closure, flange or coupler
———	product line or operational line
⊢⋈⊣	valve
— — —	return line for thermal expansion
1	tank shell

2 insulation
3 outer shell
4 test valve for vacuum (if applicable)
5 foot valve
6 gas return valve
7 side valves
8 connecting coupler (if applicable) or connecting flange
9 test lines for level loading
10 safety valves
11 pneumatic control of foot valve and gas-exchange valve
12 thermal expansion safety valve
13 connection to connect boil-off
14 evaporator/heat exchanger (if applicable)

Figure 1 — LNG tank wagon/container with connections on the side



Key

⊢ closure, flange or coupler
——— product line or operational line
⋈ valve
– – – return line for thermal expansion
1 tank shell
2 insulation
3 outer shell
4 test valve for vacuum (if applicable)
5 foot valve
6 gas return valve
7 side valves
8 connecting coupler (if applicable) or connecting flange

9 test lines for level loading
10 safety valves
11 pneumatic control of foot valve and gas-exchange valve
12 thermal expansion safety valve
13 connection to connect boil-off
14 evaporator/heat exchanger (if applicable)

Figure 2 — Tank container with connections on the end

Figure 3 — Example of an LNG tank wagon

Figure 4 — Example of an LNG tank container

4.4 Loading or unloading bay configuration

The loading or unloading bay:

a) shall be equipped with a flexible hose or loading arm, which may be equipped with a cryogenic QCDC, dry break coupler, or similar;

b) shall have means of preventing leaks at hose or arm rupture such as an ERC, cryogenic break away coupling or other measures;

c) shall be equipped with shut-off valves or ESD valves;