



**International
Standard**

ISO 5124

**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)*

**First edition
2024-10**

Reference number
ISO 5124:2024(en)

© ISO 2024  **Documents**
Document Sharing Hub



COPYRIGHT PROTECTED DOCUMENT

© ISO 2024

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	iv
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Equipment design	3
4.1 LNG tank wagon	3
4.2 LNG tank container	3
4.3 Tanks for LNG tank wagons and tank containers	3
4.4 Loading or unloading bay configuration	6
4.5 Connection couplings	8
4.5.1 Type and size of connections	8
4.5.2 Quick connect disconnect coupler (QCDC)	8
4.5.3 Emergency release coupling (ERC)	8
4.6 LNG transfer hoses or arms	8
4.7 General process design requirements	9
4.7.1 General	9
4.7.2 Overfill detection and overpressurization	9
4.7.3 Loading and unloading process	10
4.7.4 Quantity and quality measurement	10
4.7.5 Sampling	11
4.7.6 Predicting LNG quality change due to ageing	11
5 Leak and fire management	11
5.1 Leak avoidance, detection and management	11
5.1.1 General	11
5.1.2 Avoidance	11
5.1.3 Gas detection	12
5.1.4 Management	12
5.2 Fire avoidance, detection and management strategies	13
5.2.1 Fire avoidance	13
5.2.2 Fire detection	13
5.2.3 Fire management	13
6 Layout considerations	13
6.1 Safety separation distances	13
6.2 Typical equipment layout	13
6.3 Buildings	13
7 Commissioning and start-up	14
8 Operations	15
8.1 Initial checks	15
8.2 Weighing before loading or unloading operation	15
8.3 Loading terminal	16
9 Stakeholder analysis	16
Bibliography	18

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 67, *Oil and gas industries including lower carbon energy*, Subcommittee SC 9, *Production, transport and storage facilities for cryogenic liquefied gases*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 282, *Installation and equipment for LNG*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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.

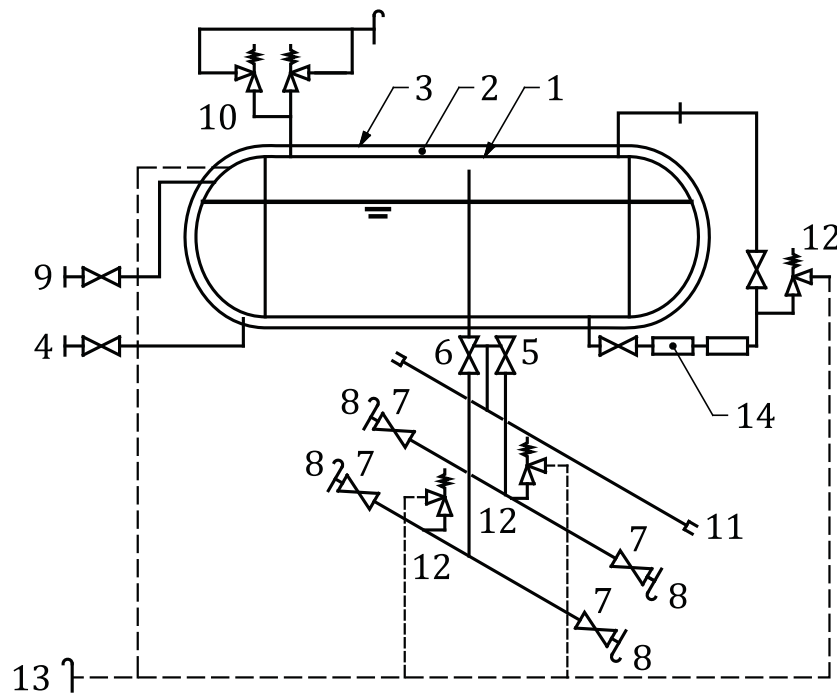
The tank shall be designed in order to withstand liquid nitrogen (for commissioning) temperatures on the low range and up to +50 °C on the high range.

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
- X— valve
- return line for thermal expansion
- 1 tank shell