SLOVENSKI STANDARD
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Napeljave in oprema za utekočinjeni zemeljski plin - Načrtovanje in preskušanje obalnih pretakališč - 2. del: Načrtovanje in preskušanje cevi za pretakanje

Installation and equipment for liquefied natural gas - Design and testing of marine transfer systems - Part 2: Design and testing of transfer hoses

Anlagen und Ausrüstung für Flüssigerdgas - Auslegung und Prüfung von Schiffsübergabesystemen - Teil 2: Auslegung und Prüfung von Übergabeschläuchen

Installations et équipements de gaz naturel liquéfié - Conception et essais des systèmes de transfert marins - Partie 2: Conception et essais des tuyaux de transfert

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Installation and equipment for liquefied natural gas - Design and testing of marine transfer systems - Part 2: Design and testing of transfer hoses

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Anlagen und AusrÃ1/4stung fÃ1/4r FlÃ1/4ssigerdgas - Auslegung und PrÃ1/4fung von SchiffsÃ1/4bergabesystemen - Teil 2: Auslegung und PrÃ1/4fung von Ã¿bergabeschlÃ¤uchen

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 1474-2:2019) has been prepared by Technical Committee CEN/TC 282 "Installation and equipment for LNG", the secretariat of which is held by AFNOR.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 1474-2:2008.

In comparison with the previous edition, the following technical modifications have been made:

— Update of the scope

— Review of Application and introduction of Hose Qualification Categories

— Revision of hose categories

— Review of design features

— Review of qualification requirements

— Review of Qualifty assurance and control

— Review of documentation

— Review of annexes

This series consists of 3 parts:

— EN 1474-1: *Installation and equipment for liquefied natural gas — Design and testing of marine transfer systems — Part 1: Design and testing of transfer arms*

(This standard has been superseded by EN ISO 16904 - Petroleum and natural gas industries - Design and testing of LNG marine transfer arms for conventional onshore terminals)

— EN 1474-2: *Installation and equipment for liquefied natural gas — Design and testing of marine transfer systems — Part 2: Design and testing of transfer hoses*

— EN 1474-3, *Installation and equipment for liquefied natural gas — Design and testing of marine transfer systems — Part 3: Offshore transfer systems*

1 Scope

This document gives general guidelines for the design, material selection, qualification, certification, and testing details of hose assemblies for Liquefied Natural Gas (LNG) marine transfer applications.

The transfer hose assemblies are part of transfer systems (it means that they may be fitted with ERS, QCDC, handling systems, hydraulic and electric components etc.) To avoid unnecessary repetition, cross-references to EN ISO 16904 and EN 1474-3 are made for all compatible items, and for references, definitions and abbreviations. Where additional references, definitions and abbreviations are required specifically for LNG hoses, they are listed in this European Standard.

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.

EN 1474-1:2008, *Installation and equipment for liquefied natural gas — Design and testing of marine transfer systems — Part 1: Design and testing of transfer arms*

EN 1474-3:2008, *Installation and equipment for liquefied natural gas - Design and testing of marine transfer systems - Part 3: Offshore transfer systems*

EN ISO 7369:2004, *Pipework - Metal hoses and hose assemblies - Vocabulary (ISO 7369:2004)*

EN ISO 8330:2014, *Rubber and plastics hoses and hose assemblies - Vocabulary (ISO 8330:2014)*

EN ISO 10619-1:2018, *Rubber and plastics hoses and tubing - Measurement of flexibility and stiffness - Part 1: Bending tests at ambient temperature (ISO 10619-1:2017)*

EN ISO 16904:2016, *Petroleum and natural gas industries - Design and testing of LNG marine transfer arms for conventional onshore terminals (ISO 16904:2016)*

3 Terms, definitions and abbreviations

3.1 Terms and Definitions

For the purposes of this document, the terms and definitions given in EN ISO 7369 and EN ISO 8330 and the following apply.

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

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
annular space
space between the inner fluid carrying layer and a second layer which can be used for insulation and/or safety purposes

3.1.2
armour layer
either a braid made of wires (see braid) or strips of metal or plastic used to provide pressure strength and/or external protection

3.1.3
axial stiffness
extent to which a hose assembly resists tensile deformation in response to an applied axial force

3.1.4
bend stiffness
ability of a flexible pipe to resist deflection when subjected to bending loads at constant tension, pressure and temperature

3.1.5
bend restrictor
device for limiting the bend radius by mechanical means

Note 1 to entry: A bend restrictor typically is comprised of a series of interlocking metallic or moulded rings, applied over the outer surface

3.1.6
bending stiffener
ancillary conical shaped component, which locally supports the pipe to limit bending stresses and curvature of the pipe to acceptance levels

Note 1 to entry: Bend stiffeners can be either attached to an end fitting or a support structure where the flexible pipe passes through the bend stiffener

3.1.7
boil-off gas
BOG
natural evaporation from liquefied natural gas due to vaporization

3.1.8
burst test
test conducted on a hose sample until it failed by internal pressurization

3.1.9
connector
part of the end fitting used to provide a leak-tight structural connection between the end fitting and adjacent piping

3.1.10
crush test
application of a vertical load through a beam placed laterally across the hose

3.1.11
double-envelope
layers or set of layers effecting the enclosure, and thus the isolation from the environment, of those structures, systems and components whose failure can lead to an unacceptable release of LNG

3.1.12
D
internal bore diameter of the hose assembly

3.1.13
dynamic load
flexible hose assembly or hose configuration that is subjected to loads that vary in time, or whose deflections or boundary conditions vary in time

3.1.14
emergency release system
ERS
system that provides a positive means of quick release of transfer system and safe isolation of LNG carrier and transfer system

Note 1 to entry: The ERS consists of an emergency release coupling (ERC) and interlocked isolating valves which automatically close on both sides, thereby containing the LNG or vapour in the lines (dry disconnect), and, if applicable, associated control system

3.1.15
end termination
Mechanical device which forms the transition between the flexible pipe body and the connector whose different pipe layers are terminated in the end fitting in such a way as to transfer the load between the flexible hose assembly and the connector

3.1.16
end fitting
assembly of connector and end termination

3.1.17
emergency release coupler
ERC
device to provide a means of quick release of the transfer system when such actions is required only as an emergency measure

3.1.18
fatigue life
number of cycles of a specified character that a given specimen sustains before failure of a specified nature occurs

3.1.19
Hose assembly
hose and its fittings

3.1.20
impact test
test for determining the impact strength of a material

3.1.21
L
length of flexible area of the hose assembly

3.1.22
leak detection system
system able to detect a failure / leak from the fluid carrying part of the hose

3.1.23
liquefied natural gas
LNG
natural gas that has been cooled and condensed into liquid form

3.1.24
Maximum allowable working pressure
MAWP
maximum pressure (gauge) across the entire specified temperature range to which the hose may be exposed and operated. It is commonly used by terminals to define their cargo system pressure capabilities (i.e. pump shut-in plus any static head or cargo system safety valve relief setting. This pressure rating is not expected to account for dynamic surge pressures, but does include nominal pressure variations during cargo transfer operations)

3.1.25
Non-destructive test
ND
test that is not expected to cause permanent damage to the hose assembly, so that the hose may be used in subsequent tests and for operation as well

3.1.26
proof pressure
pressure to which the hose is tested (i.e. during a Factory Acceptance Test) to demonstrate its structural integrity when subject to internal pressure.

Note 1 to entry: According to the IMO IGC Code this pressure test at ambient temperature shall be not less than 1,5 x MAWP and not more than two-fifths of its bursting pressure

3.1.27
pumping port
connection to attach a vacuum pump for vacuum insulated hoses

3.1.28
quick connect disconnect coupler
QCDC
manual or hydraulic mechanical device used to connect a transfer arm or hose to the cargo manifold without employing bolts

3.1.29
service life
period of time during which the hose assembly fulfils all performance requirements

3.1.30
static load
flexible hose assemblies not exposed to significant cyclically varying loads or deflections during normal operations

3.1.31
super-insulation
several high reflecting foils to reduce heat transfer via radiation as part of a vacuum insulation system

3.1.32
type approval certificate
certificate issued by an IVA confirming the suitability and appropriate limits on the manufacturer's design methodologies, manufacturing processes and materials. The name of this certificate may differ according to the IVA

3.1.33
visual inspection
Examination of parts and equipment for visible defects in material and workmanship

3.2 Abbreviations

FAT	factory acceptance test
FSRU	floating Storage Regasification Unit
IVA	Independent verification agency
LNGC	liquefied natural gas carrier
MAAT	Maximum allowable applied twist
MWL	Maximum working load

4 Applications and Qualification Categories

4.1 Applications

This section describes the main application using LNG transfer hose assemblies.

As industry and technology is developing, other type of application may consider using LNG transfer hose assemblies and shall be covered in this standard.

List of applications (not exhaustive):

— Offshore tandem FLNG offloading / loading aerial or floating;

— Ship-To-Ship transfer such as LNGC to FSRU, LNG Bunkering;

— Shore-To-Ship such as LNG bunkering;

— Ship-To-Shore such as offloading / loading.

Based on the applications, flexibles are not subject to same loads or fatigue phenomenon, therefore not requiring the same levels of qualification.

The following section introduces Hose assembly Qualification Categories (HQC).

NOTE Guidelines for the owners regarding applications and relevant HQL are available in Annex C. Selection of HQC remains the owner's responsibility.

4.2 Qualification Categories

This section establishes criteria for definition of Hose Qualification Categories for the hose assemblies covered by this specification. The Hose Qualification Categories specified below define different design verification requirements as per section 7.2.2.

The requirements of Qualification Categories define the basis for the qualification but are independent of each project specific data (metocean data, waves and current data,…) . During the qualification for a project the IVA

may require executing additional (fatigue) tests in order to determine if the proposed hose assembly is “Fit for Purpose”.

— Hose Qualification Category A

  This HQC is intended to be used for quasi-static applications (i.e. application only driven by handling and/or thermal and pressure fatigue).

  This category is including the performance requirements applicable to all aerial transfer hose assembly, typically transfer lines used in protected environment for intermittent usage without contact with water and with no or very limited dynamic motions.

— Hose Qualification Category B

  This HQC is intended to be used for dynamic applications driven by aerial transfer fatigue (bending, thermal and pressure).

  This Category is including the performance requirements applicable to all aerial transfer hose assembly and typically applicable for the lines used in combination of exposed environment and/or permanent usage and used in configurations with contact with permanent floating structures.

  In order to cover these applications where the lines will be used in dynamic environment with or without cryogenic fluid, fatigue test configuration shall be re representative of the real configuration (e.g. aerial STS transfer with U shape and saddle or catenary shape).

  The hose manufacturer shall propose a fatigue test program covering the targeted operating conditions and the operating window validated by the IVA (in terms of ship movements at manifold) will be based on this fatigue test program.

— Hose Qualification Category C

  This HQC is intended to be used for dynamic applications for submerged or floating hose assemblies.

  Qualification tests for this category includes representative tests of contact with water such as insulation, water tightness properties and permanent connection potential issues.

The hose manufacturer shall propose a fatigue assessment methodology, to be applied at project phase, verifying that the hose is fit for purpose for the intended application.

The methodology shall be validated by an IVA.

5 Description of typical LNG transfer hose assembly designs and accessories

5.1 General

This standard is addressing hose assemblies as a flange-to-flange component.

It means that all statements and requirements based on the hose assemblies shall be considered between conveyed fluid tightening surfaces at both ends.

5.2 Mandatory components

A LNG Transfer Hose assembly shall consist of the following:

— flexible hose

— associated end fittings

Hose extremity end fittings shall permit the mounting of a QCDC or a spool piece or permit direct connection to LNGC or LNG terminal or another hose assembly.

(A description of QCDC is given in EN ISO 16904, for transfer system reference is made to EN 1474-3).

Hose extremity end fittings shall permit the mounting of an emergency release system with valves and ERC (Emergency Release Coupler).

(A description of emergency release system is given in EN ISO 16904 and EN 1474-3).

— permanent identification marks

— hose handling device(s) (pad eye or lifting lugs, lifting collar, …),

Hose shall include necessary fittings for safe handling, coupling and uncoupling either from the LNGC or the onshore or offshore LNG terminal system as required by the system design (refer to EN 1474-3).

5.3 Optional components

A LNG Transfer Hose assembly may consist of the following:

— leak detection system

If required by the owner the hose shall incorporate leak detection system e.g. gaseous nitrogen bleeding in the annular space (see 5.11).

— insulation system (to minimize build-up of external ice)

— intermediate leak barrier(s)

— bending stiffeners or restrictors

— buoyancy

Specific supporting equipment

Hose may support (e.g. piggy back mounted) hydraulic or pneumatic hoses, electric cables for the powering of the ERS and QCDC systems (refer to EN ISO 16904:2016, Clause 6).

5.4 Typical construction of LNG transfer hose assemblies

5.4.1 Main hose categories

At present LNG transfer hose assemblies are categorized in three types according to their method of construction:

— those based on a reinforced corrugated metal hose construction, hereafter called corrugated metal hose;

— those based on a construction in which polymeric films and fabrics are entrapped between a pair of close wound helical wires, hereafter called composite hose;

— those based on a hose-in-hose construction with annular space and which can derivate from one of the above technologies.

— as the technology develops, other types of hose may become available and are also to be considered covered by this European Standard.