SLOVENSKI STANDARD
SIST EN 1474-3:2009

01-marec-2009

Napeljave in oprema za utekoļ injeni zemeljski plin - Naļ rtovanje in preskuġanje obalnih pretakaliġļ - 3. del: Pretakaliġļ a na morju

Installation and equipment for liquefied natural gas - Design and testing of marine transfer systems - Part 3: Offshore transfer systems

Anlagen und Ausrüstung für Flüssigerdgas - Auslegung und Prüfung von Schiffsübergabesystemen - Teil 3: Offshore Übergabesysteme

Installations et équipements de gaz naturel liquéfié - Conception et essais des systemes de transfert marins - Partie 3: Systemes de transfert offshore

Ta slovenski standard je istoveten z: **EN 1474-3:2008**

ICS:

75.200	Oprema za skladiġļ enje nafte, naftnih proizvodov in zemeljskega plina	Petroleum products and natural gas handling equipment

SIST EN 1474-3:2009 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1474-3

December 2008

ICS 75.200

English Version

Installation and equipment for liquefied natural gas - Design and testing of marine transfer systems - Part 3: Offshore transfer systems

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This European Standard was approved by CEN on 1 November 2008.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (EN 1474-3:2008) has been prepared by Technical Committee CEN/TC 282 “Installation and equipment for LNG”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2009, and conflicting national standards shall be withdrawn at the latest by June 2009.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This European Standard consists in 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*

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*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This European Standard gives general guidelines for the design of liquefied natural gas (LNG) transfer systems intended for use on offshore transfer facilities or on coastal weather exposed transfer facilities. The transfer facilities considered may be between floating units, or between floating and fixed units. The specific component details of the LNG transfer systems are not covered by this European Standard.

Reference is made to EN 1474-1 and EN 1474-2 where appropriate.

As a general statement the present standard applies to all transfer systems given in the scope. However, some transfer system designs may require a deviation from the full standard as described in normative Annex A.

2 Normative references

The following referenced documents are indispensable for the application 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 1473, *Installation and equipment for liquefied natural gas — Design of onshore installations*

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

EN 1474-2:2008, *Installation and equipment for liquefied natural gas — Part 2: Design and testing of transfer hoses*

EN 1532, *Installation and equipment for liquefied natural gas — Ship to shore interface*

EN 61511-1, *Functional safety — Safety instrumented systems for the process industry sector — Part 1: Framework, definitions, system, hardware and software requirements (IEC 61511-1:2003 + corrigendum 2004)*

EN 61511-2, *Functional safety — Safety instrumented systems for the process industry sector — Part 2: Guidelines for the application of IEC 61511-1 (IEC 61511-2:2003)*

EN 61511-3, *Functional safety — Safety instrumented systems for the process industry sector — Part 3: Guidance for the determination of the required safety integrity levels (IEC 61511-3:2003 + corrigendum 2004)*

EN ISO 9000, *Quality management systems — Fundamentals and vocabulary (ISO 9000:2005)*

EN ISO 9001, *Quality management systems — Requirements (ISO 9001:2000)*

3 Terms and definitions

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

3.1
attitude
various modes of use and/or location of the transfer system (i.e. manoeuvring, stowed, connected, washing, hydrostatic test and maintenance). The transfer system may take several positions for each attitude

NOTE Transfer system see 3.18.

3.2
bank of transfer lines
all the transfer lines on the transfer system

NOTE Transfer lines see 3.17.

3.3
cargo manifold (or manifold)
pipe assembly mounted on board LNG carrier to which the outboard flanges of the transfer system are connected

3.4
coupler
manual or hydraulic mechanical device used to connect the transfer system to the LNG carrier's manifold

NOTE This device, when not employing a bolted connection, is often also referred to as QCDC i.e. quick connect/disconnect coupler.

3.5
design pressure
pressure for which the transfer system is designed

3.6
design temperature
range of temperatures for which the transfer system is designed

3.7
emergency release coupling (ERC)
device to provide a means of quick release of the transfer system when such action is required only as an emergency measure

3.8
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. An ERS normally contain one or several ERC's

3.9
emergency shut down (ESD)
method that safely and effectively stops the transfer of LNG and vapour between the LNG carrier and the LNG terminal

3.10
envelope, operating (or operating envelope)
volume in which the presentation flange(s) of a (group of) transfer line(s) is (are) required to operate

3.11
LNGC mooring
LNGC mooring arrangement on the terminal

NOTE The possible mooring configuration includes: conventional mooring (jetty, quay, GBS/Gravity Base Structure, …), Multi-Buoy Mooring/Conventional Buoy Mooring (MBM/CBM, …), side-by-side mooring of two floating units, tandem mooring (single or double hawsers arrangement, "crowfoot" hawser arrangement, rigid or articulated yokes, …), DP (Dynamic Positioning) or semi DP systems.

3.12
LNGC First Order Motions
heave, pitch, roll, surge, sway, yaw

NOTE These motions apply as well for a floating LNG terminal.

3.13
LNGC Second Order Motions
other motions of the LNGC when moored on the LNG terminal that have to be taken into account in the design and operations like fishtailing, jack-knifing

NOTE These motions results from the behaviour of the ship due to the mooring configuration. They apply in combination with the LNGC motions in 3.12.

3.14
LNG terminal
LNG plant with liquefaction or re-gasification facilities

NOTE The LNG transfer system is part of the LNG plant. The LNG terminal is supporting the transfer system that can be onshore or offshore mounted on a fixed or floating structure with or without storage facility.

3.15
performance standard
statement, which can be expressed in qualitative or quantitative terms, of the performance required of a system, item of equipment, person or procedure, and which is used as the basis for establishing the design specification, manufacturing and installation for the safe operation through the life cycle of the installation

3.16
surge pressure
rapid change in pressure as a consequence of a change in flow rate in the transfer system

3.17
transfer line (or product line)
articulated piping, the transfer hose and swivels if any, or a combination of the piping and hose, allowing the transfer of LNG and natural gas between the LNGC and the LNG terminal

3.18
transfer system
LNG and natural gas transfer system, the transfer system comprises the transfer lines and all their supporting structure including the supporting structure on the LNG terminal, complete with all accessories, control/detection systems, energy supply

NOTE The transfer systems have typically mobile and fixed parts.

4 Definition and ability of the LNG transfer systems

4.1 System requirement

A description of the system and the operation shall be established.

Any system for offshore or coastal weather exposed operations, including LNG-C mooring and transfer systems, has to be considered as new development, should it incorporate arms or hoses. Development of specific performance standards for compliance would be required. These performance standards would be developed based on risk assessment techniques (see Clause 5).

4.2 Overall safety philosophy

An overall safety philosophy shall be established and documented by the owner, reflecting applicable legislation, owner requirements, industry standards and best practices. The overall safety philosophy shall address the risk categorisation and also acceptance criteria. It shall be complemented as necessary, prior to commissioning, with vendor specific recommendation concerning precautions for use of the systems or parts of it. It shall be consistent with the terminal general safety philosophy.

4.3 Overall functional targets and requirements

The overall functional requirements for the cargo transfer system shall be identified and documented. As a minimum the following capabilities shall be addressed for the different operational phases:

— berthing configuration (tandem or side by side or single point mooring, …);

— additional requirements to the manifold on the LNG carrier when required (e.g. tandem or single point mooring offloading);

— berthing and mooring procedure;

— procedure for connection, transfer and disconnect including emergency release;

— process of monitoring and management of continual relative movements between vessels (CPMS, telemetry etc.);

— procedure and facilities handling, lifting and storing of transfer equipment;

— transfer capacities for LNG and vapour return (volume flow, pressure, temperature);

— availability requirements;

— requirements for the ESD system (sequence, timing, process responses);

— regulatory requirements;

— requirements related to local regulations, flag if any;

— owner QA requirements, such as classification, certification requirements.

4.4 Design principles and risk assessment methodology

A risk assessment shall be conducted as part of the overall assessment of the LNG transfer system. In general for the overall system assessment the following objectives would apply:

— evaluation of the design and operational procedures;

— determination of the limiting conditions for the offloading operations;

— assessment of safety and operability via risk assessment techniques;

— determination of regulatory compliance (certification, classification): this section describes the design principles and the approach to establish design requirements for the transfer system.

Risks shall be assessed in accordance with recognized methods and risk studies shall be performed by qualified and competent persons with the necessary understanding of risk, and the risk assessment process. The risk assessment methodology and tools, assumptions, and system boundary limits shall be clearly documented.

A risk based approach shall be used to ensure that:

— critical elements and operations are identified;

— performance standards are defined when applicable;

— controls and mitigating measures are identified;

— aspects of new technology, as defined below, are identified and qualified according to requirements in Clause 5.

In this context, new technology is defined as technology that is not proven. Proven technology has a documented track record for a defined application. Information guidance can be found in the Bibliography.

The identification of new technology should be done by dividing the technology into manageable elements and classifying the technology elements with respect to newness according to Table 1 considering the status of the technology as such, and its application area.

Table 1 — Example for classifying the technology elements

Application area	Technology status		
	Proven	Limited field history	New or unproven
Known	1	2	3
New	2	3	4

This classification implies the following:

1) no new technical uncertainties;

2) new technical uncertainties;

3) new technical challenges;

4) demanding new technical challenges.

This classification applies to the totality of the applied technology as well as each separate part, function and subsystem forming it. It shall be used to highlight where care needs to be taken due to limited field history. Technology in Class 1 is proven technology where proven methods for qualification, tests, calculations and analysis can be used to document margins. Technology defined as Class 2 to 4 is defined as new technology, and shall be qualified according to Clause 5. The distinguishing between 2, 3 and 4 makes it possible to focus on the areas of concern.

4.5 Design principles

The following principles shall apply in addition to the identified requirements from a risk assessment:

General

1) Transfer system shall be designed, constructed and maintained with sufficient integrity to withstand operational and environmental loading throughout the system lifecycle, refer to Clause 6).

2) Systems and structures shall be designed with suitable functionality and survivability for prevention, detection, control and mitigation of foreseeable accident events affecting the installation.

3) Systems and structures shall be designed in compliance with internationally accepted codes and standards.

4) Where novel transfer solutions (new technology or novel application of known technology) are intended to be used, this technology is to undergo a recognized qualification procedure. Refer to Clause 5.