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Installation and equipment for liquefied natural gas — Design of onshore installations

National foreword

This British Standard is the UK implementation of EN 1473:2021. It supersedes BS EN 1473:2016, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GSE/38, Installation and equipment for LNG.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Anlagen und Ausrüstung für Flüssigerdgas - Auslegung von landseitigen Anlagen

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European foreword

This document (EN 1473:2021) 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of an identical text or by endorsement, at the latest by November 2021, and conflicting national standards shall be withdrawn at the latest by November 2021.

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

This document supersedes EN 1473:2016.

Due to the incorporation of pressurized storage the standard has been re-structured and revised. In comparison with EN 1473:2016, the following changes have been made:

— duplications detected and deleted;

— terms and definitions adjusted;

— normative references updated;

— changed subject in Annex H;

— risk assessment requirements improved;

— storage tanks classification improved.

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

Introduction

The objective of this document is to give functional guidelines for on-shore LNG installations. It recommends procedures and practices that will result in safe and environmentally acceptable design, construction and operation of LNG plants.

Given the wide range of facilities from small to large, with high and low risk profile, etc., the acceptability criteria could vary depending on the project and are subject to conclusions by the normative risk assessment.

Seveso, PED, and ATEX Directives are expected to be followed. Where national and/or local regulations exist in which some of the requirements are equal or more stringent than in this document, it is up to agreement with national and/or local regulators to determine which of the requirements apply.

It does not need to be applied retrospectively, but application is recommended when major modifications of existing installations are being considered.

This document is also recommended for debottlenecking, revamping and plant life extension in the limits that will be defined by the local authority. The appliance of the European Directives to the existing facilities is part of the limits to be defined together with the local authority.

In case of plant expansion, this document is applicable for the new facilities. The application of these recommendations for the tie-ins and connections to the existing facilities will be defined by the local authority. The limits of such application should consider the practicality of such appliance. In the same way, the limits of the European Directives appliance will be accurately defined with the local authority.

1 Scope

This document gives guidelines for the design, construction and operation of all onshore liquefied natural gas (LNG) installations for the liquefaction, storage, vaporization, transfer and handling of LNG and natural gas (NG).

This document is applicable for plants with an LNG storage capacity above 200 t.

The designated boundary limits are LNG inlet/outlet by the ship's manifold including vapour return connection, the truck loading/unloading connection including vapour return, the rail car loading/unloading connection including vapour return and the natural gas in and outlet boundary by piping systems.

Terminals or plant types have one or more boundary limits as described in this scope (see Figure 1).

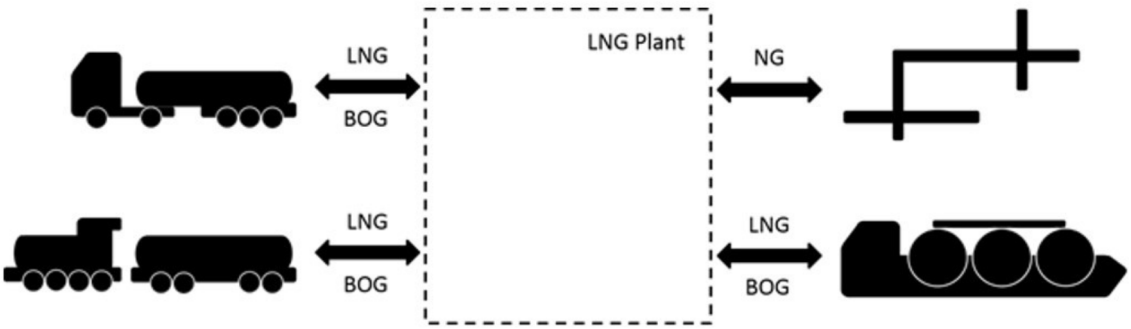

Figure 1 — Boundary limits of onshore liquefied natural gas (LNG) installations

A short description of each of these installations is given in Annex G.

Feed gas for LNG liquefaction installations (plant) can be from gas field, associated gas from oil field, piped gas from transportation grid or from renewables.

Floating solutions (for example FPSO, FSRU, SRV), whether off-shore or near-shore, are not covered by this document even if some concepts, principles or recommendations could be applied. However, in case of berthed FSRU with LNG transfer across the jetty, the following recommendations apply for the jetty and topside facilities.

In case of solutions using floating storage unit (FSU) and land-based re-gasification solution, the on-shore part is covered by these standard recommendations.

Plants with a storage inventory from 5 t up to 200 t are covered by [5].

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 809, *Pumps and pump units for liquids - Common safety requirements*

EN 1092-1, *Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN designated - Part 1: Steel flanges*

EN 1127-1, *Explosive atmospheres - Explosion prevention and protection - Part 1: Basic concepts and methodology*

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 1514-1, *Flanges and their joints - Dimensions of gaskets for PN-designated flanges - Part 1: Non-metallic flat gaskets with or without inserts*

EN 1591 (all parts), *Flanges and their joints - Design rules for gasketed circular flange connections*

EN 1776, *Gas infrastructure - Gas measuring systems - Functional requirements*

EN 1990, *Eurocode - Basis of structural design*

EN 1991 (all parts), *Eurocode 1: Actions on structures*

EN 1992 (all parts), *Eurocode 2: Design of concrete structures*

EN 1993 (all parts), *Eurocode 3: Design of steel structures*

EN 1994-1-1, *Eurocode 4: Design of composite steel and concrete structures - Part 1-1: General rules and rules for buildings*

EN 1994-1-2, *Eurocode 4 - Design of composite steel and concrete structures - Part 1-2: General rules - Structural fire design*

EN 1997-1:2004,[1] *Eurocode 7: Geotechnical design - Part 1: General rules*

EN 1997 (all parts), *Eurocode 7 - Geotechnical design*

EN 1998 (all parts), *Eurocode 8: Design of structures for earthquake resistance*

EN 10204, *Metallic products - Types of inspection documents*

EN 12065, *Installations and equipment for liquefied natural gas - Testing of foam concentrates designed for generation of medium and high expansion foam and of extinguishing powders used on liquefied natural gas fires*

EN 12162, *Liquid pumps - Safety requirements - Procedure for hydrostatic testing*

[1] As impacted by EN 1997-1:2004/AC:2009.

EN 12483, *Liquid pumps - Pump units with frequency inverters - Guarantee and compatibility tests*

EN 13445 (all parts), *Unfired pressure vessels*

EN 13458 (all parts), *Cryogenic vessels - Static vacuum insulated vessels*

EN 13480 (all parts), *Metallic industrial piping*

EN 13766, *Thermoplastic multi-layer (non-vulcanized) hoses and hose assemblies for the transfer of liquid petroleum gas and liquefied natural gas - Specification*

EN 14197 (all parts), *Cryogenic vessels - Static non-vacuum insulated vessels*

EN 14620 (all parts), , *Design and manufacture of site built, vertical, cylindrical, flat-bottomed steel tanks for the storage of refrigerated, liquefied gases with operating temperatures between 0 °C and -165 °C*

EN 60079-0, *Explosive atmospheres - Part 0: Equipment - General requirements (IEC 60079-0)*

EN 60079-1, *Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures "d" (IEC 60079-1)*

EN 60079-2, *Explosive atmospheres - Part 2: Equipment protection by pressurized enclosure "p" (IEC 60079-2)*

EN 60079-5, *Explosive atmospheres - Part 5: Equipment protection by powder filling "q" (IEC 60079-5)*

EN 60079-6, *Explosive atmospheres - Part 6: Equipment protection by liquid immersion "o" (IEC 60079-6)*

EN 60079-7, *Explosive atmospheres - Part 7: Equipment protection by increased safety "e" (IEC 60079-7)*

EN 60079-10-1, *Explosive atmospheres - Part 10-1: Classification of areas - Explosive gas atmospheres (IEC 60079-10-1)*

EN 60079-10-2, *Explosive atmospheres - Part 10-2: Classification of areas - Explosive dust atmospheres (IEC 60079-10-2)*

EN 60079-11, *Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i" (IEC 60079-11)*

EN 60079-13, *Explosive atmospheres - Part 13: Equipment protection by pressurized room "p" and artificially ventilated room "v" (IEC 60079-13)*

EN 60079-14, *Explosive atmospheres - Part 14: Electrical installations design, selection and erection (IEC 60079-14)*

EN 60079-15, *Explosive atmospheres - Part 15: Equipment protection by type of protection "n" (IEC 60079-15)*

EN 60079-17, *Explosive atmospheres - Part 17: Electrical installations inspection and maintenance (IEC 60079-17)*

EN 60079-18, *Explosive atmospheres - Part 18: Equipment protection by encapsulation "m" (IEC 60079-18)*

EN 60079-19, *Explosive atmospheres - Part 19: Equipment repair, overhaul and reclamation (IEC 60079-19)*

EN 60079-20-1, *Explosive atmospheres - Part 20-1: Material characteristics for gas and vapour classification - Test methods and data (IEC 60079-20-1)*

EN 60079-25, *Explosive atmospheres - Part 25: Intrinsically safe electrical systems (IEC 60079-25)*

EN 60204-1, *Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1)*

EN 60529, *Degrees of protection provided by enclosures (IP Code) (IEC 60529)*

EN 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems (IEC 61508 series)*

EN 61800 (all parts), *Adjustable speed electrical power drive systems (IEC 61800 all parts)*

EN 62305 (all parts), *Protection against lightning (IEC 62305 all parts)*

EN ISO 1460, *Metallic coatings - Hot dip galvanized coatings on ferrous materials - Gravimetric determination of the mass per unit area (ISO 1460)*

EN ISO 1461, *Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods (ISO 1461)*

EN ISO 3452-1, *Non-destructive testing - Penetrant testing - Part 1: General principles (ISO 3452-1)*

EN ISO 6974 (all parts), *Natural gas - Determination of composition with defined uncertainty by gas chromatography (ISO 6974 all parts)*

EN ISO 6976, *Natural gas - Calculation of calorific values, density, relative density and Wobbe indices from composition (ISO 6976)*

EN ISO 9606-1, *Qualification testing of welders - Fusion welding - Part 1: Steels (ISO 9606-1)*

EN ISO 9712, *Non-destructive testing - Qualification and certification of NDT personnel (ISO 9712)*

EN ISO 9906, *Rotodynamic pumps - Hydraulic performance acceptance tests - Grades 1, 2 and 3 (ISO 9906)*

EN ISO 10380, *Pipework - Corrugated metal hoses and hose assemblies (ISO 10380)*

EN ISO 10497, *Testing of valves - Fire type-testing requirements (ISO 10497)*

EN ISO 10715, *Natural gas - Sampling guidelines (ISO 10715)*

EN ISO 10723, *Natural gas - Performance evaluation for analytical systems (ISO 10723)*

EN ISO 12241, *Thermal insulation for building equipment and industrial installations - Calculation rules (ISO 12241)*

EN ISO 12944 (all parts), *Paints and varnishes - Corrosion protection of steel structures by protective paint systems (ISO 12944 all parts)*