

Nadomešča:**SIST EN 14620-1:2007**

Konstruiranje in proizvodnja na mestu postavitve grajenih pokončnih, valjastih jeklenih posod z ravnim dnom za shranjevanje hlajenih utekočinjenih plinov z delovnimi temperaturami med 0 °C in -196 °C - 1. del: Splošno

Design and manufacture of site built, vertical, cylindrical, flat-bottomed tank systems for the storage of refrigerated, liquefied gases with operating temperatures between 0 °C and -196 °C - Part 1: General

Auslegung und Herstellung standortgefertigter, stehender, zylindrischer Flachboden-Tanksysteme für die Lagerung von tiefkalt verflüssigten Gasen bei Betriebstemperaturen zwischen 0 °C und -196 °C - Teil 1: Allgemeines

Conception et fabrication de réservoirs cylindriques fond plat, verticaux, construits sur site, destinés au stockage des gaz réfrigérés, liquéfiés, dont les températures de service sont comprises entre 0 °C et -196 °C - Partie 1 : Généralités

Ta slovenski standard je istoveten z: EN 14620-1:2024

ICS:

23.020.10	Nepremične posode in rezervoarji	Stationary containers and tanks
-----------	----------------------------------	---------------------------------

SIST EN 14620-1:2024**en,fr,de**

EUROPEAN STANDARD

EN 14620-1

NORME EUROPÉENNE

EUROPÄISCHE NORM

May 2024

ICS 23.020.10

Supersedes EN 14620-1:2006

English Version

Design and manufacture of site built, vertical, cylindrical,
flat-bottomed tank systems for the storage of refrigerated,
liquefied gases with operating temperatures between 0 °C
and -196 °C - Part 1: General

Conception et fabrication de réservoirs cylindriques
fond plat, verticaux, construits sur site, destinés au
stockage des gaz réfrigérés, liquéfiés, dont les
températures de service sont comprises entre 0 °C et -
196 °C - Partie 1 : Généralités

Auslegung und Herstellung standortgefertigter,
stehender, zylindrischer Flachboden-Tanksysteme für
die Lagerung von tiefkalt verflüssigten Gasen bei
Betriebstemperaturen zwischen 0 °C und -196 °C - Teil
1: Allgemeines

This European Standard was approved by CEN on 16 March 2024.

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-CENELEC 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-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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, Türkiye and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Contents	Page
European foreword	4
1 Scope	6
2 Normative references	7
3 Terms and definitions	8
3.1 General	8
3.2 Components	9
3.3 Design	12
3.4 Operation	13
3.5 Other	14
4 Concept selection	14
4.1 Types of tank systems	14
4.1.1 General	14
4.1.2 Single containment system	14
4.1.3 Double containment system	15
4.1.4 Full containment system	15
4.1.5 Membrane containment system	15
4.2 Risk assessment based tank system selection	21
4.2.1 General	21
4.2.2 Site selection	21
4.2.3 Key drivers for tank system selection	21
4.2.4 Hazard identification	22
4.2.5 Risk assessment methodology	24
4.2.6 Changes	25
4.2.7 Determination of actions	25
5 Quality assurance and quality control	26
6 Health, safety and environment	26
6.1 Health, safety	26
6.2 Environmental	26
7 General design considerations	26
7.1 General	26
7.1.1 Responsibilities	26
7.1.2 Performance criteria	27
7.1.3 Limit state and allowable stress theory	27
7.1.4 Earthquake design	28
7.1.5 Tightness	29
7.1.6 Permanent openings in the primary, secondary, purge gas, warm vapour containers and membrane containment system	30
7.1.7 Attachments to primary and secondary containers and membrane containment system	32
7.1.8 Liquid levels and capacities	32
7.1.9 Cool-down	33
7.1.10 Foundation	34
7.1.11 Foundation heating system	35
7.1.12 Thermal Protection System (TPS) of concrete secondary liquid container	36

7.1.13	Bund wall.....	36
7.1.14	Lightning.....	36
7.1.15	Vertical anchors	36
7.2	Protection systems.....	37
7.2.1	Instrumentation.....	37
7.2.2	Pressure and vacuum protection.....	39
7.2.3	Fire protection.....	40
7.3	Actions (loadings).....	40
7.3.1	General	40
7.3.2	Normal actions.....	40
7.3.3	Accidental actions.....	42
7.3.4	Action combinations.....	44
7.3.5	Loads from ancillary components	44
8	Inspection and maintenance	44
9	Marking and documentation	44
9.1	Nameplates	44
9.2	Certification.....	47
9.3	Handover documentation.....	47
	Annex A (informative) Physical properties of gases.....	48
	Annex B (normative) Design information	49
	Annex C (normative) Seismic analysis.....	51
	Annex D (informative) Tank heating system.....	55
	Annex E (informative) Recommendations for geotechnical investigations and seismic hazard evaluation.....	57
	Annex F (informative) Guidance for duties and responsibilities between parties.....	63
	Bibliography	65

EN 14620-1:2024 (E)**European foreword**

This document (EN 14620-1:2024) has been prepared by Technical Committee CEN/TC 265 “Metallic tanks for the storage of liquids”, the secretariat of which is held by BSI.

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 2024, and conflicting national standards shall be withdrawn at the latest by November 2024.

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 14620-1:2006.

EN 14620-1:2024 includes the following significant technical changes with respect to EN 14620-1:2006:

- general editorial update;
- standard boundaries are defined in the scope and applicability extended to -196 °C ;
- terms and definitions adjusted;
- normative references updated;
- description of various tank system concepts updated;
- risk assessment requirements improved;
- liquid levels and capacities clarified;
- foundation requirements updated and allowable foundation settlement requirements added;
- secondary containment design requirements clarified;
- earthquake requirements clarified;
- new chapter on marking and documentation added;
- new informative annex with recommendation for geotechnical investigation and seismic hazard evaluation added;
- design requirements for permanent openings, improved.

A list of all parts in the EN 14620 series, “*Design and manufacture of site built, vertical, cylindrical, flat-bottomed tank systems for the storage of refrigerated, liquefied gases with operating temperatures between 0 °C and -196 °C* ”, can be found on the CEN website.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

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, Türkiye and the United Kingdom.

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[SIST EN 14620-1:2024](https://standards.iteh.ai/catalog/standards/sist/e39b6a32-7e6b-4fc8-87fb-99b90f5d3c47/sist-en-14620-1-2024)

<https://standards.iteh.ai/catalog/standards/sist/e39b6a32-7e6b-4fc8-87fb-99b90f5d3c47/sist-en-14620-1-2024>

EN 14620-1:2024 (E)

1 Scope

This document is a specification for vertical, cylindrical tank systems, built on site, above ground and of which either the primary liquid container or the liquid tight barrier is made of steel. The secondary liquid container, if applicable, can be of steel or of concrete or a combination of both. A primary liquid container made of pre-stressed concrete is excluded from the scope of this document.

This document provides general requirements and specifies principles and application rules for the structural design of the tank system during construction, testing, commissioning, operation (accidental included), and decommissioning. This document applies to all tank system components attached to and located within the liquid, vapour, purge gas, membrane or membrane tank outer containers of the tank system. It does not address the requirements for ancillary equipment such as pumps, pumpwells, valves, instrumentation, external staircases and walkways, roof mounted platforms, external pipe supports, etc. The requirements for those components are covered by the relevant European Standards, structurally designed in accordance with Eurocodes where appropriate, and meeting applicable safety regulations.

This document also does not address tank system operating procedures unless specified for determination of the relevant resistance and protection criteria for the tank systems. It specifies minimum performance requirements for the tank system, tank system foundation and protection systems. From a process piping standpoint, the scope of this document is limited to the following boundaries:

- a) the face of the first flange outside of the tank in bolted flanged connection;
- b) the first threaded joint outside of the tank in threaded connection;
- c) the first circumferential pipe welded joint outside of the tank in welding-end pipe connection, which does not have a flange.

This document is applicable to storage tank systems designed to store products, having an atmospheric boiling point below ambient temperature, in a dual phase, i.e. liquid and vapour. The equilibrium between liquid and vapour phases being maintained by cooling down the product to a temperature equal to, or just below, its atmospheric boiling point in combination with a slight overpressure in the storage tank system.

The maximum design pressure of the tank systems covered by this document is limited to 500 mbar. For higher pressures, reference can be made to EN 13445, Parts 1 to 5.

The operating range of the gases to be stored is between 0 °C and -196 °C.

The tank systems covered by this document are used to store large volumes of hydrocarbon products, ammonia and other non-hydrocarbon gases with low temperature boiling points, generally called "Refrigerated Liquefied Gases" (RLGs). Typical products stored in the tank systems are: methane, ethane, propane, butane, ethylene, propylene, butadiene (this range includes the Liquefied Natural Gas (LNG's) and Liquefied Petroleum Gas (LPG's)), ammonia, nitrogen, oxygen and argon.

NOTE Properties of the gases are given in Annex A.

The requirements of this document cannot cover all details of design and construction because of the variety of sizes and configurations that may be employed. Where complete requirements for a specific design are not provided, the intention is for the designer, subject to approval of the purchaser's authorized representative and of the regulatory body, to provide design and details that are as safe as those laid out in this document.

EN 14620 consists of multiple parts. This document specifies general requirements for the tank system concept, selection and general design considerations.

In case of a conflict between general requirements of this document and the requirements in other parts of EN 14620 related to a specific liquefied gas, the product-specific requirements set forth in the other parts prevail.

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 1990:2023, *Eurocode — Basis of structural and geotechnical design*

EN 1991-1-3:2003,¹ *Eurocode 1 — Actions on structures — Part 1-3: General actions - Snow loads*

EN 1991-1-4:2005,² *Eurocode 1: Actions on structures — Part 1-4: General actions - Wind actions*

EN 1991-1-6:2005,³ *Eurocode 1 — Actions on structures Part 1-6: General actions - Actions during execution*

EN 1997-1:2004,⁴ *Eurocode 7: Geotechnical design — Part 1: General rules*

EN 1998-1:2004,⁵ *Eurocode 8: Design of structures for earthquake resistance — Part 1: General rules, seismic actions and rules for buildings*

EN 1998-4:2006, *Eurocode 8 — Design of structures for earthquake resistance — Part 4: Silos, tanks and pipelines*

EN 1998-5:2004, *Eurocode 8: Design of structures for earthquake resistance — Part 5: Foundations, retaining structures and geotechnical aspects*

EN 14620-2:2006, *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 — Part 2: Metallic components*

EN 14620-3:2006, *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 — Part 3: Concrete components*

EN 14620-4:2006, *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 — Part 4: Insulation components*

EN 14620-5:2006, *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 — Part 5: Testing, drying, purging and cool-down*

EN ISO 28300:2008, *Petroleum, petrochemical and natural gas industries — Venting of atmospheric and low-pressure storage tanks (ISO 28300:2008)*

¹ As impacted by EN 1993-1-3:2003/AC:2009 and EN 1993-1-3:2003/A1:2015.

² As impacted by EN 1993-1-4:2005/A1:2010 and EN 1993-1-4:2005/AC:2010.

³ As impacted by EN 1991-1-6:2005/AC:2013.

⁴ As impacted by EN 1997-1:2004/A1:2013.

⁵ As impacted by EN 1998-1:2004/AC:2009 and EN 1998-1:2004/A1:2013.

EN 14620-1:2024 (E)**3 Terms and definitions**

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

ISO and IEC maintain terminological 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 General**3.1.1****double containment tank system**

liquid and vapour tight primary container, which itself is a single containment tank system, built inside a liquid tight secondary container

Note 1 to entry: See 4.1.3.

3.1.2**full containment tank system**

liquid tight primary container and a liquid and vapour tight secondary container, which together form an integrated storage tank system

Note 1 to entry: See 4.1.4.

Note 2 to entry: For an open top primary container the secondary container contains the vapour in normal operation. The secondary container ensures controlled venting in case of the primary container leakage for any primary container configuration.

3.1.3**hazard**

event having the potential to cause harm, including ill health and injury, damage to property, products or the environment, production losses or increased liabilities

3.1.4**membrane containment tank system**

metallic liquid barrier (membrane) together with load bearing thermal insulation and a self- supporting membrane tank outer container jointly forming an integrated, composite system

Note 1 to entry: See 4.1.5.

3.1.5**risk**

measure of the combination (usually the product) of the probability or frequency of occurrence of a defined hazard and the magnitude of the consequences of the occurrence

[SOURCE: EN 1991-1-7:2006/A1:2014, 1.5.13]

3.1.6**single containment tank system**

tank system having only one self-supporting steel tank (primary liquid container) capable of storing liquid product

Note 1 to entry: The product vapour is contained by the primary container or by means of a metallic outer tank. See also 4.1.2.

3.1.7

tank system

equipment designed for the purpose of storing refrigerated liquefied gas (RLG) consisting of one or more containers together with all other necessary components within the scope of this document

3.2 Components

3.2.1

annular space

space between the primary liquid container and the outer tank

3.2.2

base slab

continuous concrete base supporting the tank system (either on the ground or elevated)

3.2.3

bund wall

low construction of earth or concrete surrounding the storage tank system at a considerable distance to contain spilled liquid

3.2.4

foundation

elements of the construction that comprise the base slab, ring-wall, pile system or other engineered elements required to support the tank system and contents

3.2.5

insulation space

volume containing insulation material in the tank system annular space, and between the tank system bottoms or roofs

3.2.6

insulation system

component of the tank system consisting of a complete package of insulation material and, when applicable, components for the insulation material fixing and protection to limit heat in-leak in the tank system and maintain RLG in the liquefied state at pressure close to atmospheric

3.2.7

liner

metallic plate installed against the inside of the concrete outer tank, impervious to product vapour and water vapour

3.2.8

liquid barrier

parts of the tank system which prevents direct contact of refrigerated liquefied gas (RLG) with other components of the system but does not have structural capabilities to independently carry liquid load

3.2.9

load bearing insulation

thermal insulation with special properties capable of transferring loads to the appropriate load bearing structures

EN 14620-1:2024 (E)**3.2.10****membrane**

part of a membrane containment tank system that, during normal operation, forms a liquid and vapour tight barrier

3.2.11**membrane tank outer container**

the part of a membrane containment tank system that carries liquid and pressure loads during normal operation and may contain liquid in the event of liquid leakage from the membrane

Note 1 to entry: The membrane tank outer container type M-CC ensures controlled venting in the case of a membrane leakage.

3.2.12**moisture barrier**

layer to prevent entry of water vapour and other atmospheric gases into the insulation or into the outer tank

3.2.13**outer tank**

self-supporting cylindrical secondary liquid container, purge gas container or warm vapour container made of steel or concrete

3.2.14**pressure relief valve**

valve designed to open and relieve excess pressure and to reclose and prevent the further flow of fluid out after normal conditions have been restored

3.2.15**primary liquid container**

part of a single, double or full containment tank system that contains the liquid during normal operation

3.2.16**purge gas container**

parts of a tank system that contain only purge gas and are not expected to function after exposure to product temperature

3.2.17**ringbeam**

circular support under the shell of the tank

3.2.18**roof**

structure on top of a shell or wall containing the vapour pressure and sealing off the contents from the atmosphere

3.2.19**secondary liquid container**

part of a double or a full containment tank system that contains the liquid in the event of leakage from the primary liquid container

3.2.20**self-supporting tank**

container designed to independently carry the liquid and the vapour pressure loads as well as the external loads, where applicable

3.2.21**shell**

metallic vertical cylinder

3.2.22**suspended roof**

structure for supporting the internal insulation of the roof

3.2.23**Thermal Protection System****TPS**

thermally insulating and liquid tight system to protect the concrete secondary liquid container or the membrane tank outer container against low temperatures in the event of leakage through primary liquid container or the membrane respectively

Note 1 to entry: The TPS is a part of a secondary containment system.

Note 2 to entry: Examples include bottom and bottom corner (see also 7.1.12).

3.2.24**vacuum relief valve**

valve designed to open and relieve negative pressure (vacuum) and then reclose to prevent further inflow of fluid after normal conditions have been restored

3.2.25**vapour barrier**

impermeable layer to prevent escape of product vapours from the tank system

3.2.26**vapour container**

part of a single, double, full containment or membrane tank systems that contains the vapour during normal operation

3.2.27**warm vapour container**

parts of a tank system that contain product vapour, and prevent entry of water vapour and other atmospheric gases during normal operation but are not expected to function once exposed to refrigerated product temperature

Note 1 to entry: This includes fixed roofs over suspended insulation roof and the outer container of a double wall, open top single containment tank system.

EN 14620-1:2024 (E)**3.3 Design****3.3.1
action**

mechanical influence on a structure, or a structural member, exerted directly or indirectly from its environment

Note 1 to entry: See EN 1990:2023, 3.1.3.2, 3.1.3.3, 3.1.3.5 to 3.1.3.10 for definitions of specific actions.

[SOURCE: EN 1990:2023, 3.1.3.1]

**3.3.2
design metal temperature**

minimum temperature for which the metal component is designed

**3.3.3
design negative pressure**

maximum permissible negative pressure (vacuum)

**3.3.4
design pressure**

maximum permissible pressure

**3.3.5
design service life**

assumed period for which a structure or part of it is to be used for its intended purpose with anticipated maintenance but without major repair being necessary

[SOURCE: EN 1990:2023, 3.1.2.11]

**3.3.6
lodmat**

lowest one-day average ambient temperature

Note 1 to entry: The average temperature is half the sum of the maximum and minimum temperature.

**3.3.7
maximum design liquid level****DLL**

maximum liquid level which shall not be exceeded and is used for the static design

**3.3.8
minimum design temperature**

assumed temperature of the product, specified by the purchaser, for which the tank system is designed

Note 1 to entry: This temperature can be lower than the actual product temperature.

**3.3.9
Operating Basis Earthquake****OBE**

maximum earthquake event for which no damage is sustained and restart and safe operation can continue