

Tanks for the transport of dangerous goods - Metallic
pressure tanks - Design and construction

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 14025:2013+A1:2016 sisaldab Euroopa standardi EN 14025:2013+A1:2016 ingliskeelset teksti.	This Estonian standard EVS-EN 14025:2013+A1:2016 consists of the English text of the European standard EN 14025:2013+A1:2016.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 22.06.2016.	Date of Availability of the European standard is 22.06.2016.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 13.300, 23.020.20

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:

Aru 10, 10317 Tallinn, Eesti; koduleht www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:

Aru 10, 10317 Tallinn, Estonia; homepage www.evs.ee; phone +372 605 5050; e-mail info@evs.ee

English Version

Tanks for the transport of dangerous goods - Metallic pressure tanks - Design and construction

Citernes destinées au transport de matières
dangereuses - Citernes métalliques sous pression -
Conception et fabrication

Tanks für die Beförderung gefährlicher Güter -
Metallische Drucktanks - Auslegung und Bau

This European Standard was approved by CEN on 31 August 2013 and includes Amendment 1 approved by CEN on 29 April 2016.

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

European foreword.....	4
1 Scope.....	5
2 Normative references.....	5
3 Terms, definitions and symbols.....	7
3.1 Terms and definitions	7
3.2 Symbols.....	7
4 Materials.....	8
4.1 General.....	8
4.2 Compatibility	9
5 Design.....	9
5.1 General.....	9
5.2 Minimum shell thickness	9
5.3 Reduction of shell thickness.....	9
5.4 Protection of the shell	10
5.5 Protection of equipment.....	10
5.6 Other design requirements	11
6 Calculation.....	11
6.1 General.....	11
6.1.1 General.....	11
6.1.2 Calculation scheme for the wall thickness of metallic pressure tanks of RID/ADR Chapter 6.8.....	11
6.1.3 Calculation scheme for the wall thickness of metallic portable pressure tanks of RID/ADR chapter 6.7	12
6.2 Design criteria.....	13
6.3 Calculation for internal pressure	15
6.3.1 General.....	15
6.3.2 Wall thickness of the cylindrical section	15
6.3.3 Wall thickness of ends.....	15
6.3.4 Wall thickness of conical sections.....	19
6.3.5 Openings and reinforcements.....	21
6.3.6 Manhole covers.....	28
6.3.7 Flanges, joints, bolts.....	33
6.4 Calculation for external pressure.....	34
6.4.1 General.....	34
6.4.2 Tanks, where external over pressure is part of operating conditions	35
6.4.3 Tanks, where external over pressure is <u>not</u> part of operating conditions.....	35
6.4.4 Test.....	35
6.5 Tank to frame connection/interface.....	35
7 Construction and manufacturing	36
7.1 General requirements	36
7.2 Cutting.....	36
7.3 Forming.....	37
7.3.1 General.....	37

7.3.2	Cold forming	37
7.3.3	Hot forming.....	37
7.3.4	Ends	37
7.3.5	Heat treatment and normalising.....	37
7.4	Welding	38
7.4.1	Qualification	38
7.4.2	Welded joints	38
7.4.3	Examination and testing of welds.....	38
7.4.4	Temporary attachments	40
7.5	Manufacturing tolerances	40
7.5.1	Plate alignment	40
7.5.2	Defects of form.....	41
7.5.3	Thickness.....	41
7.5.4	Dished ends.....	41
7.5.5	Cylindrical sections.....	41
8	Repairs.....	42
8.1	General	42
8.2	Repair of surface defects in the parent metal	42
8.3	Repair of weld defects.....	42
Annex A (informative) Sample calculation for tank containers according to RID/ADR		
	Chapter 6.8"	43
A.1	Introduction	43
A.2	Dimensions, characteristics of materials, operating and testing conditions.....	43
A.3	Calculation according to branch A.....	44
A.4	Calculation according to branch B.....	44
A.5	Calculation according to branch C	45
A.6	Calculation according to branch D	47
A.7	Results	54
Annex B (informative) Explosion pressure shock resistant design of tanks.....		56
Bibliography		58

European foreword

This document (EN 14025:2013+A1:2016) has been prepared by Technical Committee CEN/TC 296 “Tanks for the transport of dangerous goods”, 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 December 2016, and conflicting national standards shall be withdrawn at the latest by December 2016.

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 document includes Amendment 1 approved by CEN on 29 April 2016.

This document supersedes A1 EN 14025:2013 A1.

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 A1.

A1 *deleted text* A1

This document is submitted for reference into the RID [9] and/or in the technical annexes of the ADR [10].

NOTE The technical annexes are available at the following website: <http://www.unece.org/trans/danger/danger.htm> for ADR and for RID at <http://www.otif.org/en/dangerous-goods.htm> respectively.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

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, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies the minimum requirements for the design and construction of metallic pressure tanks having a maximum working or test pressure exceeding 50 kPa (0,5 bar), for the transport of dangerous goods by road and rail and sea. This European Standard includes requirements for openings, closures and structural equipment; it does not cover requirements of service equipment. For tanks for the transport of cryogenic liquids, EN 13530-1 and EN 13530-2 apply.

NOTE 1 Design and construction of pressure tanks according to the scope of this European Standard are primarily subject to the requirements of RID/ADR, 6.8.2.1, 6.8.3.1 and 6.8.5, as relevant. In addition, the relevant requirements of RID/ADR, columns 12 and 13 of Table A to chapter 3.2, 4.3 and 6.8.2.4 apply. For the structural equipment subsections 6.8.2.2 and 6.8.3.2 apply, as relevant. The definitions of RID/ADR 1.2.1 are referred to. For portable tanks see also Chapter 4.2 and Sections 6.7.2 and 6.7.3 of RID and ADR. In addition, the relevant requirements of RID/ADR, columns 10 and 11 of Table A to Chapter 3.2, 4.2, 6.7.2 and 6.7.3 apply. The paragraph numbers above relate to the 2013 issue of RID/ADR which are subject to regular revisions. This can lead to temporary non-compliances with EN 14025. It is important to know that requirements of RID/ADR take precedence over any clause of this standard.

NOTE 2 This standard is applicable to liquefied gases including LPG, however for a dedicated LPG standard see EN 12493.

If not otherwise specified, provisions which take up the whole width of the page apply to all kind of tanks. Provisions contained in a single column apply only to:

road and rail pressure tanks according to RID/ADR chapter 6.8 (left-hand column);	portable tanks according to RID/ADR chapter 6.7 (right-hand column).
---	--

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 287-1, *Qualification test of welders — Fusion welding — Part 1: Steels*

EN 1418, *Welding personnel — Approval testing of welding operators for fusion welding and resistance weld setters for fully mechanized and automatic welding of metallic materials*

EN 1435, *Non-destructive examination of welds — Radiographic examination of welded joints*

EN 1591-1, *Flanges and their joints — Design rules for gasketed circular flange connections — Part 1: Calculation method*

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

EN 13094:2008, *Tanks for the transport of dangerous goods — Metallic tanks with a working pressure not exceeding 0,5 bar — Design and construction*

EN 13445-2, *Unfired pressure vessels - Part 2: Materials*

EN 13445-3:2009, *Unfired pressure vessels — Part 3: Design*

EN 13445-4, *Unfired pressure vessels - Part 4: Fabrication*

EN 13445-8, *Unfired pressure vessels - Part 8: Additional requirements for pressure vessels of aluminium and aluminium alloys*

EN ISO 3834-1, *Quality requirements for fusion welding of metallic materials — Part 1: Criteria for the selection of the appropriate level of quality requirements (ISO 3834-1)*

EN ISO 3834-2, *Quality requirements for fusion welding of metallic materials — Part 2: Comprehensive quality requirements (ISO 3834-2)*

EN ISO 4136, *Destructive tests on welds in metallic materials — Transverse tensile test (ISO 4136)*

EN ISO 5173, *Destructive tests on welds in metallic materials — Bend tests (ISO 5173)*

EN ISO 5817, *Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections (ISO 5817)*

EN ISO 9606-2, *Qualification test of welders — Fusion welding — Part 2: Aluminium and aluminium alloys (ISO 9606-2)*

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

EN ISO 10042, *Welding — Arc-welded joints in aluminium and its alloys — Quality levels for imperfections (ISO 10042)*

EN ISO 15607, *Specification and qualification of welding procedures for metallic materials — General rules (ISO 15607)*

EN ISO 15609-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding (ISO 15609-1)*

EN ISO 15609-3, *Specification and qualification of welding procedures for metallic materials — Welding procedures specification — Part 3: Electron beam welding (ISO 15609-3)*

EN ISO 15609-4, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 4: Laser beam welding (ISO 15609-4)*

EN ISO 15613, *Specification and qualification of welding procedures for metallic materials — Qualification based on pre-production welding test (ISO 15613)*

EN ISO 15614-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys (ISO 15614-1)*

EN ISO 15614-2, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 2: Arc welding of aluminium and its alloys (ISO 15614-2)*

EN ISO 17635, *Non-destructive testing of welds — General rules for metallic materials (ISO 17635)*

EN ISO 17637, *Non-destructive testing of welds — Visual testing of fusion-welded joints (ISO 17637)*

EN ISO 17640, *Non-destructive testing of welds — Ultrasonic testing — Techniques, testing levels, and assessment (ISO 17640)*

ISO 1496-3, *Series 1 freight containers — Specification and testing — Part 3: Tank containers for liquids, gases and pressurized dry bulk*

ISO 7005-1, *Pipe flanges — Part 1: Steel flanges for industrial and general service piping systems*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the following term and definition applies.

3.1.1

pressure-tank

tank as defined in the international regulations for the transport of dangerous goods by road or rail having a maximum working pressure or a test pressure exceeding 50 kPa (0,5 bar)

3.2 Symbols

The following general symbols are used throughout the text. They are listed in alphabetical order and special symbols are explained with the relevant formulae. Additional symbols used in the text are explained in:

RID/ADR Chapter 6.8

RID/ADR Chapter 6.7

A_1 minimum elongation at fracture of the metal chosen under tensile stress in %

d_i inside diameter of an opening

D internal diameter of shell in mm

D_C mean diameter of the cylindrical part of the tank at the junction of a cone

D_e outside diameter of the cylindrical part of the tank or the straight flange of the dished end

D_i	inside diameter of the cylindrical part of the tank or the straight flange of dished end	D_i	diameter of the shell (in m), but not less than 1,80 m
-------	--	-------	--

e minimum required wall thickness (in mm) of the shell

e_0 minimum shell thickness for mild steel in mm, according to 6.8.2.1.18 and 6.8.2.1.19 of RID/ADR

e_1 minimum shell thickness for the metal chosen in mm

e_k wall thickness of a conical part of a shell

e_R wall thickness of a hemispherical end

E Young's modulus

f_d nominal design stress (allowable stress)

h inside height of an ellipsoidal dished end

K shape factor of ellipsoidal ends

MWP maximum working pressure, in MPa

$MAWP$ maximum allowable working pressure, in MPa

p design pressure, in MPa

P design pressure, in MPa

p_{dyn} equivalent dynamic pressure