

**LEEKKUUMUTUSETA SURVEANUMAD.  
OSA 2: MATERJALID**

**Unfired pressure vessels - Part 2: Materials**

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

See Eesti standard EVS-EN 13445-2:2021+A1:2023 sisaldab Euroopa standardi EN 13445-2:2021 ja selle muudatuse A1:2023 ingliskeelset teksti.	This Estonian standard EVS-EN 13445-2:2021+A1:2023 consists of the English text of the European standard EN 13445-2:2021 and its amendment A1:2023.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.  Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 12.05.2021, muudatus A1 29.03.2023.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation and Accreditation.  Date of Availability of the European standard is 12.05.2021, for A1 29.03.2023.
Muudatusega A1 lisatud või muudetud teksti algus ja lõpp on tekstis tähistatud sümbolitega <b>A1</b> <b>A1</b> .  See dokument on 2023. aasta juunikuus avaldatud ingliskeelse standardi EVS-EN 13445-2:2021+A1:2023 parandatud väljaanne. Tehtud parandused on tähistatud püstjoonega lehe vasakul veerisel.  Standard on kättesaadav Eesti Standardimis- ja Akrediteerimiskeskusest.	The start and finish of text introduced or altered by amendment A1 is indicated in the text by tags <b>A1</b> <b>A1</b> .  This Document is a corrected version of the EVS-EN 13445-2:2021+A1:2023, published on June 2023. The corrections made are indicated by a vertical line in the left margin of the text.  The standard is available from the Estonian Centre for Standardisation and Accreditation.

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

ICS 23.020.30

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English Version

## Unfired pressure vessels - Part 2: Materials

Réceptacles sous pression non soumis à la flamme -  
Partie 2: Matériaux

Unbefeuerte Druckbehälter - Teil 2: Werkstoffe

This European Standard was approved by CEN on 24 February 2021 and includes Amendment 1 approved by CEN on 21 February 2023 and Amendment 1 approved by CEN on 13 June 2023.

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.

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

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## European foreword

This document (EN 13445-2:2021+A1:2023) has been prepared by Technical Committee CEN/TC 54 “Unfired pressure vessels”, 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 February 2024, and conflicting national standards shall be withdrawn at the latest by February 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 A1 EN 13445-2:2021 A1.

This document includes Amendment 1 approved by CEN on 21 February 2023.

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

This document has been prepared under a standardisation request addressed to CEN by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

EE NOTE Corrected “[the relevant ESO]” to “CEN”.

For the relationship with EU Legislation, see informative Annex ZA, which is an integral part of this document.

The list of all parts in the EN 13445 series can be found on the CEN website.

Although these Parts may be obtained separately, it should be recognised that the Parts are inter-dependant. As such the manufacture of unfired pressure vessels requires the application of all the relevant Parts in order for the requirements of the Standard to be satisfactorily fulfilled.

Corrections to the standard interpretations where several options seem possible are conducted through the Migration Help Desk (MHD). Information related to the Help Desk can be found at <http://www.unm.fr/en13445@unm.fr>. A form for submitting questions can be downloaded from the link to the MHD website. After subject experts have agreed an answer, the answer will be communicated to the questioner. Corrected pages will be given specific issue number and issued by CEN according to CEN Rules. Interpretation sheets will be posted on the website of the MHD.

This document supersedes EN 13445-2:2014. This new edition incorporates the Amendments which have been approved previously by CEN members, and the corrected pages up to Issue 5 without any further technical change. Annex Y provides details of significant technical changes between this European Standard and the previous edition.

Amendments to this new edition may be issued from time to time and then used immediately as alternatives to rules contained herein. It is intended to deliver a new Issue of EN 13445:2021 each year, starting with the precedent as Issue 1, consolidating these Amendments and including other identified corrections.

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 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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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## 1 Scope

This document specifies the requirements for steel products used for unfired pressure vessels.

For some metallic materials other than steel, such as spheroidal graphite cast iron, aluminium, nickel, copper, titanium, requirements are or will be formulated in separate parts of this document.

For metallic materials which are not covered by a harmonized material standard and are not likely to be in near future, specific rules are given in this part or the above cited parts of this document.

## 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 764-1:2015+A1:2016, *Pressure equipment — Terminology — Part 1: Pressure, temperature, volume, nominal size*

EN 764-2:2012, *Pressure equipment — Part 2: Quantities, symbols and units*

⌈A1⌋ *deleted text* ⌈A1⌋

EN 764-4:2014, *Pressure equipment — Part 4: Establishment of technical delivery conditions for metallic materials*

EN 764-5:2014, *Pressure equipment — Part 5: Inspection documentation of metallic materials and compliance with the material specification*

EN 1092-1:2018, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 1: Steel flanges*

⌈A1⌋ EN 10028-2:2017 ⌈A1⌋, *Flat products made of steels for pressure purposes — Part 2: Non-alloy and alloy steels with specified elevated temperature properties*

⌈A1⌋ EN 10028-3:2017 ⌈A1⌋, *Flat products made of steels for pressure purposes — Part 3: Weldable fine grain steels, normalized*

⌈A1⌋ EN 10028-4:2017 ⌈A1⌋, *Flat products made of steels for pressure purposes — Part 4: Nickel alloy steels with specified low temperature properties*

⌈A1⌋ EN 10028-5:2017 ⌈A1⌋, *Flat products made of steels for pressure purposes — Part 5: Weldable fine grain steels, thermomechanically rolled*

⌈A1⌋ EN 10028-6:2017 ⌈A1⌋, *Flat products made of steels for pressure purposes — Part 6: Weldable fine grain steels, quenched and tempered*

⌈A1⌋ EN 10028-7:2016 ⌈A1⌋, *Flat products made of steels for pressure purposes — Part 7: Stainless steels*

EN 10204:2004, *Metallic products — Types of inspection documents*

EN 10216-3:2013, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 3: Alloy fine grain steel tubes*



EN 10216-4:2013, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 4: Non-alloy and alloy steel tubes with specified low temperature properties*

EN 10217-3:2019, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 3: Electric welded and submerged arc welded alloy fine grain steel tubes with specified room, elevated and low temperature properties*

EN 10217-4:2019, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 4: Electric welded non-alloy steel tubes with specified low temperature properties*

EN 10217-6:2019, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 6: Submerged arc welded non-alloy steel tubes with specified low temperature properties*

EN 10222-3:2017, *Steel forgings for pressure purposes — Part 3: Nickel steels with specified low temperature properties*

EN 10222-4:2017+A1:2021, *Steel forgings for pressures purposes — Part 4: Weldable fine grain steels with high proof strength*

EN 10269:2013, *Steels and nickel alloys for fasteners with specified elevated and/or low temperature properties*

EN 10273:2016, *Hot rolled weldable steel bars for pressure purposes with specified elevated temperature properties*

EN 12074:2000, *Welding consumables — Quality requirements for manufacture, supply and distribution of consumables for welding and allied processes*

EN 13445-1:2021, *Unfired pressure vessels — Part 1: General*

EN 13445-3:2021, *Unfired pressure vessels — Part 3: Design*

EN 13445-4:2021, *Unfired pressure vessels — Part 4: Fabrication*

EN 13445-5:2021, *Unfired pressure vessels — Part 5: Inspection and testing*

EN 13479:2017, *Welding consumables — General product standard for filler metals and fluxes for fusion welding of metallic materials*

EN ISO 148-1:2016, *Metallic materials — Charpy pendulum impact test — Part 1: Test method (ISO 148-1:2016)*

EN ISO 204:2018, *Metallic materials — Uniaxial creep testing in tension — Method of test (ISO 204:2009)*

EN ISO 898-1:2013, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs with specified property classes — Coarse thread and fine pitch thread (ISO 898-1:2013)*

EN ISO 898-2:2012, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 2: Nuts with specified property classes — Coarse thread and fine pitch thread (ISO 898-2:2012)*

EN ISO 2566-1:2021, *Steel — Conversion of elongation values — Part 1: Carbon and low alloy steels (ISO 2566-1:2021)*

EN ISO 2566-2:2021, *Steel — Conversion of elongation values — Part 2: Austenitic steels* (ISO 2566-2:2021) <sup>A1</sup>

EN ISO 3506-1:2020, *Mechanical properties of corrosion-resistant stainless-steel fasteners — Part 1: Bolts, screws and studs with specified grades and property classes* (ISO 3506-1:2020) <sup>A1</sup>

EN ISO 3506-2:2020, *Mechanical properties of corrosion-resistant stainless-steel fasteners — Part 2: Nuts with specified grades and property classes* (ISO 3506-2:2020) <sup>A1</sup>

EN ISO 6892-1:2019, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature* (ISO 6892-1:2019) <sup>A1</sup>

CEN ISO/TR 15608:2017, *Welding — Guidelines for a metallic materials grouping system* (ISO/TR 15608:2017) <sup>A1</sup>

### 3 Terms, definitions, symbols and units

#### 3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13445-1:2021, EN 764-1:2015+A1:2016 <sup>A1</sup> *deleted text* <sup>A1</sup> 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

**minimum metal temperature**  $T_M$

the lowest temperature determined for any of the following conditions (also see 3.1.2, 3.1.3):

- normal operations;
- start up and shut down procedures;
- possible process upsets, such as flashings of fluid, which have an atmospheric boiling point below 0 °C;
- during pressure or leak testing.

##### 3.1.2

**temperature adjustment term** <sup>A1</sup>  $T_A$  <sup>A1</sup>

relevant to the calculation of the design reference temperature  $T_R$  and is dependent on the calculated tensile membrane stress at the appropriate minimum metal temperature

Note 1 to entry: Values for <sup>A1</sup>  $T_A$  <sup>A1</sup> are given in Table B.2-12.

Note 2 to entry: For tensile membrane stress reference is made to EN 13445-3:2021, Annex C.

##### 3.1.3

**design reference temperature**  $T_R$

the temperature used for determining the impact energy requirements and is determined by adding the temperature adjustment <sup>A1</sup>  $T_A$  <sup>A1</sup> to the minimum metal temperature  $T_M$ :