

This is a preview of "BS EN 13445-2:2021". [Click here to purchase the full version from the ANSI store.](#)



**BSI Standards Publication**

## **Unfired pressure vessels**

---

Part 2: Materials

This is a preview of "BS EN 13445-2:2021". [Click here to purchase the full version from the ANSI store.](#)

## National foreword

This British Standard is the UK implementation of EN 13445-2:2021. It supersedes BS EN 13445-2:2014+A3:2018, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PVE/1, Pressure Vessels.

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

### Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

This publication has been prepared under a mandate given to the European Standards Organizations by the European Commission and the European Free Trade Association and is intended to support essential requirements of the EU legislation detailed in the European foreword. Annex ZA/ZZ describes how the publication relates to the legislation.

For the Great Britain market (England, Scotland and Wales), if the UK Government has designated this publication for conformity with UKCA marking legislation and has not amended the essential requirements of that legislation, Annex ZA/ZZ and any references to EU law in the publication should be read in accordance with the designation as applying to UK legislation in the same way as to EU law. Further information on designated standards can be found at [www.bsigroup.com/standardsandregulation](http://www.bsigroup.com/standardsandregulation).

For the Northern Ireland market, UK law will continue to implement relevant EU law subject to periodic confirmation. References to EU legislation are therefore still valid.

More information on legislation can be found at [www.gov.uk](http://www.gov.uk).

© The British Standards Institution 2021  
Published by BSI Standards Limited 2021

ISBN 978 0 539 04738 7

ICS 23.020.30

**Compliance with a British Standard cannot confer immunity from legal obligations.**

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 May 2021.

This is a preview of "BS EN 13445-2:2021". [Click here to purchase the full version from the ANSI store.](#)

**Amendments/corrigenda issued since publication**

Date

Text affected

---

This is a preview of "BS EN 13445-2:2021". [Click here to purchase the full version from the ANSI store.](#)

This is a preview of "BS EN 13445-2:2021". [Click here to purchase the full version from the ANSI store.](#)

## EUROPÄISCHE NORM

May 2021

ICS 23.020.30

Supersedes EN 13445-2:2014

English Version

## Unfired pressure vessels - Part 2: Materials

Réceptifs 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.

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, Turkey 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
<b>1 Scope.....</b>	<b>5</b>
<b>2 Normative references.....</b>	<b>5</b>
<b>3 Terms, definitions, symbols and units .....</b>	<b>7</b>
<b>3.1 Terms and définitions .....</b>	<b>7</b>
<b>3.2 Symbols and units.....</b>	<b>9</b>
<b>4 Requirements for materials to be used for pressure-bearing parts .....</b>	<b>11</b>
<b>4.1 General.....</b>	<b>11</b>
<b>4.2 Special provisions .....</b>	<b>13</b>
<b>4.2.1 Special properties .....</b>	<b>13</b>
<b>4.2.2 Design temperature above 20 °C.....</b>	<b>13</b>
<b>4.2.3 Prevention of brittle fracture .....</b>	<b>14</b>
<b>4.2.4 Design properties in the creep range .....</b>	<b>14</b>
<b>4.2.5 Specific requirements for steels for fasteners.....</b>	<b>14</b>
<b>4.3 Technical delivery conditions .....</b>	<b>15</b>
<b>4.3.1 European Standards.....</b>	<b>15</b>
<b>4.3.2 European Approval for Materials.....</b>	<b>15</b>
<b>4.3.3 Particular material appraisals .....</b>	<b>15</b>
<b>4.3.4 Clad products.....</b>	<b>15</b>
<b>4.3.5 Welding consumables.....</b>	<b>15</b>
<b>4.4 Marking.....</b>	<b>15</b>
<b>5 Requirements for materials to be used for non-pressure parts .....</b>	<b>16</b>
<b>Annex A (normative) Grouping system for steels for pressure equipment.....</b>	<b>17</b>
<b>Annex B (normative) Requirements for prevention of brittle fracture at low temperatures.....</b>	<b>19</b>
<b>B.1 General.....</b>	<b>19</b>
<b>B.2 Material selection and impact energy requirements.....</b>	<b>20</b>
<b>B.2.1 Introduction .....</b>	<b>20</b>
<b>B.2.2 Method 1.....</b>	<b>20</b>
<b>B.2.3 Method 2 .....</b>	<b>30</b>
<b>B.2.4 Method 3 — Fracture mechanics analysis.....</b>	<b>42</b>
<b>B.3 General test requirements.....</b>	<b>43</b>
<b>B.3.1 General.....</b>	<b>43</b>
<b>B.3.2 Sub-sized specimens .....</b>	<b>44</b>
<b>B.4 Welds .....</b>	<b>45</b>
<b>B.4.1 General.....</b>	<b>45</b>
<b>B.4.2 Welding procedure qualification .....</b>	<b>45</b>
<b>B.4.3 Production test plates .....</b>	<b>45</b>
<b>B.5 Materials for use at elevated temperatures .....</b>	<b>45</b>
<b>B.5.1 General.....</b>	<b>45</b>
<b>B.5.2 Materials.....</b>	<b>46</b>
<b>B.5.3 Welding procedure qualification and production test plates.....</b>	<b>46</b>
<b>B.5.4 Start up and shut down procedure .....</b>	<b>46</b>
<b>B.5.5 Pressure test.....</b>	<b>46</b>

This is a preview of "BS EN 13445-2:2021". [Click here to purchase the full version from the ANSI store.](#)

<b>Annex C (informative) Procedure for determination of the weld creep strength reduction factor (WCSRF) .....</b>	<b>54</b>
<b>Annex D (informative) Technical delivery conditions for clad products for pressure purposes .....</b>	<b>55</b>
<b>D.1 Introductory note .....</b>	<b>55</b>
<b>D.2 Requirements for the material .....</b>	<b>55</b>
<b>D.3 Requirements for the deposited material .....</b>	<b>55</b>
<b>D.4 Qualification of the cladding procedure.....</b>	<b>56</b>
<b>D.5 Production tests.....</b>	<b>57</b>
<b>Annex E (informative) European steels for pressure purposes.....</b>	<b>59</b>
<b>E.1 European Standards for steels and steel components for pressure purposes.....</b>	<b>59</b>
<b>E.2 European standardised steels grouped according to product forms .....</b>	<b>60</b>
<b>Annex F (normative) Special provisions for materials and components .....</b>	<b>83</b>
<b>F.1 General .....</b>	<b>83</b>
<b>F.2 Mechanical properties and technical delivery conditions for fasteners in accordance with EN ISO 3506.....</b>	<b>83</b>
<b>F.2.1 Mechanical properties for austenitic bolts in accordance with EN ISO 3506-1 .....</b>	<b>83</b>
<b>F.2.2 Delivery conditions for austenitic fasteners.....</b>	<b>84</b>
<b>Annex Y (informative) History of EN 13445-2.....</b>	<b>85</b>
<b>Y.1 Differences between EN 13445-2:2014 and EN 13445-2:2021.....</b>	<b>85</b>
<b>Annex ZA (informative) Relationship between this European Standard and the essential requirements of Directive 2014/68/EU aimed to be covered .....</b>	<b>86</b>
<b>Bibliography .....</b>	<b>87</b>

This is a preview of "BS EN 13445-2:2021". [Click here to purchase the full version from the ANSI store.](#)

## European foreword

This document (EN 13445-2:2021) 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 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 has been prepared under a standardization request given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

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](mailto: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.

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.



This is a preview of "BS EN 13445-2:2021". [Click here to purchase the full version from the ANSI store.](#)

## 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*

EN 764-3:2002, *Pressure equipment — Part 3: Definition of parties involved*

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*

EN 10028-2:2009, *Flat products made of steels for pressure purposes — Part 2: Non-alloy and alloy steels with specified elevated temperature properties*

EN 10028-3:2009, *Flat products made of steels for pressure purposes — Part 3: Weldable fine grain steels, normalized*

EN 10028-4:2009, *Flat products made of steels for pressure purposes — Part 4: Nickel alloy steels with specified low temperature properties*

EN 10028-5:2009, *Flat products made of steels for pressure purposes — Part 5: Weldable fine grain steels, thermomechanically rolled*

EN 10028-6:2009, *Flat products made of steels for pressure purposes — Part 6: Weldable fine grain steels, quenched and tempered*

EN 10028-7:2007, *Flat products made of steels for pressure purposes — Part 7: Stainless steels*

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