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English Version

Unfired pressure vessels - Part 1: General

Réipients sous pression non soumis à la flamme - Partie
1: Généralités

Unbefeuerte Druckbehälter - Teil 1: Allgemeines

This amendment A3 modifies the European Standard EN 13445-1:2002; it was approved by CEN on 23 May 2007.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for inclusion of this amendment into the relevant national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This amendment 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 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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Foreword

This document (EN 13445-1:2002/A3:2007) has been prepared by Technical Committee CEN/TC 54 “Unfired pressure vessels”, the secretariat of which is held by BSI.

This Amendment to the European Standard EN 13445-1:2002 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2008, and conflicting national standards shall be withdrawn at the latest by February 2008.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 97/23/EC.

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

The amendment is based on EN 13445-1:2002 up to issue 27 (June 2007).

The document includes the text of the amendment itself. The corrected pages of EN 13445-1 will be delivered as issue 28 of the standard.

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

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Introduction

Delete all text except the first paragraph and the note following it:

Add the following after the note:

In Parts 2 to 5 only pressure vessels manufactured from steels and steel castings as detailed in Part 2 of this standard are covered. Parts 6 and 8 specifically deal with vessels of spheroidal graphite cast iron and aluminium, respectively, where special considerations apply.

Part 1

This part contains general information on the scope of the standard as well as terms, definitions, quantities, symbols and units which are applied throughout the standard.

Part 2

This part deals with the general philosophy on materials, material grouping and low temperature behaviour. It is limited to steel with sufficient ductility and, for components operating in the creep range, sufficient creep ductility.

Part 2 also provides the general requirements for establishing technical delivery conditions and the requirements for marking of material.

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Part 3

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This part of the standard gives the rules to be used for design and calculation under internal and/or external pressure (as applicable), local loads and actions other than pressure. The rules provided are both design by formulae (DBF), design by analysis (DBA) and design by experiment (DBE).

The part also sets the requirements for when fatigue analysis must be performed and the rules to be followed when this is the case.

Part 4

This part is based on existing good practice in previous national European Standards on manufacturing. It covers forming, welding procedures and welding qualification, production testing, and post weld heat treatment and repairs. Rules are also provided for material traceability and tolerances.

Part 5

This part covers all those inspection and testing activities associated with the verification of the pressure vessel for compliance with the standard, including design review by the manufacturer and supporting technical documentation, NDT and other inspection activities including document control, material traceability, joint preparation and welding.

The level of testing is driven by the selection of the vessel testing group. Basically, the testing group determines the level of NDT and the joint coefficient used in the design.

In terms of NDT, the overall philosophy has been the general adoption of EN ISO 5817:2003 quality level 'C' for predominantly non-cyclic loaded vessels and level 'B' for vessels subject to cyclic loadings.

Part 6

This part contains special rules for material, design, fabrication, inspection, and testing of pressure vessels made from spheroidal graphite cast iron. In general the rules in the relevant parts of parts 2–5 apply with additions and exceptions outlined in this part.

Part 7

This part gives guidance on how to use the conformity assessment procedures in the Pressure Equipment Directive 97/23/EC. It is not a standard, but merely a CEN Technical Report.

Part 8

This part contains special rules for material, design, fabrication, inspection, and testing of pressure vessels made from aluminium and aluminium alloys. In general the rules in the relevant parts of parts 2–5 apply with additions and exceptions outlined in this part.

Part 9

This part details the conformance of the whole EN 13445 series to ISO/FDIS 16528-1 "Boilers and pressure vessels – Part 1: Performance requirements". This is a CEN Technical Report. The first edition is limited to vessels of steel construction, but will be amended later to include spheroidal graphite cast iron and aluminium.

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1 Scope

1.1 General

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Replace the whole section with the following text:

This part of this European Standard defines the terms, definitions, symbols and units that are used throughout the EN 13445. It also contains instructions on how to use the standard (Annex A) as well as an index which covers the whole standard (Annex B). This information is aimed to aid the user of the EN 13445.

This European Standard applies to unfired pressure vessels with a maximum allowable pressure greater than 0,5 bar (0,05 MPa) gauge but may be used for vessels operating at lower pressures, including vacuum.

NOTE The selection, application and installation of safety related accessories intended to protect pressure vessels during operation are covered in EN 764-7.

1.2 Exclusions

Replace the text in item e) with the following:

e) vessels of lamellar cast iron or any other materials not included in parts 2, 6, or 8 of the standard;

2 Normative references

In the first reference, replace prEN 764-1:2001 with EN 764-1:2004

Add the following additional normative references:

EN 13445-2:2002, *Unfired pressure vessels – Part 2: Materials*

EN 13445-3:2002, *Unfired pressure vessels – Part 3: Design*

EN 13445-4:2002, *Unfired pressure vessels – Part 4: Fabrication*

EN 13445-5:2002, *Unfired pressure vessels – Part 5: Inspection and testing*

EN 13445-6:2002, *Unfired pressure vessels – Part 6: Requirements for the design and fabrication of pressure vessels and pressure parts constructed from spheroidal graphite cast iron*

EN 13445-8:2006, *Unfired pressure vessels – Part 8: Additional requirements for pressure vessels of aluminium and aluminium alloys*

Add a new Clause 3 as follows, and renumber existing Clause 3 as Clause 4 and existing Clause 4 as Clause 5:

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3 Interdependency of the parts of the series

Parts 2 to 6 and part 8 of EN 13445, together with Part 1, form a consistent set of specifications which shall be followed for compliance to the standard.

NOTE Parts 7 and 9 of this series are published as a CEN Report and a draft CEN Technical Report. They are not European Standards.

4 Terms and definitions

On the first line, replace prEN 764-1:2001 with EN 764-1:2004

Add a new Annex A with the following text:

Annex A (informative)

Using the standard

A.1 Purpose

EN 13445 is a new standard (first issued in 2002) and in many places uses new design, fabrication, inspection, and testing philosophies. This annex is designed to facilitate the introduction to the use of the standard.

This annex only gives a general overview of the requirements of the standard. Reference must always be made to the standard text itself, and not all requirements are necessarily mentioned in this annex.

A.2 General

The standard is harmonized under the Pressure Equipment Directive (97/23/EC). This means that if an unfired pressure vessel meets the requirements of the standard, this pressure vessel can be presumed to conform to those essential safety requirements in Annex I of the Directive which are listed in the Annexes ZA of the individual parts of the standard.

In this connection, it should be understood that the standard is indivisible. The design and manufacture of unfired pressure vessels requires the application of all relevant Parts of the standard for the requirements of the standard to be fulfilled. Only in the case that the standard gives no information to specific parts of pressure vessels other standards may be used exceptionally. In such a case, special attention should be paid to ensure that application of such other standard(s) is made consistent with the safety philosophy and the general safety requirements of EN 13445 (i.e. same nominal design stresses, same safety margins, etc.).

NOTE Part 7 and Part 9 are not mandatory parts of the standard in this sense.

This standard applies to unfired pressure vessels with the limitations and exclusions stated in Clause 1 of EN 13445-1:2002.

A.3 Prerequisites

Prior to designing and manufacturing a pressure vessel under the standard, the manufacturer must establish a number of prerequisites:

- The conditions under which the vessel will be operating.
- Load cases to be considered are enumerated in 5.3.1 to 5.3.2 of EN 13445-3:2002.
- The category of the vessel (I to IV) as defined in the Directive. Subclause 4.2 of CR 13445-7:2002 and Annex A of CR 13445-7:2002 show how the category of a vessel is to be established.

NOTE 1 The category determines the type of inspection document required for the materials of the main pressure-bearing parts, as stated in Annex I, section. 4.3 of the Directive (Inspection Documents are defined in EN 10204:2004). The category may also influence how particular material appraisals (see A.4.2) are to be performed.

- The assessment module (as defined in the directive) to be used. Subclause 4.3 of CR 13445-7:2002 and Annex B of CR 13445-7:2002 describe the different assessment modules and which assessment modules can be used for the different categories.

NOTE 2 The choice of module may affect the participation of a notified body and/or a recognized third party organization or user inspectorate in the inspection and testing of the vessel as enumerated in Annex C of CR 13445-7:2002. (It should be noted that the use of user inspectorates may not be permitted in all member states).

- The testing group of the vessel according to 6.6.1.1 of EN 13445-5:2002. The available testing groups depend upon the material group, thickness, and welding method. Category 4 is further limited with regards to pressure, temperature, content, number of cycles, design stress, and dimensions.

NOTE 3 The testing group affects not only the testing requirements but also design and manufacturing aspects, e.g., joint coefficient, permitted weld details and required weld production tests.

NOTE 4 Although the same testing group normally applies to the whole vessel, it is (with the exception of Group 4) permissible to have different testing groups apply to different parts (e.g., welds).

A.4 Materials

A.4.1 General

Specific requirements for steels are given in Part 2.

NOTE Specific rules for spheroidal graphite cast iron and aluminium are given in Part 6 (see A.8 in this annex) and part 8 (see A.9 in this annex), respectively. In some instances, references may be made from these parts to Part 2.

A.4.2 Permitted materials

Only materials which are qualified for pressure equipment may be used. Qualification of materials can be made in three different ways

- Materials from European harmonized Standards, see 4.3.1 of EN 13445-2:2002;
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Certain materials supplied in accordance with European material Standards are accepted as qualified for use in pressure-bearing parts. These materials are enumerated in Table A.2-1 of EN 13445-2:2002.

- Materials with a European Approval for Materials (EAM), see 4.3.2 of EN 13445-2:2002;

Materials with an EAM, which states that they can be used for products under the PED, are qualified for use in relevant products according to this standard.

EAMs are published in the Official Journal, and the European Commission maintains a list of EAMs on their web site

NOTE 1 This web site is presently accessible under the address http://europa.eu.int/comm/enterprise/pressure_equipment/ped/index.en.html.

- Materials with a Particular Material Appraisal (PMA), see 4.3.3 of EN 13445-2:2002.

Materials, which have been subject to a PMA are qualified. This appraisal is carried out by the manufacturer (and in certain cases checked by a Notified Body).

NOTE 2 The European Commission and Member States have in November 2006 agreed on "Guiding Principles for the contents of Particular Materials Appraisals. The document is published on, http://europa.eu.int/comm/enterprise/pressure_equipment/ped/index_en.html.

Whichever method of qualification is used, the qualification does not necessarily cover the suitability of the material with regards to the environment and content of the vessel, i.e., corrosion, erosion, etc. The manufacturer will always have to evaluate the material's resistance to such action.

Whichever way the material has been qualified, all other rules in Part 2 will have to be fulfilled.

A.4.3 Prevention of brittle fracture

Rules for prevention against brittle fracture are given in Annex B of EN 13445-2:2002.

Three different routes are allowed.

- Reliance on operating experience (B.2.2 of EN 13445-2:2002)
- A combination of operating experience and fracture mechanics (B.2.3 of EN 13445-2:2002)
- Fracture mechanics (B.2.4 of EN 13445-2:2002)

The first two methods aim at determining a relationship between the lowest material temperature in the vessel (T_M) and the temperature at which impact testing (T_{KV}) has to be performed, and they are both limited with regards to materials and thicknesses.

NOTE A revised version of method 1 and method 2, based on latest European research results in engineering critical assessment methods is currently under preparation.

The third method allows the use of engineering critical assessment methods when methods 1 and 2 are not suitable for material selection. This method requires more work than the first two.

A.4.4 Material grouping

Materials are grouped in Table A.1-1 of EN 13445-2:2002 with respect to major chemical elements, specified minimum tensile test data. This grouping is used throughout the standard to decide design, manufacturing, and inspection aspects.

A.5 Design

A.5.1 General

Most of the requirements for design are to be found in Part 3.

NOTE Specific design rules for vessels manufactured from spheroidal graphite cast iron and aluminium are given in Part 6 (see A.8 in this annex) and Part 8 (see A.9 in this annex), respectively.

A.5.2 Design for static loads

There are four different methods for design, which can be used either separately or in combination with each other

- Design by formulas (DBF)

These rules are contained in Clauses 7 to 16 of EN 13445-3:2002 and Annexes F, G, and J of EN 13445-3:2002.

For simple geometries such as cylinders and spheres, formulas can be given where pressure and geometrical dimensions give the required minimum thicknesses directly.

For more complicated geometries, a trial-and-error approach must be used in most cases. The designer will have to assume the analysis thickness(es), and use the formulas to compute the stresses and/or the