

**norm****NEN-EN 13445-8**

Unfired pressure vessels - Part 8:  
Additional requirements for pressure  
vessels of aluminium and aluminium  
alloys

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English Version

## Unfired pressure vessels - Part 8: Additional requirements for pressure vessels of aluminium and aluminium alloys

Réipients sous pression non soumis à la flamme - Partie 8: Exigences complémentaires pour les réipients sous pression en aluminium et allages d'aluminium

Unbefeuerte Druckbehälter - Teil 8: Zusätzliche Anforderungen an Druckbehälter aus Aluminium und Aluminiumlegierungen

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## Foreword

This document (prEN 13445-8:2013) has been prepared by Technical Committee CEN/TC 54 "Unfired pressure vessels", the secretariat of which is held by BSI.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 13445-8:2009.

Changes to EN 13445-8:2009 are as follows:

- the Normative References were updated;
- in 5.6 requirements for inspection documents were added;
- in 6.2 the requirements on design temperature and properties have been revised;
- sub-clause 6.7 on flat ends was added;
- sub-clause 6.8 on design by experiment was added;
- sub-clause 6.9 on port-hole extruded tubes was added;
- sub-clause 7.3 on tolerances was added and the subsequent paragraphs were re-numbered correspondingly;
- in 7.9 the clause on production tests and reference criteria was completely revised;
- in 7.14.1 the requirements on destructive testing of formed and heat treated parts were revised;
- in 8.6 a modification was added to the clause on the standard hydrostatic testing;
- a normative Annex A including allowable design stress values was added.

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

For relationship with EU Directive 97/23/EC, see informative Annex ZA, which is an integral part of this document.

## 1 Scope

This Part 8 of this EN 13445 specifies requirements for unfired pressure vessels and their parts made of aluminium and aluminium alloys in addition to the general requirements for unfired pressure vessels under EN 13445:2009 Parts 1 to 5. This European Standard specifies unfired pressure vessels for loads up to 500 full cycles.

NOTE Cast materials are not included in this version. Details regarding cast materials will be subject to an amendment to or a revision of this European Standard.

## 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 485-2, *Aluminium and aluminium alloys — Sheet, strip and plate — Part 2: Mechanical properties*

EN 571-1:1997, *Non-destructive testing — Penetrant testing — Part 1: General principles*

EN 573-3:2009, *Aluminium and aluminium alloys — Chemical composition and form of wrought products — Part 3: Chemical composition and form of products*

EN 583-4:2002, *Non-destructive testing — Ultrasonic examination — Part 4: Examination for discontinuities perpendicular to the surface*

EN 586-2, *Aluminium and aluminium alloys — Forgings — Part 2: Mechanical properties and additional property requirements*

EN 754-2, *Aluminium and aluminium alloys — Cold drawn rod/bar and tube — Part 2: Mechanical properties*

EN 755-2 (all parts), *Aluminium and aluminium alloys — Extruded rod/bar, tube and profiles*

EN 764-5:2002, *Pressure equipment — Part 5: Compliance and inspection documentation of materials*

EN 1435:1997+A1:2002, *Non-destructive examination of welds — Radiographic examination of welded joints*

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

EN 12392:2000, *Aluminium and aluminium alloys — Wrought products — Special requirements for products intended for the production of pressure equipment*

EN 13445-1:2009, *Unfired pressure vessels — Part 1: General*

EN 13445-2:2009, *Unfired pressure vessels — Part 2: Materials*

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

EN 13445-4:2009, *Unfired pressure vessels — Part 4: Fabrication*

EN 13445-5:2009, *Unfired pressure vessels — Part 5: Inspection and testing*

EN ISO 3834-2:2005, *Quality requirements for fusion welding of metallic materials — Part 2: Comprehensive quality requirements (ISO 3834-2:2005)*

**prEN 13445-8:2013 (E)**

EN ISO 3834-3:2005, *Quality requirements for fusion welding of metallic materials — Part 3: Standard quality requirements* (ISO 3834-3:2005)

EN ISO 4063:2010, *Welding and allied processes — Nomenclature of processes and reference numbers* (ISO 4063:2009, Corrected version 2010-03-01)

EN ISO 6520-1:2007, *Welding and allied processes — Classification of geometric imperfections in metallic materials — Part 1: Fusion welding* (ISO 6520-1:2007)

EN ISO 9606-2:2004, *Qualification test of welders — Fusion welding — Part 2: Aluminium and aluminium alloys* (ISO 9606-2:2004)

EN ISO 10042:2005, *Welding — Arc-welded joints in aluminium and its alloys — Quality levels for imperfections* (ISO 10042:2005)

EN ISO 11666:2010, *Non-destructive testing of welds — Ultrasonic testing — Acceptance levels* (ISO 11666:2010)

EN ISO 15614-2:2005, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 2: Arc welding of aluminium and its alloys* (ISO 15614-2:2005)

EN ISO 17635:2010, *Non-destructive testing of welds — General rules for metallic materials* (ISO 17635:2010)

EN ISO 17637:2011, *Non-destructive testing of welds — Visual testing of fusion-welded joints* (ISO 17637:2003)

EN ISO 17640:2010, *Non-destructive testing of welds — Ultrasonic testing — Techniques, testing levels, and assessment* (ISO 17640:2010)

EN ISO 23277:2009, *Non-destructive testing of welds — Penetrant testing of welds — Acceptance levels* (ISO 23277:2006)

CR ISO/TR 15608:2005, *Welding — Guidelines for a metallic materials grouping system* (ISO/TR 15608:2005)

ISO 857-1:1998, *Welding and allied processes — Vocabulary — Part 1: Metal welding processes*

### **3 Terms, definitions, symbols and units**

For the purposes of this document, the terms, definitions, symbols and units given in EN 13445:2009 parts 1 to 5 apply.

NOTE Further symbols are listed in 8.2.3.

### **4 General requirements**

The general requirements of EN 13445-1:2009 shall apply.



## 5 Materials

### 5.1 General

The requirements of EN 13445-2:2009 shall apply with the following additions/exclusions.

### 5.2 Elongation after fracture

NOTE Also see 4.1.4 of EN 13445-2:2009.

Aluminium and aluminium alloys used for welded parts of pressure vessels that are subjected to cold forming (e.g. rolled shells and heads) shall have a specified minimum elongation after fracture measured on a gauge length

$$L_o = 5,65\sqrt{S_o} \quad (5.2-1)$$

that is  $\geq 14$  % in the longitudinal or transverse direction as defined by the material specification.

Aluminium and aluminium alloys used for parts of pressure vessels that are not subjected to cold forming (e.g. straight flanges and nozzles) shall have a specified minimum elongation after fracture measured on a gauge length

$$L_o = 5,65\sqrt{S_o} \quad (5.2-2)$$

that is  $\geq 10$  % in the longitudinal or transverse direction as defined by the material specification.

### 5.3 Prevention of brittle fracture

NOTE 1 Also see 4.1.6 of EN 13445-2:2009.

Annex B of EN 13445-2:2009 is not applicable.

NOTE 2 The requirements of 4.3 of EN 1252-1:1998 should be used for determining the minimum design and temperature and the requirements to prevent brittle fracture.

### 5.4 Lamellar tearing

NOTE Also see 4.2.1.2 of EN 13445-2:2009.

Specific requirements of lamellar tearing for pressure vessels of aluminium and its alloys are not applicable.

### 5.5 Chemical composition

The chemical composition shall be in accordance with their material specification, except that all materials shall have a maximum lead content of 150  $\mu\text{g/g}$ .

It is recommended that the material to be used for welded components be produced from rolling or extrusion ingots with hydrogen level no greater than 0,2 ml per 100 g aluminium, measured on liquid metal during casting.

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