
Neogrevane tlačne posode - 8. del: Dodatne zahteve za tlačne posode iz aluminija in aluminijevih zlitin

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

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

Réceptifs sous pression non soumis à la flamme - Partie 8: Exigences complémentaires pour les réceptifs sous pression en aluminium et alliages d'aluminium

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Réceptifs sous pression non soumis à la flamme - Partie 8:
Exigences complémentaires pour les réceptifs sous
pression en aluminium et alliages d'aluminium

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Anforderungen an Druckbehälter aus Aluminium und
Aluminiumlegierungen

This amendment A1 modifies the European Standard EN 13445-8:2014; it was approved by CEN on 18 October 2014.

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-CENELEC Management Centre or to any CEN member.

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Foreword

This document (EN 13445-8:2014/A1:2014) 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 13445-8:2014 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2015, and conflicting national standards shall be withdrawn at the latest by June 2015.

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 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 97/23/EC, see informative Annex ZA, which is an integral part of this document.

This document includes the text of the amendment itself. The corrected pages of EN 13445-8 will be published in July 2015 as Issue 2 of the standard.

This document was submitted to the Formal Vote with the reference EN 13445-8:2009/FprA1.

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.

EN 13445-8:2014/A1:2014 (E)**1 Modification to Clause 2**

Replace normative references with the following:

EN 485-2:2013, *Aluminium and aluminium alloys — Sheet, strip and plate — Part 2: Mechanical properties*

EN 573-3:2013, *Aluminium and aluminium alloys — Chemical composition and form of wrought products — Part 3: Chemical composition and form of products*

EN 586-2:1994, *Aluminium and aluminium alloys — Forgings — Part 2: Mechanical properties and additional property requirements*

EN 754-2:2013, *Aluminium and aluminium alloys — Cold drawn rod/bar and tube — Part 2: Mechanical properties*

EN 755 (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 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 3452-1:2013, *Non-destructive testing — Penetrant testing — Part 1: General principles (ISO 3452-1:2013)*

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

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 16826:2014, *Non-destructive testing — Ultrasonic testing — Examination for discontinuities perpendicular to the surface (ISO 16826:2012)*

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

EN ISO 17636-1:2013, *Non-destructive testing of welds — Radiographic testing — Part 1: X- and gamma-ray techniques with film (ISO 17636-1:2013)*

EN ISO 17636-2:2013, *Non-destructive testing of welds — Radiographic testing — Part 2: X- and gamma-ray techniques with digital detectors (ISO 17636-2:2013)*

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 15608:2013, *Welding — Guidelines for a metallic materials grouping system (ISO/TR 15608:2013)*

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

2 Modification to subclause 5.1

Add before the first paragraph:

Materials for pressure-bearing parts compliant with the requirements of this European Standard shall be accompanied by inspection documents in accordance with EN 10204:2004.

The type of inspection document shall be in accordance with EN 764-5:2002 and include a declaration of compliance to the material specification.

3 Modification of subclause 5.2

Replace the last paragraph, starting with “Aluminium and aluminium alloys...” until “...defined by the material specification.” by the following:

Aluminium and aluminium alloys used for parts of pressure vessels that are not subject to cold forming (e.g. straight flanges and nozzles) shall have a specified minimum elongation after fracture of ≥ 10 % in the longitudinal or transverse direction as defined by the material specification, measured on a gauge length as defined in eq. (5.2-1).

EN 13445-8:2014/A1:2014 (E)**4 Modification of subclause 5.3**

Replace the complete text of subclause 5.3 by the following:

EN 13445-2:2009, Annex B, is not applicable. All materials of Table 5.6-1 are suitable for any minimum metal temperature without impact testing.

NOTE See also EN 1252-1 and EN 12392:2000, 8.4.

5 Modification of subclause 5.4

In the NOTE replace 4.2.1.2 of EN 13445-2:2009 by EN 13445-2:2009, 4.2.1.2.

6 Modification of subclause 5.5

Replace the text by the following:

The chemical composition shall be in accordance with the material specification.

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 (see EN 12392:2000, 5.1.3).

EN 12392:2000, 4.1, recommends a maximum lead content not exceeding 150 µg/g.

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7 Modification of subclause 5.6 [SIST EN 13445-8:2014/A1:2015](#)

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Replace the text of the first and second paragraph by the following:

Annex A of EN 13445-2:2009 is not applicable for pressure vessels of aluminium and its alloys. The allowable materials for the construction of aluminium alloy pressure vessels shall be according to Table 5.6-1 below.

Any product form available in EN 12392:2000 for a material in Table 5.6-1 at an acceptable temper is acceptable for construction to this European Standard, as long as the requirements of 5.2 and 5.5 are fulfilled. Other materials not defined here may be used by agreement by the parties concerned (see EN 13445-2:2009, 4.1.4) if they meet the requirements of 5.2 and 5.5 and a particular material appraisal is produced (see EN 764-4:2002).

Change the heading of Table 5.6.1 by the following:

Table 5.6-1 — Grouping system based on CR ISO/TR 15608:2013 and allowable materials of construction based on EN 12392:2000 using the EN AW numbers according to EN 573-3:2013

Delete the NOTE before Table 5.6-1.

8 Modification of subclause 6.2

Replace the complete text of subclause 6.2 with the following:

NOTE 1 Also see EN 13445-2:2009, 4.2.2.

EN 13445-2:2009, 4.2.2.1, 2nd paragraph, is not applicable for aluminium and its alloys.

Design strength values are given in Tables A.2 to A.5 in Annex A. Design temperatures that exceed the respective temperature limit in Annex A are not permitted.

For materials of group 22.4 temperatures above 80 °C may result in grain boundary precipitation of Al₃-Mg₂. These materials may be used at temperatures above 80 °C up to 200 °C only for non-corrosive service.

NOTE 2 For further material properties see EN 12392:2000.

For welded parts and heat treated parts after forming only the values equivalent to the O temper shall be used for design when 6 000 series flanges, etc. are welded. These values are not quoted in EN 12392:2000 and so the tabulated values for f shown in Table 6.3-2 shall be used for design. The weld area shall be based on the O temper but the flange strength away from the weld ($2t$) may be based on the actual temper (T4 or T6).

For aluminium and aluminium alloys values of 0,2 % proof stress (or 1 % proof stress for material group 21-1 000 series aluminium) for temperatures above 20 °C shall be established by linear interpolation between two adjacent values in Annex A or in EN 12392:2000, except that for alloys 5083 and 5086 the respective value at 50 °C may be used for 65 °C.

For material of group 22.4: For short periods, higher temperatures (e.g. when defrosting refrigerating plant) up to 150 °C are permissible provided that the pressure is reduced to half the working pressure for a period up to 8 h and to atmospheric pressure for a period up to 24 h.

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9 Modification to subclause 6.3

In Table 6.3-1, 3rd column, 1st line, replace $[R_{p1,0,20} / 1,05]$ by $[R_{p1,0, 20} / 1,05]$ (add a space in the index between 1,0 and 20).

In the heading of Table 6.3-2 replace Aluminium by aluminium (lower case letter).

EN 13445-8:2014/A1:2014 (E)**10 Modification to subclause 6.5**

Replace the first paragraph by the following:

Fatigue design for over 500 full equivalent pressure cycles is not covered by this Part 8 for aluminium and aluminium alloy pressure vessels. For the determination of 500 full equivalent pressure cycles see EN 13445-3:2009, 5.4.2

11 Modification to subclause 6.6.4

Replace the second sentence by the following:

Permanent backing strips are permitted for circumferential seams and for shell or head closure plates (see EN 13445-3:2009, Table A, reference E 7) only under the following conditions:

12 New subclause 6.7 Flat ends

Add a new subclause 6.7:

6.7 Flat ends

The requirements of Clause 10 of EN 13445-3:2009 shall apply with the following additions/exclusions:

- Joint types E 5 and E 14 in Table A-3 of EN 13445-3:2009:
Only the first term of equation (10.4-10) shall be considered.
- Joint types E 6, E 7, and E 15 in Table A-3 of EN 13445-3:2009:
For values of C_1 and C_2 higher than 0,45 in equation (10.4-10) the value of 0,45 may be taken.
- Joint types E 10, E 11, E 17, and E 19 in Table A-3 of EN 13445-3:2009:
For values of C_1 and C_2 higher than 0,5 in equation (10.4-10) the value of 0,5 may be taken.

13 New subclause 6.8 Design by experiment

Add a new subclause 6.8:

6.8 Design by experiment

When a plate-and-fin structure is to be designed by experimental method, the procedure shall be based on the principles laid down in Annex T of EN 13445-3:2009, however, with the following modifications:

- A test piece shall be subject to a pressure load until the required pressure P_B is reached or the test piece is destroyed.
- PS shall be determined by P_B , divided by 4.

14 New subclause 6.9 Port-hole-extruded tubes

Add a new subclause 6.9:

6.9 Port-hole-extruded tubes

Port-hole-extruded tubes in accordance with the EN 755-series may be used up to and including DN 25, provided that a joint efficiency of 0,7 is applied. When these tubes are subject to a combined pressure-leak-test for the entire length the joint efficiency may be set to a factor of 1. If this test is carried out:

by the tube manufacturer, the test pressure shall be

$$P_T = \frac{e_n}{D_e} \cdot 0,95 \cdot R_{px} \quad (6.9-1)$$

by the pressure vessel manufacturer, the test pressure shall be

$$P_T = 1,43 \cdot PS \quad (6.9-2)$$

The combined pressure-leak test for achieving a joint efficiency factor of 1 is to be carried out before integration in the piping system either using helium or a gas mixture containing helium, depending on the application. It does not replace the pressure test as specified in Clauses 8.6 and 8.7.

15 New subclause 7.3 Tolerances

Add a new subclause 7.3 and re-number the current paragraphs 7.3 to 7.15 to become 7.4 to 7.16:

7.3 Tolerances

The requirements of EN 13445-4:2009, 5.4, shall apply with the following modification:

For the dished end tolerances of the circumference C the following limit deviations are applicable:

- for outer diameters $D_e \leq 300$ mm: +/- 4 mm;
- for outer diameters D_e with $300 \text{ mm} < D_e \leq 4000$ mm: +/- 10 mm;
- for outer diameters $D_e > 4000$ mm, the tolerance shall be +/- 10 mm or more if agreed before fabrication commences

16 Modification to current Sub-Clause 7.3 “Welding procedure specification (WPS)” (to become subclause 7.4)

Replace EN ISO 4063:2000 by EN ISO 4063:2010.

17 Modification to current subclause 7.8 “Production test, reference criteria” (to become subclause 7.9)

Replace the complete text by the following:

The requirements in 8.2 of EN 13445-4:2009 are not applicable.

Production test plates are required for pressure vessels manufactured according to this European Standard in the case of a joint coefficient z of $0,85 < z \leq 1,0$. If a joint coefficient of 0,85 or less is specified by the designer no production test plates are required.

Requirements for impact testing are not relevant to aluminium materials.