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**Neogrevane tlačne posode - 6. del: Zahteve za konstruiranje in proizvodnjo tlačnih posod in tlačnih delov posode iz nodularne litine - Dopolnilo A1**

Unfired pressure vessels - Part 6: Requirements for the design and fabrication of pressure vessels and pressure parts constructed from spheroidal graphite cast iron

Unbefeuerte Druckbehälter - Teil 6: Anforderungen an die Konstruktion und Herstellung von Druckbehältern und Druckbehältern aus Gusseisen mit Kugelgraphit

Réipients sous pression non soumis à la flamme - Partie 6: Exigences pour la conception et la fabrication des réipients sous pression et des parties sous pression moulés en fonte à graphite sphéroïdal

**Ta slovenski standard je istoveten z: EN 13445-6:2014/A1:2015**

**ICS:**

23.020.32	Tlačne posode	Pressure vessels
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## Unfired pressure vessels - Part 6: Requirements for the design and fabrication of pressure vessels and pressure parts constructed from spheroidal graphite cast iron

Réceptifs sous pression non soumis à la flamme -  
Partie 6: Exigences pour la conception et la fabrication  
des réceptifs sous pression et des parties sous  
pression moulés en fonte à graphite sphéroïdal

Unbefeuerte Druckbehälter - Teil 6: Anforderungen an  
die Konstruktion und Herstellung von Druckbehältern  
und Druckbehälterteilen aus Gusseisen mit  
Kugelgraphit

This amendment A1 modifies the European Standard EN 13445-6:2014; it was approved by CEN on 22 August 2015.

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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-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 13445-6:2014/A1:2015) has been prepared by Technical Committee CEN/TC 54 “Unfired pressure vessels”, the secretariat of which is held by BSI.

This amendment to EN 13445-6:2014 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2016, and conflicting national standards shall be withdrawn at the latest by April 2016.

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/EU.

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

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 13445-6:2014/A1:2015 (E)

**1 Modification to Clause 1 Scope**

Replace the existing Scope with the following:

“This European Standard specifies requirements for the design, materials, manufacturing and testing of pressure vessels and pressure vessel parts intended for use with a maximum allowable pressure, PS, equal or less than:

- 100 bar when containing gases or liquids in group 1 or 2
- 1000 bar when containing liquids in group 2 only.

and shell wall thicknesses not exceeding 60 mm, which are constructed of ferritic or austenitic spheroidal graphite cast iron. The thickness limitation of the shell does not apply to thickness of flanges, reinforcements, bosses etc.

NOTE 1 Austenitic spheroidal graphite cast iron grades are principally used for high and low temperature applications and for their corrosion resistance properties.

NOTE 2 The allowable grades of spheroidal graphite cast iron are listed in Tables 3 and 4. Service conditions are given in Clause 4.

This European standard, EN 13445-6, does not include lamellar graphite cast iron grades for ferritic and austenitic grades with, with an elongation after fracture equal or less than 15 % which are explicitly excluded. Requirements for the use of cast irons with an elongation after fracture equal or less than 15 % are given in EN 15776.”

**2 Modifications to Clause 2 Normative references**

<https://standards.iteh.ai/catalog/standards/sist/4ab9e545-8a1b-4e6e-9175-13445-6-2014-a1-2016>

Insert the following additional standard references:

“EN 287-6:2010, *Qualification test of welders — Fusion Welding — Part 6: Cast iron*

EN 1011-8:2004, *Welding — Recommendations for welding of metallic materials — Part 8: Welding of cast irons*

EN ISO 15614-3:2008, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 3: Fusion welding of non-alloyed and low-alloyed cast irons (ISO 15614-3:2008)*”.

Modify the edition of the following standard references:

“EN 1563:2011, *Founding — Spheroidal graphite cast irons*

EN 13835:2012, *Founding — Austenitic cast irons*”.

### 3 Modification to 3.3 Symbols

Replace symbol  $R_{m(3)}$  in Table 3.3-1 with the following:

**“Table 3.3-1 — Symbols**

Symbol	Quantity	Unit
$RM3$	Average material strength from 3 test samples for DBE purposes	MPa

### 4 Modifications to 5.1 Materials

Add the following new second paragraph:

“The material grades listed in Table 5.1-1 and Table 5.1-2 may be produced in the as-cast or heat treated condition (see EN 1563:2012, Clause 6).”.

Replace Tables 5.1-1 and 5.1-2 with the following:

**“Table 5.1-1 — Allowable material grades for usual design temperatures (-10 °C up to 300 °C)**

Material standard	Material designation <sup>a</sup>		Design temperature limits °C
	Symbol	Number	
EN 1563:2012	EN-GJS-350-22-RT	5.3101	-10 ≤ TS ≤ 300
	EN-GJS-350-22	5.3102	-10 ≤ TS ≤ 300
	EN-GJS-400-18-RT	5.3104	-10 ≤ TS ≤ 300
	EN-GJS-400-18	5.3105	-10 ≤ TS ≤ 300
	EN-GJS-450-18	5.3108	-10 ≤ TS ≤ 300

<sup>a</sup> When materials specified in these tables are not available, other suitable materials may be used when the technical documentation defining the characteristics of the materials has been accepted in accordance with the requirements for European approval for materials (EAM) or particular material appraisal (PMA).

**Table 5.1-2 — Allowable material grades for low or high temperature design conditions**

Material standard	Material designation <sup>a</sup>		Design temperature limits °C
	Symbol	Number	
EN 1563:2012	EN-GJS-350-22-LT	5.3100	-40 ≤ TS ≤ 300
	EN-GJS-400-18-LT	5.3103	-20 ≤ TS ≤ 300
EN 13835:2012	EN-GJSA-XNiMn23-4	5.3501	-196 ≤ TS ≤ 300
	EN-GJSA-XNi22	5.3503	-40 ≤ TS ≤ 540
	EN-GJSA-XNiMn13-7	5.3506	-40 ≤ TS ≤ 300

<sup>a</sup> When materials specified in these tables are not available, other suitable materials may be used when the technical documentation defining the characteristics of the materials has been accepted in accordance with the requirements for European approval for materials (EAM) or particular material appraisal (PMA).

## 5 Modification to 5.2.2.1.1 Principle

Insert the following notes after the fifth paragraph:

“NOTE 1 Testing factors (0,8 or 0,9) are already accounted for in determining nominal design stress in 5.2.2.2 of this Part 6.

NOTE 2 For non-circular sections (rectangular sections), see EN13445-3:2014, Clause 15 (see remark about fatigue design and radius requirements in 5.2.2.7).”

## 6 Modification to 5.2.2.1.3 to 5.2.2.1.6

Renumber 5.2.2.1.3 to 5.2.2.1.6 as follows:

“5.2.2.1.2.1 Design by formula (DBF)

5.2.2.1.2.2 Design by analysis (DBA)

5.2.2.1.2.3 Design by experiment (DBE)

5.2.2.1.2.4 Determination of the hydraulic burst pressure and maximum allowable pressure for static loading”.

## 7 Modifications to 5.2.2.1.2.3 Design by experiment (DBE)

Replace  $R_{m(3)}$  with  $RM3$  in equation 5-1 as follows:

$$e_a = e_{act} \cdot \left( \frac{S \cdot PS \cdot RM3}{P_{b,act} \cdot R_{p0,2} \cdot C_Q \cdot C_T \cdot C_e} \right)^{1/n} \quad (5-1)$$



*Insert the following text immediately after the explanation of variables:*

“For determining  $RM3$  three tensile test specimens shall be performed in accordance with EN 1563:2012 or EN 13835:2012 material standards for each of the required positions taken from the same cast.

The specimen positions shall be in accordance with the specifications in the technical delivery conditions of the product form for materials for pressure equipment. In addition to the requirements of the material standards, the manufacturer and the purchaser may agree on the properties required at stated positions in the casting. These properties shall be determined by testing machined test pieces cut from the casting at these stated positions. The mean value of the three specimens shall be used to determine the ratio of  $RM3/R_m$ .

Specimens may be taken before the burst test on an identical part or on the same part after burst test. It is not allowed to use scaled-down part of the part under investigation.<sup>1)</sup>

The position on the casting from where the sample is cut shall be in an area where the casting wall thickness is close to the relevant wall thickness of the casting. For the purpose of determining the size of the test pieces to be used, the purchaser shall, by the time of acceptance of the order, indicate to the manufacturer which are the important sections. In the absence of any direction by the purchaser, the manufacturer may choose the size of the test piece to be used according to the relevant standard.

No specimen may show a lower value than the minimum value of  $R_m$  stated in the respective material standards of the material grade under investigation, taking into account the corresponding thickness.

The preferred test piece diameter is 14 mm, but, for technical reasons and for test pieces machined from castings, it is permitted to use a test piece of different diameter or equivalent diameter.

Retesting shall be carried out if a test is not valid. A test is not valid if there is:

- a faulty mounting of the test piece or defective operation of the test machine;
- a defective test piece because of incorrect pouring or incorrect machining;
- a fracture of the tensile test piece outside the gauge length;
- a casting defect in the test piece, evident after fracture.

In all cases, a new test piece shall be taken from the same sample or a duplicate sample cast at the same time. The result of the retest shall be used.”

## **8 Modification to 5.2.2.1.2.4 Determination of the hydraulic burst pressure and maximum allowable pressure for static loading**

*In item 6), replace the existing formulae with the following:*

$$P_b \geq PS \cdot \frac{RM3}{f} \left( \frac{e_{act}}{e_{min} - c} \right)^n \quad (5-3)$$

1) When taking values after burst testing these may show lower tensile strength properties for some grades and should only be used with caution in exceptional cases (single part or very large part, etc.).