



**SLOVENSKI STANDARD**  
**SIST EN 13445-2:2021/A1:2023**  
**01-junij-2023**

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**Nekurjene tlačne posode - 2. del: Materiali - Dopnilo A1**

Unfired pressure vessels - Part 2: Materials

Unbefeuerte Druckbehälter - Teil 2: Werkstoffe

Réipients sous pression non soumis à la flamme - Partie 2 : matériaux

**Ta slovenski standard je istoveten z: EN 13445-2:2021/A1:2023**

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EUROPEAN STANDARD

EN 13445-2:2021/A1

NORME EUROPÉENNE

EUROPÄISCHE NORM

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## Unfired pressure vessels - Part 2: Materials

Réceptacles sous pression non soumis à la flamme -  
Partie 2 : matériaux

Unbefeuerte Druckbehälter - Teil 2: Werkstoffe

This amendment A1 modifies the European Standard 2626659; it was approved by CEN on 21 February 2023.

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.

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 13445-2:2021/A1:2023) 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of an identical text or by endorsement, at the latest by September 2023, and conflicting national standards shall be withdrawn at the latest by September 2023.

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) / Regulation(s).

For relationship with EU Directive(s) / Regulation(s), see informative Annex ZA, which is an integral part of EN 13445-2:2021.

This document includes the text of the amendment itself. The amendment will be consolidated within EN 13445-2:2021 in accordance with the maintenance system of EN 13445 series approved by the CEN/BT Decision C172/2021.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: 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, Türkiye and the United Kingdom.

**EN 13445-2:2021/A1:2023 (E)****1 Modification to Clause 2, Normative references**

Update the normative references as follows in this clause and in the whole document:

Delete “EN 764-3:2002, Pressure equipment — Part 3: Definition of parties involved”

Replace “EN 10028-2:2009” by “EN 10028-2:2017”, “EN 10028-3:2009” by “EN 10028-3:2017”, “EN 10028-4:2009” by “EN 10028-4:2017”, “EN 10028-5:2009” by “EN 10028-5:2017”, “EN 10028-6:2009” by “EN 10028-6:2017” and “EN 10028-7:2007” by “EN 10028-7:2016”

Replace “EN 10217-3:2002, EN10217-3:2002/A1:2005, Welded steel tubes for pressure purposes — Technical delivery conditions — Part 3: Alloy fine grain steel tubes” by “EN 10217-3:2019, Welded steel tubes for pressure purposes — Technical delivery conditions — Part 3: Electric welded and submerged arc welded alloy fine grain steel tubes with specified room, elevated and low temperature properties”

Replace “EN 10217-4:2002, EN 10217-4:2002/A1:2005” by “EN 10217-4:2019”,

Replace “EN 10217-6:2002, EN 10217-6:2002/A1:2005” by “EN 10217-6:2019”

Replace “EN 10222-3:1998” by “EN 10222-3:2017”

Replace “EN 10222-4:1998, EN 10222-4:1998/A1:2001” by “EN 10222-4:2017+A1:2021”

Replace “EN 10273:2007” by “EN 10273:2016”

Replace “EN 13479:2004” by “EN 13479:2017”

Replace “EN ISO 148-1:2010, Metallic materials — Charpy pendulum impact test — Part 1: Test method (ISO 148-1:2010)” by “EN ISO 148-1:2016, Metallic materials — Charpy pendulum impact test — Part 1: Test method (ISO 148-1:2016)”

Replace “EN ISO 204:2009” by “EN ISO 204:2018”

Replace “EN ISO 2566-1:1999, Steel — Conversion of elongation values — Part 1: Carbon and low alloy steels (ISO 2566-1:1984)” by “EN ISO 2566-1:2021, Steel — Conversion of elongation values — Part 1: Carbon and low alloy steels (ISO 2566-1:2021)”

Replace “EN ISO 2566-2:1999, Steel — Conversion of elongation values — Part 2: Austenitic steels (ISO 2566-2:1984)” by “EN ISO 2566-2:2021, Steel — Conversion of elongation values — Part 2: Austenitic steels (ISO 2566-2:2021)”

Replace “EN ISO 3506-1:2009, Mechanical properties of corrosion-resistant stainless-steel fasteners — Part 1: Bolts, screws and studs (ISO 3506-1:2009)” by “EN ISO 3506-1:2020, Mechanical properties of corrosion-resistant stainless-steel fasteners — Part 1: Bolts, screws and studs with specified grades and property classes (ISO 3506-1:2020)”

Replace “EN ISO 3506-2:2009, Mechanical properties of corrosion-resistant stainless-steel fasteners — Part 2: Nuts (ISO 3506-2:2009)” by “EN ISO 3506-2:2020, Mechanical properties of corrosion-resistant stainless-steel fasteners — Part 2: Nuts with specified grades and property classes (ISO 3506-2:2020)”

Replace “EN ISO 6892-1:2009, Metallic materials — Tensile testing — Part 1: Method of test at room temperature (ISO 6892-1:2009)” by “EN ISO 6892-1:2019, Metallic materials — Tensile testing — Part 1: Method of test at room temperature (ISO 6892-1:2019)”

Replace “CEN ISO/TR 15608:2000, Welding — Guidelines for a metallic material grouping system (ISO/CR 15608:2000)” by “CEN ISO/TR 15608:2017, Welding — Guidelines for a metallic materials grouping system (ISO/TR 15608:2017)”

## 2 Modification to 3.1, *Terms and definitions*

Delete the reference to EN 764-3:2002 in the first sentence of this subclause, which shall read as follows:

“For the purposes of this document, the terms and definitions given in EN 13445-1:2021, EN 764-1:2015+A1:2016 and the following apply.”

## 3 Modification to 3.1.2, *temperature adjustment term $T_s$*

Replace “ $T_s$ ” by “ $T_A$ ” and accordingly in the whole EN 13445-2:2021.

## 4 Modification to 4.1.7

Replace Table 4.1-1 with the following:

“

Steel group (according to Table A.1)	Maximum content of cast analysis		
	% C	% P	% S
Steels (1 to 6 and 9)	0,23 <sup>a</sup>	0,035	0,025
Steels (1 to 6 and 9) when DBA – Direct Route is used <sup>c</sup>	0,20	0,025	0,015
Ferritic stainless steels (7.1)	0,08	0,040	0,015
Martensitic stainless steels (7.2)	0,06	0,040	0,015
Austenitic stainless steels (8.1) (8.3)	0,08	0,045	0,015 <sup>b</sup>
Austenitic stainless steels (8.2)	0,10	0,035	0,015
Austenitic-ferritic stainless steels (10)	0,030	0,035	0,015

<sup>a</sup> Maximum content of product analysis may be 0,25 %.

<sup>b</sup> For products to be machined a controlled sulphur content of 0,015 % to 0,030 % is permitted by agreement provided the resistance to corrosion is satisfied for the intended purpose.

<sup>c</sup> In addition the ratio on thickness reduction (ratio of initial thickness of slab/ingot to the thickness of the final plate) shall be equal or greater than:

- 4 for NL2 steels and steels of material group 9;
- 3 for other materials.

“

## 5 Modification to Annex A, Grouping system for steels for pressure equipment

Replace Table A.1 with the following:

**Table A.1 — Grouping system for steels (extract from CEN ISO/TR 15608:2017)**

Group	Sub-group	Type of steel
1		Steels with a specified minimum yield strength $R_{eH} \leq 460$ MPa <sup>a</sup> and with analysis in %: $C \leq 0,25$ $Si \leq 0,60$ $Mn \leq 1,70$ $Mo \leq 0,70^b$ $S \leq 0,045$ $P \leq 0,045$ $Cu \leq 0,40^b$ $Ni \leq 0,5^b$ $Cr \leq 0,3$ (0,4 for castings) <sup>b</sup> $Nb \leq 0,05$ $V \leq 0,12^b$ $Ti \leq 0,05$
	1.1	Steels with a specified minimum yield strength $R_{eH} \leq 275$ MPa
	1.2	Steels with a specified minimum yield strength $275 \text{ MPa} < R_{eH} \leq 360$ MPa
	1.3	Normalised fine grain steels with a specified minimum yield strength $R_{eH} > 360$ MPa
	1.4	Steels with improved atmospheric corrosion resistance whose analysis may exceed the requirements for the single elements as indicated under 1
2		Thermomechanically treated fine grain steels and cast steels with a specified minimum yield strength $R_{eH} > 360$ MPa
	2.1	Thermomechanically treated fine grain steels and cast steels with a specified minimum yield strength $360 \text{ MPa} < R_{eH} \leq 460$ MPa
	2.2	Thermomechanically treated fine grain steels and cast steels with a specified minimum yield strength $R_{eH} > 460$ MPa
3		Quenched and tempered steels and precipitation hardened steels except stainless steels with a specified minimum yield strength $R_{eH} > 360$ MPa
	3.1	Quenched and tempered steels with a specified minimum yield strength $360 \text{ MPa} < R_{eH} \leq 690$ MPa
	3.2	Quenched and tempered steels with a specified minimum yield strength $R_{eH} > 690$ MPa
	3.3	Precipitation hardened steels except stainless steels



Group	Sub-group	Type of steel
4		Low vanadium alloyed Cr-Mo-(Ni) steels with $Mo \leq 0,7 \%$ and $V \leq 0,1 \%$
	4.1	Steels with $Cr \leq 0,3 \%$ and $Ni \leq 0,7 \%$
	4.2	Steels with $Cr \leq 0,7 \%$ and $Ni \leq 1,5 \%$
5		Cr-Mo steels free of vanadium with $C \leq 0,35 \%$ <sup>c</sup>
	5.1	Steels with $0,75 \% \leq Cr \leq 1,5 \%$ and $Mo \leq 0,7 \%$
	5.2	Steels with $1,5 \% < Cr \leq 3,5 \%$ and $0,7 < Mo \leq 1,2 \%$
	5.3	Steels with $3,5 \% < Cr \leq 7,0 \%$ and $0,4 < Mo \leq 0,7 \%$
	5.4	Steels with $7,0 \% < Cr \leq 10 \%$ and $0,7 < Mo \leq 1,2 \%$
6		High vanadium alloyed Cr-Mo-(Ni) steels
	6.1	Steels with $0,3 \% \leq Cr \leq 0,75 \%$ , $Mo \leq 0,7 \%$ and $V \leq 0,35 \%$
	6.2	Steels with $0,75 \% < Cr \leq 3,5 \%$ , $0,7 \% < Mo \leq 1,2 \%$ and $V \leq 0,35 \%$
	6.3	Steels with $3,5 \% < Cr \leq 7,0 \%$ , $Mo \leq 0,7 \%$ and $0,45 \% \leq V \leq 0,55 \%$
	6.4	Steels with $7,0 \% < Cr \leq 12,5 \%$ , $0,7 \% < Mo \leq 1,2 \%$ and $V \leq 0,35 \%$
7		Ferritic, martensitic or precipitation hardened stainless steels with $C \leq 0,35 \%$ and $10,5 \% \leq Cr \leq 30 \%$
	7.1	Ferritic stainless steels
	7.2	Martensitic stainless steels
	7.3	Precipitation hardened stainless steels
8		Austenitic steels
	8.1	Austenitic stainless steels with $Cr \leq 19 \%$
	8.2	Austenitic stainless steels with $Cr > 19 \%$
	8.3	Manganese austenitic stainless steels with $4 \% < Mn \leq 12 \%$
9		Nickel alloyed steels with $Ni \leq 10 \%$
	9.1	Nickel alloyed steels with $Ni \leq 3 \%$
	9.2	Nickel alloyed steels with $3 \% < Ni \leq 8 \%$
	9.3	Nickel alloyed steels with $8 \% < Ni \leq 10 \%$
10		Austenitic ferritic stainless steels (duplex)
	10.1	Austenitic ferritic stainless steels with $Cr \leq 24 \%$ and $Ni \leq 4 \%$
	10.2	Austenitic ferritic stainless steels with $Cr > 24 \%$ and $Ni \geq 4 \%$
	10.3	Austenitic ferritic stainless steels with $Cr > 24 \%$ and $Ni \leq 4 \%$
<p><sup>a</sup> In accordance with the specification of the steel product standards, <math>R_{eH}</math> may be replaced by <math>R_{p0,2}</math> or <math>R_{t0.5}</math>.</p> <p><sup>b</sup> A higher value is accepted provided that <math>Cr + Mo + Ni + Cu + V \leq 0,75 \%</math>.</p> <p><sup>c</sup> "Free of vanadium" means not deliberately added to the material.</p>		

“

## EN 13445-2:2021/A1:2023 (E)

**6 Modification to Bibliography**

Update the following bibliographical items accordingly:

“

[13] EN ISO 6892-1:2019, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature* (ISO 6892-1:2019)

[14] EN 10079:2007, *Definition of steel products*

[18] EN 10028-1:2017, *Flat products made of steels for pressure purposes — Part 1: General requirements*

[19] EN 10213:2007+A1:2016, *Steel castings for pressure purposes*

[23] EN 10217-1:2019, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 1: Electric welded and submerged arc welded non-alloy steel tubes with specified room temperature properties*

[24] EN 10217-2:2019, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 2: Electric welded non-alloy and alloy steel tubes with specified elevated temperature properties*

[25] EN 10217-5:2019, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 5: Submerged arc welded non-alloy and alloy steel tubes with specified elevated temperature properties*

[26] EN 10217-7:2021, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 7: Stainless steel tubes*

[27] EN 10222-1:2017, *Steel forgings for pressure purposes — Part 1: General requirements for open die forgings*

[28] EN 10222-2:2017+A1:2021, *Steel forgings for pressure purposes — Part 2: Ferritic and martensitic steels with specified elevated temperature properties*

[29] EN 10253-2:2021, *Butt-welding pipe fittings — Part 2: Non alloy and ferritic alloy steels with specific inspection requirements*

[30] EN 10272:2016, *Stainless steel bars for pressure purposes*

[31] EN ISO 14343:2017, *Welding consumables — Wire electrodes, strip electrodes, wires and rods for fusion welding of stainless and heat resisting steels — Classification* (ISO 14343:2017)

“