SLOVENSKI STANDARD
SIST EN 13445-2:2002/oprA5:2007

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Neogrevane tlaļne posode ï 2. del: Materiali

Unfired pressure vessels - Part 2: Materials

Unbefeuerte Druckbehälter - Teil 2: Werkstoffe

Récipients sous pression non soumis a la flamme - Partie 2: Matériaux

Ta slovenski standard je istoveten z: **EN 13445-2:2002/prA5**

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Unfired pressure vessels - Part 2: Materials

Récipients sous pression non soumis à la flamme - Partie 2: Matériaux

Unbefeuerte Druckbehälter - Teil 2: Werkstoffe

This draft amendment is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 54.

This draft amendment A5, if approved, will modify the European Standard EN 13445-2:2002. If this draft becomes an amendment, 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.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 13445-2:2002/prA5:2006) 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 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(s).

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

This document includes the text of the amendment itself. The corrected pages of EN 13445-6 will be delivered as issue xx of the standard.

Add the following references to clause 2:

2 Normative references

EN 1092-1:2001, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories — Part 1: Steel flanges, PN designated*

EN 10216-3:2003/A1:2004, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 3: Alloy fine grain steel tubes; Amendment A1*

EN 10216-4:2002/A1:2004, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 4: Non-alloy and alloy steel tubes with specified low temperature properties; Amendment A1*

EN 10217-3:2002/A1:2005, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 3: Alloy fine grain steel tubes; Amendment A1*

EN 10222-4:1998/A1:2001, *Steel forgings for pressure purposes — Part 4: Weldable fine grain steels with high proof strength; Amendment A1*

EN 10269:1999/A1:2006, *Steels and nickel alloys for fasteners with specified elevated and/or low temperature properties; Amendment A1*

EN 20898-2:1993, *Mechanical properties of fasteners — Part 2: Nuts with specified proof load values — Coarse thread (ISO 898-2:1992)*

EN ISO 898-1:1999, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs (ISO 898-1:1999)*

EN ISO 3506-1:1997, *Mechanical properties of corrosion-resistant stainless steel fasteners — Part 1: Bolts, screws and studs (ISO 3506- 1:1997)*

EN ISO 3506-2:1997, *Mechanical properties of corrosion-resistant stainless steel fasteners — Part 2: Nuts (ISO 3506-2:1997)*

Delete existing Annex B and replace it with the following text:

Annex B
(normative)

Requirements for prevention of brittle fracture at low temperatures

B.1 General

This annex distinguishes between pressure equipment that has normal operation temperatures higher or lower than 50 °C.

For pressure equipment with normal operation temperatures higher than 50 °C B.5 applies. If B.5 is not applicable, the following rules for lower normal operation temperatures shall be used.

For pressure equipment with design temperature equal to or less than 50 °C this annex specifies three alternative methods for establishing criteria for the avoidance of low temperature brittle fracture[1)] of steels in the form of plate, strip, tubes, fittings, forgings, castings, flanges, fasteners and weldments used in pressure parts. The criteria are based on impact energy requirements at specified temperatures for the base material, heat affected zone (including the fusion line) and weld metals.

The three methods are:

Method 1 Technical requirements developed from the principles of fracture mechanics and from operating experience and applicable to all steels, but limited to certain thicknesses depending on minimum impact energy requirements as specified in harmonized European material standards for pressure equipment (see Table B.2–1).

Method 2 Technical requirements developed from the same principle of fracture mechanics as method 1 and from operating experiences but only applicable to C, CMn and low alloy ferritic steels and austenitic ferritic steels with a specified minimum yield strength $\leq$ 500 N/mm^2. This method may be applied to a wider range of thicknesses and temperatures than method 1 (see Figures B.2–1 to B.2–12).

Method 3 The application of a fracture mechanics analysis. This general method is applicable to cases not covered by methods 1 or 2. This method may also be used to justify deviations from the requirements of method 1 or 2. Only general guidance is given on the use of this method which shall only be used in agreement with the parties concerned.

Each of the three methods may be used independently. It is only necessary to satisfy the requirement of any one method.

All applicable combinations of the temperatures T_M (minimum metal temperature) and T_S (temperature adjustment term) shall be considered and the lowest possible T_R-value (design reference temperature) shall be used for the determination of the required material impact test temperature.

NOTE For definitions of temperature terms see 3.1.1 to 3.1.4.

1) Including temperatures at pressure tests

B.2 Material selection and impact energy requirements

The methods specified in B.2.1 (method 1) or B.2.2 (method 2) shall be used to determine impact energy required to avoid brittle fracture. Alternatively, B.2.3 (method 3) may be used to determine the required toughness. The method used shall be fully documented, in order to ensure that compliance can be verified.

Reference thickness for constructional details is defined in table B.6-1.

B.2.1 Method 1

B.2.1.1 General

Method 1 allows the selection of materials taken from harmonised European standards with regard to avoidance of brittle fracture. Table B.2–1 gives an overview to the following tables by steel type and product form.

The weld metal, the heat affected zone and other parts affected by manufacturing processes shall satisfy the same impact test requirements as the guaranteed minimum properties for the base material at T_R given in the tables.

The tables list design reference temperatures for maximum thickness at given strength levels represented by steels from European standards with guaranteed minimum strength and impact properties. Where it is not possible to achieve these minimum properties after fabrication, tougher material shall be selected.

Table B.2–1 — Guide to material selection

Table	Material or product form	Steel group	Clause
B.2–2	Plates and strips	Ferritic steels	B.2.1.2
B.2–3	Seamless and welded pipes		
B.2–4	Bars		
B.2–5	Forgings		
B.2–6	Ni alloyed steels (1,5 < Ni $\leq$ 5 %)	Ferritic steels	B.2.1.3
B.2–7	Ni-alloyed steel (9 % Ni)		
B.2–8	Bolts and nuts	Ferritic steels	B.2.1.4
B.2–9		Austenitic steels	
B.2–10			
B.2–11	Austenitic steel grades	Austenitic steels	B.2.1.5

NOTE Requirements for austenitic-ferritic steels are given in B.2.2 (method 2).

Where test pieces of at least 5 mm wide can not be obtained the material shall not be subject to impact testing.

Values of the design reference temperature T_R shall be calculated from the metal temperature T_M using the values of the temperature adjustment T_S given in Table B.2–12.

B.2.1.2 Ferritic steels

Tables B.2–2 to B.2–5 list ferritic steels taken from harmonised European material standards normally used for low temperature service with an impact test temperature T_{KV} below – 10 °C.

The tabulated value of T_R is equated with impact test temperature T_{KV} for KV = 27J.

Table B.2–2 — General requirements for prevention of brittle fracture with reference thickness for plates and strips

Plates and Strips								
No. as per Table D.2-1	European Standard EN	Grade	Material No.	Max. reference thickness e_B		Design reference temperature T_R (°C)	Material group to CR ISO 15608:2000	Remarks
				AW	PWHT			
1	10028-2:2003	P235GH	1.0345	35	110	– 20	1.1	
2		P265GH	1.0425	35	110			
3		P295GH	1.0481	35	110		1.2	
4		P355GH	1.0473	35	60			
29	10028-3:2003	P275NH	1.0487	35	110	– 20	1.1	
30		P275NL1	1.0488	35	110	– 40		
31		P275NL2	1.1104	35	110	– 50		
32		P355N	1.0562	35	60	– 20	1.2	
33		P355NH	1.0565	35	60	– 20		
34		P355NL1	1.0566	35	60	– 40		
35		P355NL2	1.1106	35	60	– 50		
36		P460NH	1.8935	26	37	– 20	1.3	
37		P460NL1	1.8915	26	37	– 40		
38		P460NL2	1.8918	26	37	– 50		
39	10028-4:2003	11MnNi5-3	1.6212	35	110	– 60	9.1	
40		13MnNi6-3	1.6217	35	60	– 60		
41		15NiMn6	1.6228	35	60	– 80		
50	10028-5:2003	P355M	1.8821	30	30	– 20	1.2	
51		P355ML1	1.8832	30	30	– 40		
52		P355ML2	1.8833	30	30	– 50		
53		P420M	1.8824	32	42	– 20	2.1	
54		P420ML1	1.8835	32	42	– 40		
55		P420ML2	1.8828	32	42	– 50		
56		P460M	1.8826	28	37	– 20		
57		P460ML1	1.8837	28	37	– 40		
58		P460ML2	1.8831	28	37	– 50		
59	10028-6:2003	P355Q	1.8866	35	60	– 20	1.2	
60		P355QH	1.8867	35	60	– 20		
61		P355QL1	1.8868	35	60	– 40		
62		P355QL2	1.8869	35	60	– 60	3.1	
63		P460Q	1.8870	27	37	– 20		
64		P460QH	1.8871	27	37	– 20		
65		P460QL1	1.8872	27	37	– 40		
66		P460QL2	1.8864	27	37	– 60		

Table B.2–3 — General requirements for prevention of brittle fracture with reference thickness for seamless and welded tubes

Seamless and welded tubes								
No. as per Table D.2-1	European Standard EN	Grade	Material No.	Max. reference thickness e_B AW	Max. reference thickness e_B PWHT	Design reference temperature T_R (°C)	Material group to CR ISO 15608:2000	Remarks
231	10216-3:2003 + A1:2004	P275NL1	1.0488	35	74	– 40	1.1	
232		P275NL2	1.1104	35	74	– 50		
233		P355N	1.0562	35	52	– 20	1.2	
234		P355NH	1.0565	35	52	– 20		
235		P355NL1	1.0566	35	52	– 40		
236		P355NL2	1.1106	35	52	– 50		
237		P460N	1.8905	27	37	– 20	3.1	
238		P460NH	1.8935	27	37	– 20		
239		P460NL1	1.8915	27	37	– 40		
240		P460NL2	1.8918	27	37	– 50		
248	10216-4:2002 + A1:2004	P215NL	1.0451	10	10	– 40	1.1	
249		P255QL	1.0452	35	40	– 50		
250		P265NL	1.0453	25	25	– 40		
251		26CrMo4-2	1.7219	15	39	– 60	5.1	
252		11MnNi5-3	1.6212	35	40	– 60	9.1	
253		13MnNi6-3	1.6217	35	40	– 60	9.1	
306	10217-3:2002 + A1:2005	P275NL1	1.0488	35	40	– 40	1.1	
307		P275NL2	1.1104	35	40	– 50		
308		P355N	1.0562	35	40	– 20	1.2	
309		P355NH	1.0565	35	40	– 20		
310		P355NL1	1.0566	35	40	– 40		
311		P355NL2	1.1106	35	40	– 50		
312		P460	1.8905	26	37	– 20	3.1	
313		P460NH	1.8935	26	37	– 20		
314		P460NL1	1.8915	26	37	– 40		
315		P460NL2	1.8918	26	37	– 50		
316	10217-4:2002 + A1:2005	P215NL	1.0451	10	10	– 40	1.1	
317		P265NL	1.0453	25	25	– 40	1.1	
321	10217-6:2002 + A1:2005	P215NL	1.0451	10	10	– 40	1.1	
322		P265NL	1.0453	25	25	– 40	1.1	

Table B.2–4 — General requirements for prevention of brittle fracture with reference thickness for bars

Bars								
No. as per Table D.2-1	European Standard EN	Grade	Material No.	Max. reference thickness e_B		Design reference temperature T_R (°C)	Material group to CR ISO 15608:2000	Remarks
				AW	PWHT			
147	10273:2000	P275NH	1.0487	35	110	– 20	1.1	
148		P355NH	1.0565	35	60		1.2	
149		P460NH	1.8935	35	45		3.1	
150		P355QH	1.8867	35	60		1.2	
151		P460QH	1.8871	35	60		3.1	

Table B.2–5 — General requirements for prevention of brittle fracture with reference thickness for forgings

Forgings								
No. as per Table D.2-1	European Standard EN	Grade	Material No.	Max. ref.. thickness e_B		Design reference temperature T_R (°C)	Material group to CR ISO 15608:2000	Remarks
				AW	PWHT			
367	10222-3:1998	13MnNi6-3	1.6217	35	70	– 60	9.1	
369		15NiMn6	1.6228	35	50	– 80	9.1	NT, QT
378	10222-4:1998 + A1/2001	P285QH	1.0478	35	110	– 20	1.2	
380		P355QH1	1.0571	35	60	– 20	1.2	
382		P420QH	1.8936	35	42	– 20	3.1	

B.2.1.3 Ni –alloyed steels (Ni > 1,5 %)

Table B.2-6 lists Ni alloyed steels up to and including 5 % Nickel taken from harmonised European material standards.

Table B.2-7 lists Ni alloyed steels with 9 % Nickel taken from harmonised European material standards.

The tabulated value of T_R is equated with impact test temperature T_{KV} for KV = 27J.