SLOVENSKI STANDARD
SIST EN 13445-3:2014/A7:2019

01-maj-2019

Neogrevane (nekurjene) tlačne posode - 3. del: Konstruiranje - Dopolnilo A7

Unfired pressure vessels - Part 3: Design

Unbefeuerte Druckbehälter - Teil 3: Konstruktion

Récipients sous pression non soumis à la flamme - Partie 3 : Conception

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Ta slovenski standard je istoveten z: **EN 13445-3:2014/A7:2019**

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ICS:

23.020.32 Tlačne posode Pressure vessels

SIST EN 13445-3:2014/A7:2019 **en,fr,de**

2003-01.Slovenski inštitut za standardizacijo. Razmnoževanje celote ali delov tega standarda ni dovoljeno.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 13445-3:2014/A7

April 2019

ICS 23.020.30

English Version

Unfired pressure vessels - Part 3: Design

Récipients sous pression non soumis à la flamme - Partie 3 : Conception

Unbefeuerte Druckbehälter - Teil 3: Konstruktion

This amendment A7 modifies the European Standard EN 13445-3:2014; it was approved by CEN on 12 November 2018.

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European foreword

This document (EN 13445-3:2014/A7:2019) 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of an identical text or by endorsement, at the latest by October 2019, and conflicting national standards shall be withdrawn at the latest by October 2019.

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 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, which is an integral part of EN 13445-3:2014.

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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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1 Modification to Annex R (informative), Coefficients for creep-rupture model equations for extrapolation of creep-rupture strength

Replace the existing annex with the following one:

“

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Annex R
(informative)

Coefficients for creep-rupture model equations for extrapolation of creep-rupture strength

R.1 General

Long-time creep-rupture strength values for a wide range of engineering steels have been determined for inclusion in European product and design standards. In a number of cases, the model equations and the respective material dependent constants to underpin these strength values have been published (e.g. [1], [2]). Constants for 37 alloys are collated in the following annex to enable the determination of their rupture strength values for lifetimes lower than those specified in the material standards to which they relate.

The collated material dependent constants are for the selection of model equations available in BS-PD6605 [3] (Table R.1)[1]. When model equation parameters are available for the same alloy in both source references [1], [2], those given in ECCC Data Sheets are adopted[2]. These were determined originally, in a rigorous manner, according to ECCC recommendations [4]. Strength values determined according to ECCC recommendations have been verified by at least one check assessment, with the results of all assessments having passed the ECCC post assessment tests [4]. The constants available for certain steels are the same in both source references [1], [2]. In such cases, both references are cited in Table R.2. In 2015, the updated ECCC Data Sheets [5] were reviewed, and where necessary, revised coefficients were provided, as described in [6]. These are now included in Table R.2. Moreover, the limits of the original strength tables derived from those parameters are now included in Table R.3, for information purposes.

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The steels in Table R.2 are given their Material Identification from the source documents [1], [2], [5] (first column from the left), and the actual or closest grade identified in EN standards (second and third columns). See also Annex E, European steels for pressure purposes, in EN 13445-2:2014. A few of the materials in Table R.2 are not listed in EN 13445-2:2014, Annex E; if they are to be used within this standard, a Particular Material Appraisal will be required.

The constants given in Table R.2 shall only be used to determine creep rupture strengths for the range of application temperatures, and up to the maximum life times, specified in the relevant material standard or reference data source [1], [2]. It is also recommended that the data are not used to interpolate to lifetimes less than 1 000 h. There will be an unacceptable level of uncertainty for strength values determined using the constants outside of these $t_u^*(T,\sigma)$ limits.

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1 In BS-PD6605 [3], predicted times are expressed as natural logarithms in the standard-option model equations. The model equations given in Table R.1 express predicted time as logarithm to the base 10 to be consistent with the format adopted in BS-PD6525 [1]. Constants in Table R.2 derived in ECCC assessments [2] and [5] using the BS-PD6605 procedure have been adjusted accordingly, and the models expressed in Table R.2 explicitly to base 10.

2 ECCC refers to the European Creep Collaborative Committee. The ECCC Data Sheets are contained in [2], [5].

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Table R.1 — Creep-rupture model equations

MODEL	Code	*COMMENT*
Algebraic models:		
1) Soviet Model 1		
$\log_{10}[t_u^*] = \beta_0 + \beta_1 \cdot \log_{10}(T) + \beta_2 \cdot \log_{10}[\sigma] + \beta_3/T + \beta_4 \cdot \sigma/T$	SM1	
2) Soviet Model 2		
$\log_{10}[t_u^*] = \beta_0 + \beta_1 \cdot \log_{10}(T) + \beta_2 \cdot \log_{10}[\sigma]/T + \beta_3/T + \beta_4 \cdot \sigma/T$	SM2	
3) Minimum Commitment Model		
$\log_{10}[t_u^*] = \beta_0 + \beta_1 \cdot \log_{10}[\sigma] + \beta_2 \cdot \sigma + \beta_3 \cdot \sigma^2 + \beta_4 \cdot T + \beta_5/T$	MC	
TTP models:		
$f(\sigma) = \beta_0 + \beta_1 \cdot \log_{10}[\sigma] + \beta_2 \cdot (\log_{10}[\sigma])^2 + \beta_3 \cdot (\log_{10}[\sigma])^3 + \beta_4 \cdot (\log_{10}[\sigma])^4$		
a) Mendelson-Roberts-Manson (MRM)		
$\log_{10}[t_u^*] = f(\sigma) \cdot (T - T_o)^r + \beta_5$		
b) MRM with $r = -1$		
$\log_{10}[t_u^*] = f(\sigma)/(T - T_o) + \beta_5$	MR*n*	*n* is order of $f(\sigma)$ polynomial
c) Larson-Miller (MR*n* with $T_o = 0$)		
$\log_{10}[t_u^*] = f(\sigma)/T + \beta_5$	LM*n*	*n* is order of $f(\sigma)$ polynomial
d) Manson-Haferd (MRM with r = 1)		
$\log_{10}[t_u^*] = f(\sigma) \cdot (T - T_o) + \beta_5$	MH*n*	*n* is order of $f(\sigma)$ polynomial
e) Manson-Haferd with $T_o = 0$		
$\log_{10}[t_u^*] = f(\sigma) \cdot T + \beta_5$	MH0*n*	*n* is order of $f(\sigma)$ polynomial
f) Orr-Sherby-Dorn		
$\log_{10}[t_u^*] = f(\sigma) + \beta_5$	OSD*n*	*n* is order of $f(\sigma)$ polynomial
t_u^* is time to rupture in h, T is temperature in K, and σ is stress in MPa.		

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Table R.2 — Constants for creep-rupture equations

MATERIAL IDENTIFICATIONS			REF		*R*	T_o	β_0	β_1	β_2	β_3	β_4	β_5
Grade from Refs [1], [2], [5]	EN Material Grade, Heat Treatment, Number (or closest in brackets)											
C semi and Si killed, C7-C24	-		1	MH4	1	500	−1,258375287	2,614840508	−2,058339119	0,717218578	−0,093936935	10,6787138
C Si and Al killed	P235GH P265GH	1.0345 1.0425	1,2	LM3	−1	0	12083,4375	11945,41016	−5041,64209	277,0161743		−20,58018303
C-Mn	P355GH	1.0473	1,2	MH4	1	500	−0,665640116	1,416657686	−1,151554346	0,413083047	−0,055795278	10,6588726
0.5% Mo	(16Mo3)	(1.5415)	1	LM2	−1	650	−15,9188175	1638,47802	−587,796264			−1,3147382
½%Cr½%Mo¼%V	(12MoCrV6-2-2)	(1.7767)	2,6	MC			−17,6265460	−3,423511490	−0,00225127270	−1,04001E-05	0,004063368	21568,38475
1%CrMo (Norm)	25CrMo4	1.7218	1	MR3	−1	600	7297,777344	−7238,72168	3306,159668	−568,921875		−2,609928608
1%CrMo (Norm, +T)	13CrMo4–5	1.7335	1	MH3	1	280	0,066684094	−0,143434107	0,073764831	−0,013083912		20,32884026
1¼%CrMo (Norm, +T)	(13CrMo4–5)	(1.7335)	1	MH3	1	280	0,066684094	−0,143434107	0,073764831	−0,013083912		20,32884026
0.4%C1¼%CrMo (D900)	42CrMo5–6	1.7233	1	MR4	−1	650	−58488,13213	107347,2301	−71847,65041	21171,74394	−2332,020504	−1,116471322
0.4%C1¼%CrMoV	40CrMoV4–6+NT	(1.7711)	1	MH4	1	650	−29,5491581	49,96889496	−31,70220566	8,939930916	−0,946190417	8,976790428
1%CrMoVTiB (D1055)	20CrMoVTiB4–10	1.7729	2	MH4	1	590	−4,46561718	8,252388	−5,727178097	1,762619853	−0,2033182085	10,523564339
2¼%CrMo (Norm, +T<720°C)	10CrMo9–10+NT	1.7380	1	MH4	1	610	−1,386920571	2,832926035	−2,196207523	0,756533384	−0,098411702	10,39575958
2¼%CrMo (Norm, +T<750°C)	10CrMo9–10+NT	1.7380	1	MH4	1	610	−0,524605751	1,04690969	−0,819874346	0,289080709	−0,03939661	10,36085415
9%CrMo (Annealed)	X11CrMo9–1+I1	1.7386 +I	1	MH4	1	600	−0,806423008	1,757547379	−1,45764327	0,53260231	−0,073432676	11,69501019
9%CrMo (Norm, +T)	X11CrCrMo9–1+NT	1.7386+NT	1	MH4	1	560	0,111461408	−0,22190614	0,114587747	−0,016373638	−0,001907427	14,17219162
Steel-91 (2009)	X10CrMoVNb9–1	1.4903	5	MH4	1	550	−0,86363	1,8227	−1,4795	0,53004	−0,071486	17,5
Cast Steel-91	GX12CrMoVNbN9–1	-	2,6	MH3	1	590	1,07365967	−1,62626152	0,80859709	−0,13622707		14,20969019
E911	X11CrMoWVNb9–1-1	-	2	MH4	1	613	−2,4726	5,1073	−3,9845	1,3796	−0,17956	13,3
ASTM Grade 92 (T/P92)	X10CrWMoVNb9–2-2	1.4901	2	MH4	1	500	−0,400372007	0,843448668	−0,707398695	0,262299255	−0,036764352	17,59416003
12%CrMoV (Rm690–840MPa)	X20CrMoNiV11–1	1.4922	1,6	MH4	1	450	−0,133479285	0,265318778	−0,236739625	0,091272674	−0,013306470	17,67927146
Esshete 1250	X10CrNiMoMnNbVB 15-10-1	1.4982	1	LM4	−1	0	−336414,5313	799872,0625	−654687,0625	234517,4219	−31193,5293	−18,43135262
18%Cr8%Ni (Type 304H)	X6rNi18–10	1.4948	1	MH04	1	0	0,202073291	−0,440956682	0,328647107	−0,108594514	0,013175405	25,24123001

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