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Unfired pressure vessels - Part 2: Materials

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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 A1, 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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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 13445-2:2002/prA1:2004) 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).

1 Scope

Add at the end of the first sentence after sufficient ductility:

but it is, for components operating in the creep range, also limited to sufficiently creep ductile materials.

Delete the second sentence

3 Terms and definitions

Add:

3.1.6
creep weld strength reduction factor
factor to account for possible strength reduction at the weldment

In Table 3.2-2 – Mechanical quantities

Include:

Mean 1% creep strain limit at lifetime *T* and calculation temperature *t*	$S_{\mathrm{P1,0/T/t}}$	MPa, N/mm²
Mean creep rupture strength at lifetime *T* and calculation temperature *t*	$S_{\mathrm{R/T/t}}$	MPa, N/mm²
Weld creep strength reduction factor	z_{creep}	-

4 Requirements for materials to be used for pressure-bearing parts

4.1 General

In 4.1 add:

4.1.6 A material is considered to be sufficiently creep ductile if the average elongation or reduction of area at creep rupture is greater than five times the product, at the same temperature and stress, of the average minimum creep rate and the average time to rupture.

The steels and steel castings listed in Table A.2-1 of EN 13445-2:2002 for which, for the relevant temperature regime, creep strengths are given in the referred to material standards, are considered to be sufficiently creep ductile. This is, without proof, not valid for weldments, for which sufficient creep ductility shall be proven.

4.2 Special provisions

4.2.1 Special properties

4.2.1.1 General

Change second indent to:

— operating conditions: e.g. creep, hydrogen embrittlement, corrosion, scaling and ageing behaviour of the material after cold forming.

Add a new paragraph 4.2.3 as follows:

4.2.3 Design temperature in the creep range

4.2.3.1 Creep properties

For interpolation and extrapolation of creep properties given in the material standard, see EN 13445-3, Clause 19.

4.2.3.2 Yield strength

For extrapolation of yield strength at temperatures beyond those given in the material standard, see EN 13445-3, Clause 19.

4.2.3.3 Weld creep strength reduction factor determination by tests

Creep properties of weld joints subject to forces normal to the weld may differ essentially from those of the base material. The creep rupture strength of the weld joint is obtained by multiplying the creep rupture strength of the base material by the weld creep strength reduction factor z_{creep}.

An acceptable method to determine z_{creep} by cross-weld tests is given in the informative Annex D.

Annex D
(informative)

Procedure for determination of the weld creep strength reduction factor (WCSRF)

a) Each steel manufacturer (or group of manufacturers as part of the same company organisation) shall provide the following information on creep resistance of the welded joint if WCSRF is to be taken as 1.0.

b) Stress rupture tests on similar (compared to the real application in field) welded joints with similar manufacturing process (weld metal, PWHT) of the steel shall be carried out according to the E.C.C.C. recommendations.

c) Two test temperatures shall be selected within a range of +/- 30 °C about the mean design temperature. At each of these temperatures, creep tests shall be carried out at stresses selected to give durations up to 1/3 of the design life (typically 1, 3, 10, 30, 60, 100 kh, etc.). It has to be shown that the lower limit of the achieved creep values of the welded joint are not lower than the lower accepted scatter band (-20%) of specified mean values of the creep strength of the base material according the material standard. However if the failure is located in the HAZ, extrapolation is not allowed without further longer testing showing no further apparent decrease. In this case extrapolation may be made by a factor equivalent to the factor showing stabilised conditions used in the further longer testing.

d) When no cracking in the HAZ has been found in the tests prescribed above, an additional set of tests at a higher temperature shall be made with the value of LMP equal to or greater than that at the extrapolation point. This testing shall be made to confirm that the location of the failure does not change from the base material to HAZ. The temperature shall ideally be no more than 50°C greater than the higher temperature test in c) (in order to avoid an unacceptable modification of the microstructure). The stress shall lead to a minimum testing time of 10kh. The temperature and testing time shall be selected so that the LMP in these tests is at least the value at the extrapolation point (time and temperature). A minimum of 3 samples shall be tested. The fracture location of the creep specimens shall be checked by microscopic examination.

e) If fracture location of the creep specimens in d) is within the base material, the WCSRF may be taken as unity for a time equal to the time achieved in the tests in c) multiplied by a maximum of 3.

f) When the creep strength properties of cross weld specimens fall below the minimum value given in the scatter band a specific weld reduction factor can be used based on the ratio of the average value of the creep strength compared to 80 % of the mean value of the base material.