SLOVENSKI STANDARD
SIST EN 13445-3:2014/A2:2016

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Neogrevane tlačne posode - 3. del: Konstruiranje - Dopolnilo A2

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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EUROPEAN STANDARD

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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 A2 modifies the European Standard EN 13445-3:2014; it was approved by CEN on 12 June 2016.

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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
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European foreword

This document (EN 13445-3:2014/A2:2016) 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of an identical text or by endorsement, at the latest by February 2017, and conflicting national standards shall be withdrawn at the latest by February 2017.

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/EC.

For relationship with EU Directive 97/23/EC, see informative Annex ZA, which is an integral part of EN 13445-3:2014.

This document includes the text of the amendment itself. The corrected pages of EN 13445-3 will be published in July 2017 as Issue 4 of the standard.

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, 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.

1 Modification to Annex M (informative), In service monitoring of vessels operating in fatigue or creep service

Replace the existing Annex M with the following:

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Annex M
(informative)

In service monitoring of vessels operating in fatigue or creep service

M.1 Purpose

This annex gives guidance on the monitoring of vessels which operate in either fatigue or creep service.

M.2 Fatigue operation

The operator should record in a suitable fashion the number of load cycles occurring and a plan should be prepared for the inspection of the vessel throughout its life. Typically, a pressure vessel operating in fatigue should be internally and if necessary externally inspected (by VT, RT, UT, PT, etc. as relevant). Surface inspection is generally more relevant than volumetric inspection.

The first inspection should take place after a period corresponding to not more than 50 % of the calculated allowable fatigue life. The following inspections should take place after a further period of not more than 50 % (i.e. before 100 % of the calculated allowable fatigue life).

NOTE 1 The time of first inspection corresponds to 50 % of the allowable number of cycles when the design stress range spectrum includes only one type of cycle. For more complex loading spectra, it corresponds to the time when a total fatigue damage index of 0,5 (see definition in Clauses 17 or 18) has been reached.

NOTE 2 The records of loading cycles may indicate a need for sooner inspection than originally planned on the basis of the design specification.

For pressure vessels subject to cyclic loading, in-service inspections are of particular importance for early detection of incipient damage. Internal visual inspections should be supplemented by non-destructive tests on highly loaded locations especially by surface crack tests and ultrasonic tests.

NOTE 3 For monitoring inaccessible areas, an ultrasonic test from the outside surface of the vessel may be appropriate.

If the operating conditions deviate from those assumed in the design calculation according to Clauses 17 or 18 and are likely to cause greater fatigue damage, or if other damage of the vessel wall is to be expected owing to other operating influences, before the end of an inspection interval, then the inspection interval should be shortened to 25 % of the allowable number of cycles, or correspond to a total fatigue damage index of 0,25.

M.3 Measures to be taken when the calculated allowable fatigue lifetime has been reached and/or cracks or crack-like defects are detected

When the calculated allowable fatigue lifetime for a component has been reached (i.e. if the allowable number of cycles has been reached, or if the total fatigue damage index according to Clauses 17 or 18

has reached the value 1), non-destructive tests should be performed as completely as possible concentrating on the highly stressed locations.

If no cracks are detected in the non-destructive tests conducted in the inspection intervals and in the test above, continued operation may be allowed. The next inspection intervals should be shortened to correspond either to 25 % of the calculated allowable number of cycles, or to an additional total fatigue damage index of 0,25.

NOTE The period may be able to be increased if damage tolerance analysis based on fracture mechanics is undertaken.

If cracks or crack-like defects, or other more extensive damage are detected, either before or after the calculated allowable fatigue lifetime has been reached, the component or the structural element concerned should be repaired and re-inspected, or replaced, unless continued operation appears admissible by virtue of other appropriate measures. The next inspection interval of this location should be a period corresponding to 25 % of the calculated allowable number of cycles, or corresponding to a total fatigue damage index of 0,25.

The following design, manufacturing and process-related measures can be considered with regard to continued operation:

a) removal of cracks by grinding. Possible reduction in wall thickness should be assessed by special analysis;

b) grinding the welds to remove all notches;

c) elimination of deformation restraints, e.g. replacement of cracked rigid braces by flexible connections;

d) change in mode of operation;

e) repairs by welding (with post-weld heat treatment, if necessary).

M.4 Operation in the creep range

A plan should be prepared for the monitoring and inspection of the vessel throughout its life.

NOTE TRD 508, chapter 2.2 [1], ECCC recommendations Part 2 [2] and CTI-R5 section 5 [3] give guidance on monitoring in the creep range.

Typically, a vessel should be internally and if necessary externally inspected (by VT, RT, UT, PT, etc. as relevant) at a period not later than 50 % of the allowed lifetime. Internal inspections should be supplemented by non-destructive tests on creep critical locations.

Replica testing may provide a means for monitoring creep damage. A suitable region should be selected on the most vulnerable component. A replica test should be made before the vessel enters service and at appropriate intervals during service.

Measurement of diameter may also give guidance on creep accumulation.

Measurement of hardness may indicate the material condition before and after service.

Where lifetime monitoring is provided, higher stresses are permitted and there is no check on creep strain if the design is made by design by formulae according to Clause 19. This permits a thinner vessel

but an appropriate in-service inspection programme is highly recommended, including check of creep deformations and replicas.

If the operating conditions deviate from those assumed in the design, the inspection intervals should be modified.

M.5 Measures to be taken when the calculated allowable creep lifetime has been reached

If the allowed lifetime for a component has been reached, non-destructive tests should be performed as completely as possible concentrating on the highly stressed locations.

If no evidence of damage is shown by the non-destructive tests conducted at the inspection intervals and in the test above, continued operation may be allowed.

If cracks or crack-like defects or other more extensive damage are found, the component should be replaced, unless continued operation appears admissible by virtue of appropriate measures, such as:

a) removal of cracks by grinding;

b) removal of damaged locations by grinding;

c) elimination of deformation restraints;

d) change in mode of operation;

e) repairs by welding.

M.6 Bibliography

[1] Technische Regeln für Dampfkessel 508, Chapter 2.2, 1986

[2] European Creep Collaborative Committee Recommendations, Part 2, Vol. 6 and Vol. 9

[3] ComitatoTermotecnico Italiano - R5:2005, section 5, Milan

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