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## Unfired pressure vessels - Part 5 : Inspection and testing

Réipients sous pression non soumis à la flamme - Partie  
5: Inspection et contrôle

Unbefeuerte Druckbehälter - Teil 5: Inspektion und Prüfung

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 A2, if approved, will modify the European Standard EN 13445-5:2009. 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  
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## Foreword

This document (EN 13445-5:2009/prA2:2009) 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, which is an integral part of this document.

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*Delete the existing Annex A and substitute the following.*

## **Annex A** **(normative)**

### **Inspection and testing of serially produced pressure vessels**

#### **A.1 Introduction**

Inspection and testing of serially produced vessels manufactured according to this standard may have reduction according to this Annex A. The vessel shall be within the limitations of this Annex to be classified as serially produced and have model acceptance according to this Annex.

This annex describes the level of inspection and testing of serially produced pressure vessels in accordance with this standard to permit reduced levels of NDT during serial production. The inspection and testing plan has to be described in the documents that are part of model acceptance.

This annex is not applicable to testing group 1 and testing group 4 vessels.

NOTE See Clause 3 of this Part 5 for terms and definitions which are specifically relevant to serially produced pressure vessels of this annex.

#### **A.2 Limitations for vessels permitted to be classified as serially produced**

Pressure vessels serially produced under the same technical documentation may be inspected and tested as described in A.7 providing the following limitations can be satisfied.

- a) The shell thickness does not exceed 16 mm.
- b) All governing longitudinal welded joints and main circumferential welded joints are welded by a fully mechanised or an automatic welding process.
- c) Limitation to joggle joints of diameter  $\leq$  xxx. Flanges of less than 4 bolts are limited to a diameter  $\leq$  xxx
- d) The number of vessels shall be ten or more in one batch.
- e) A quality plan or manufacturing plan (A.6) shall be available.

#### **A.3 Limitations for model**

The scope of pressure vessels built under the same technical documentation can be depending on size, pressure or pressure range, nozzle connections and material specifications.

Vessels are considered of the same model, if they comply with all the following:

- a) same working conditions and same method of support;
- b) manufactured by same manufacturer using the same processes;
- c) same geometrical form except for variation in nozzle position;
- d) same material specification as indicated in the technical documents or the choice of material specification as limited by the technical documents and the relevant welding procedure qualification;

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- e) same weld materials/weld consumables as allowed by the welding procedure qualification;
- f) same length, diameter and wall thickness in the case of external pressure;
- g) variation in the length, except those affecting the size of inspection openings or other design consideration, are permitted up to + 150 %;
- h) nozzle apertures of the same type (i.e. nozzle orientation variations acceptable subject to these not affecting the design parameter);
- i) same arrangement of tube plate layout in heat exchangers;
- j) same classification group of fluid.

**A.4 Prototype test and technical description**

The inspections and tests shall be conducted on each prototype vessel representing a single model acceptance.

**A.5 Model acceptance**

Where the prototype vessel satisfies the explicit requirements of this standard, a model acceptance shall be issued. The model acceptance shall contain all necessary data for identification of the approved model, conclusions of the examination and a list of the relevant parts of the technical documentation.

All modification to the model acceptance shall be assessed to ensure that they do not affect compliance with this standard or prescribed conditions for use. The assessment shall be documented in an additional report traceable to the original model acceptance.

The information to be presented for different vessel parts in the model acceptance shall include the information as required by normative Annex B.

**A.6 Quality or manufacturing plan**

Before production commences, a detailed manufacturing or quality plan shall be prepared by the manufacturer. This plan shall indicate the inspection or sampling points and the frequency of testing. Provision shall be made within the plan for rejected or re-worked components to be re-inspected and an identifiable scrap area defined for rejected parts. The plan shall ensure the following:

- a) materials used in the manufacture of the vessels comply with the materials standards or specifications as specified;
- b) all variables in the manufacturing procedures that affect the integrity of the vessel are specified, monitored and controlled;
- c) testing and inspection of the vessel is done at least at the frequency given in this standard, using appropriate test methods;
- d) inspection functions within the manufacturer's organisation are clearly prescribed.

**A.7 Inspection, non-destructive testing and pressure testing****A.7.1 Introduction**

Inspection of manufacturing activities shall generally be in accordance with 6.1 with the following additional requirements to reflect aspects to address pressure vessels produced serially.



## A.7.2 General NDT procedure for serially produced pressure vessels

### A.7.2.1 First vessel in each series

The inspection and testing of the first vessel in a series shall be made for type approval with additional testing (in addition to normal requirements of this standard) as follows:

- a) whole length of governing welds shall be 100 % tested by UT or RT with the acceptance criteria given in Table 6.6.3-1. Other welds shall have 10 % appropriate NDT (other than visual) defined by the manufacturer.
- b) final assessment including proof test in accordance with 10.2
- c) instead of NDT the vessel may be burst tested (if the size of vessel allows dimensioning by experimental method). On basis of burst pressure the allowable pressure of vessel shall be defined and it shall not be less than the intended allowable pressure for the vessel.

### A.7.2.2 Testing in each batch

At least 20 % of all vessels in each batch shall have testing as required in table 6.6.2-1.

### A.7.2.3 Reduced NDT of weld joints based on satisfactory experience

Based on satisfactory experience the requirements of A.7.2.2 may be further reduced to:

- a) For material groups 1.1, 1.2 and 8.1 each longitudinal and circumferential weld joint shall have RT or UT once per vessel with a minimum length of 150 mm and with a minimum of 2 % of all the finished welds per shift. 2 % of the intersections per shift shall be tested. For other material groups the previous amounts shall be doubled.
- b) At least 10 % of the length of attachment welds shall be tested using either MT or PT when deemed necessary.

Satisfactory experience shall be a minimum amount of welds of vessels successfully produced and tested within the scope/parameters of the welding procedure approval test, as given below:

- in case of groups 1.1, 1.2 and 8.1 materials, the successful production is 50 consecutive metres of welded joints made by same procedure (one WPS);
- in case of materials of other groups, it is 100 of consecutive metres of welded joint.

If any vessel does not pass the pressure test or if there is any imperfection requiring repair during the process of demonstrating experience, this shall require that the manufacturer start again the complete demonstration process.

Subsequently, (after demonstration of experience) isolated imperfections shall be handled in accordance with 6.5.3. and shall not affect the demonstration of experience. If some vessel breaks at pressure test, the reason shall be investigated and reported. If the research reveals that the reason is a systematic defect in the manufacturing process, the demonstration shall start from beginning. Failure is non-systematic, if there will be an acceptable result in 10 subsequent pressure tests.

However, multiple, systematic or process imperfections shall be investigated, corrected and the full demonstration of experience repeated. Such imperfections tend to be repetitive and similar in nature. They can be the result of inadequate welding parameters (e.g. resulting from equipment malfunction, a too large range of parameters, incorrect use of parameters within the range of approval) or operator error. In the case of inadequate parameters, consideration of requalification of the Welding Procedure Specification (WPS) should be performed.