BS EN 12953-4:2018

BSI Standards Publication

Shell boilers

Part 4: Workmanship and construction of pressure parts of the boiler

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National foreword

This British Standard is the UK implementation of EN 12953-4:2018. It supersedes BS EN 12953-4:2002, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PVE/2, Water Tube And Shell Boilers.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Großwasserraumkessel - Teil 4: Verarbeitung und Bauausführung für drucktragende Kesselteile

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Full document details: BS EN 12953-4:2018

Contents

Page

European foreword ... 4
1 Scope ... 6
2 Normative references ... 6
3 Terms and definitions ... 7
4 Symbols ... 7
5 General requirements ... 7
5.1 General ... 7
5.2 Traceability ... 8
5.2.1 General ... 8
5.2.2 Material ... 8
5.2.3 Welding ... 8
5.2.4 Inspection (NDT) ... 8
5.3 Cylindrical shells ... 9
5.4 Tell-tale holes ... 11
5.5 End plates and tube plates ... 11
5.6 Plain tubes and stay tubes ... 11
5.7 Manhole frames and openings ... 12
5.7.1 Jointing flanges ... 12
5.7.2 Openings for access and inspection ... 12
5.8 Connections for accessories ... 13
5.8.1 Accessories ... 13
5.8.2 Set-in flange and set-on flange ... 13
5.8.3 Flanges on nozzles ... 13
5.8.4 Bolting ... 14
5.9 Cylindrical furnaces ... 14
5.10 Water-cooled reversal chamber ... 16
5.11 Stays ... 16
5.11.1 Bar stays ... 16
5.11.2 Girder stays ... 17
5.11.3 Tube stays ... 17
5.11.4 Non-perpendicular bar stays or tube stays ... 17
5.12 Design of welded joints ... 17
5.12.1 Weld deposition ... 17
5.12.2 Weld crosses ... 17
5.12.3 Types of welds ... 18
5.12.4 Weld preparations ... 19
5.12.5 Welding plates of unequal thickness ... 19
5.13 Openings in or adjacent to welds ... 19
5.14 Fabrication ... 19
5.14.1 General ... 19
5.14.2 Welding ... 19
5.14.3 Cutting, fitting and alignment ... 20
5.14.4 Longitudinal seams ... 21
5.14.5 Circumferential seams ... 21
5.14.6 Surface condition before welding ... 21

Documents
Document Sharing Hub
Full document details: BS EN 12953-4:2018

5.14.7 Middle line alignments 21
5.14.8 Surface alignment tolerances 22
5.14.9 Miscellaneous welding requirements 23
5.14.10 Repair of weld defects 24
5.15 Post-weld heat treatment (PWHT) and other heat treatments 24
5.15.1 General 24
5.15.2 Material thickness 24

Annex A (normative) **Typical welds for shell boilers** 27

Annex B (informative) **Gaskets for closing systems of access and inspection openings** 32

Annex C (informative) **Significant technical changes between this European Standard and the previous edition** 33

Annex ZA (informative) **Relationship between this European Standard and the Essential Requirements of EU Directive 2014/68/EU aimed to be covered** 34

Bibliography 35

Documents
Document Sharing Hub
Full document details: BS EN 12953-4:2018

European foreword

This document (EN 12953-4:2018) has been prepared by Technical Committee CEN/TC 269 “Shell and water-tube boilers”, the secretariat of which is held by DIN.

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 September 2018, and conflicting national standards shall be withdrawn at the latest by September 2018.

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 supersedes EN 12953-4:2002.

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.

The informative Annex C lists the significant technical changes between this European Standard and the previous edition.

EN 12953, *Shell boilers*, consists of the following parts:

— *Part 1: General*;

— *Part 2: Materials for pressure parts of boilers and accessories*;

— *Part 3: Design and calculation for pressure parts*;

— *Part 4: Workmanship and construction of pressure parts of the boiler*;

— *Part 5: Inspection during construction, documentation and marking of pressure parts of the boiler*;

— *Part 6: Requirements for equipment for the boiler*;

— *Part 7: Requirements for firing systems for liquid and gaseous fuels for the boilers*;

— *Part 8: Requirements for safeguards against excessive pressure*;

— *Part 9: Requirements for limiting devices of the boiler and accessories*;

— *Part 10: Requirements for feedwater and boiler water quality*;

— *Part 11: Acceptance tests*;

— *Part 12: Requirements for grate firing systems for solid fuels for the boiler*;

— *Part 13: Operating instructions*;

— *Part 14: Guideline for involvement of an inspection body independent of the manufacturer* [CR 12953-14].

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Full document details: BS EN 12953-4:2018

Although these parts can be obtained separately, the parts are interdependent. As such, the design and manufacture of shell boilers requires the application of more than one part in order for the requirements of the standard to be satisfactorily fulfilled.

NOTE A "Boiler Helpdesk" has been established in CEN/TC 269 which can be contacted for any questions regarding the application of the European Standards series EN 12952 and EN 12953, see the following website: http://www.boiler-helpdesk.din.de.

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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Full document details: BS EN 12953-4:2018

1 Scope

This European Standard specifies requirements for the workmanship and construction of shell boilers as defined in EN 12953-1.

NOTE 1 For other components such as water tube walls, see the EN 12952 series.

NOTE 2 For economizers and superheaters, see EN 12953-4 or EN 12952-5.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1092-1:2007+A1:2013, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 1: Steel flanges*

EN 1092-2:1997, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 2: Cast iron flanges*

EN 1515-4:2009, *Flanges and their joints — Bolting — Part 4: Selection of bolting for equipment subject to the Pressure Equipment Directive 97/23/EC*

EN 1759-1:2004, *Flanges and their joint — Circular flanges for pipes, valves, fittings and accessories, Class designated — Part 1: Steel flanges, NPS 1/2 to 24*

EN 10216-2:2013, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 2: Non-alloy and alloy steel tubes with specified elevated temperature properties*

EN 10217-2:2002, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 2: Electric welded non-alloy and alloy steel tubes with specified elevated temperature properties*

EN 10217-5:2002, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 5: Submerged arc welded non-alloy and alloy steel tubes with specified elevated temperature properties*

EN 12953-1:2012, *Shell boilers — Part 1: General*

EN 12953-2:2012, *Shell boilers — Part 2: Materials for pressure parts of boilers and accessories*

EN 12953-3:2016, *Shell boilers — Part 3: Design and calculation for pressure parts*

EN 12953-5:2002, *Shell boilers — Part 5: Inspection during construction, documentation and marking of pressure parts of the boiler*

EN ISO 2553:2013, *Welding and allied processes — Symbolic representation on drawings — Welded joints (ISO 2553:2013)*

EN ISO 9606-1:2017, *Qualification testing of welders — Fusion welding — Part 1: Steels (ISO 9606-1:2012 including Cor 1:2012 and Cor 2:2013)*

EN ISO 14731:2006, *Welding coordination — Tasks and responsibilities (ISO 14731:2006)*

EN ISO 14732:2013, *Welding personnel — Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials (ISO 14732:2013)*

Documents
Document Sharing Hub
Full document details: BS EN 12953-4:2018

EN ISO 15609-1:2004, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding (ISO 15609-1:2004)*

EN ISO 15614-1:2017, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys (ISO 15614-1:2017)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12953-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
seam
generic term for welded joints, welded seams or welds

4 Symbols

For the purposes of this document, the symbols given in EN 12953-1:2012, Table 1 apply.

5 General requirements

5.1 General

5.1.1 The rules in this part are applicable to all aspects of fabrication, including welding, of boilers and boiler parts, and shall be used in conjunction with the specific requirements applicable to the grades of materials used.

5.1.2 All welding activities shall be in accordance with the requirements of this standard.

5.1.3 For category II, III and IV boilers, all welders or welding operators and welding procedures shall be approved (see 5.14.2). For category I boilers, approval shall not be mandatory.

5.1.4 The manufacturer of a boiler, built in accordance with the requirements of this European Standard, shall be responsible for the welding done by his workmen or subcontracted by him. The manufacturer shall designate a competent welding supervisor in accordance with EN ISO 14731.

No production work should be undertaken on category II, III and IV boilers according to the Pressure Equipment Directive PED 2014/68/EU until both the welding procedures and the welders or welding operators have been approved.

5.1.5 Materials and welding consumables shall fulfil the requirements of EN 12953-2:2012.

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Full document details: BS EN 12953-4:2018

5.2 Traceability

5.2.1 General

The manufacturer shall demonstrate during the whole manufacturing process that identification and traceability shall be achieved for at least:

— pressure part materials;

— welding;

— inspection (NDT).

This traceability shall be achieved through either marking of the part or by a documentation system.

5.2.2 Material

5.2.2.1 Pressure bearing parts

When laying out and cutting material the manufacturer shall take into consideration the location of the transferred identification markings to ensure that they are clearly visible when the pressure part is completed.

In case the original identification markings are unavoidably cut out or the material is divided into two or more pieces the markings shall be accurately transferred by the manufacturer's nominated personnel prior to cutting.

The actual material marking shall be by methods which are not harmful to the material in subsequent use/operation.

The transfer of markings shall take place before partitioning of the product and after verification of the marks present with the corresponding certification.

The manufacturer shall verify traceability of the material markings with the material certificates.

5.2.2.2 Non pressure bearing parts

For non-pressure-bearing parts welded to a pressure part of the shell boiler, the material shall be compatible with the pressure part material, corresponding to a specification which can be identified, and shall have a maximum carbon content in the ladle analysis of 0,24 %.

5.2.2.3 Welding consumables

The manufacturer shall ensure that the correct welding consumables according to the relevant welding procedure specification (WPS) are used.

5.2.3 Welding

The welds made by each welder shall be marked with a stamp showing the welder’s identity or some other appropriate record shall be made. If hand stamping is employed; only low-stress shall be used.

5.2.4 Inspection (NDT)

An as built sketch or equivalent shall be produced by the manufacturer in order to record the locations where the NDT has been performed.

On welds which have undergone RT or UT the “zero datum point” shall be indicated.

The location of any repairs shall be also clearly indicated on the reports.

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Full document details: BS EN 12953-4:2018

5.3 Cylindrical shells

5.3.1 Each ring shall be formed from not more than two plates, bent to cylindrical form to the extreme ends of the plate. The bending shall be performed entirely by machine, and local heating or hammering shall not be used.

5.3.2 The shell of completed boilers shall be in accordance with the following requirements.

a) Straightness

Unless otherwise shown on the drawing, the maximum deviation of the shell from a straight line shall not exceed 0,3 % both of the total cylindrical length and of any 5 m length. Measurements shall be made to the surface of the parent plate and not to a weld, fitting, or other raised part.

b) Irregularities in profile

1) Gradual local departures from circularity

Irregularities in profile (checked by a 20° gauge) shall not exceed 2 % of the gauge length.

This maximum value may be increased by 25 % if the length of the irregularities does not exceed one quarter of the length of the shell part between two circumferential seams, with a maximum of 1 m. Greater irregularities require proof by calculation or strain gauge measurement that the stresses are permissible.

2) Peaking at welded seams

If an irregularity in profile occurs at the welded seam and is associated with “flats” adjacent to the weld, the irregularity in profile or “peaking” shall not exceed the values given in Table 1.

Table 1 — Maximum permitted peaking for dynamic and cyclic loads

Dimensions in millimetres

Wall thickness e	Maximum permitted peaking
$e < 3$	1,5
$3 \leq e \leq 6$	2,5
$6 \leq e \leq 9$	3,0
$9 \leq e$	the lesser of e/3, or 10 mm

A conservative method of measurement (covering peaking and ovality) shall be by means of a 20° profile gauge or template.

The use of such a profile gauge shall be in accordance with Figure 1. Two readings shall be taken, P_1 and P_2, on each side of the seam at any particular location, the peaking is taken as being equivalent to 0,25 (P_1+P_2), or P_3.

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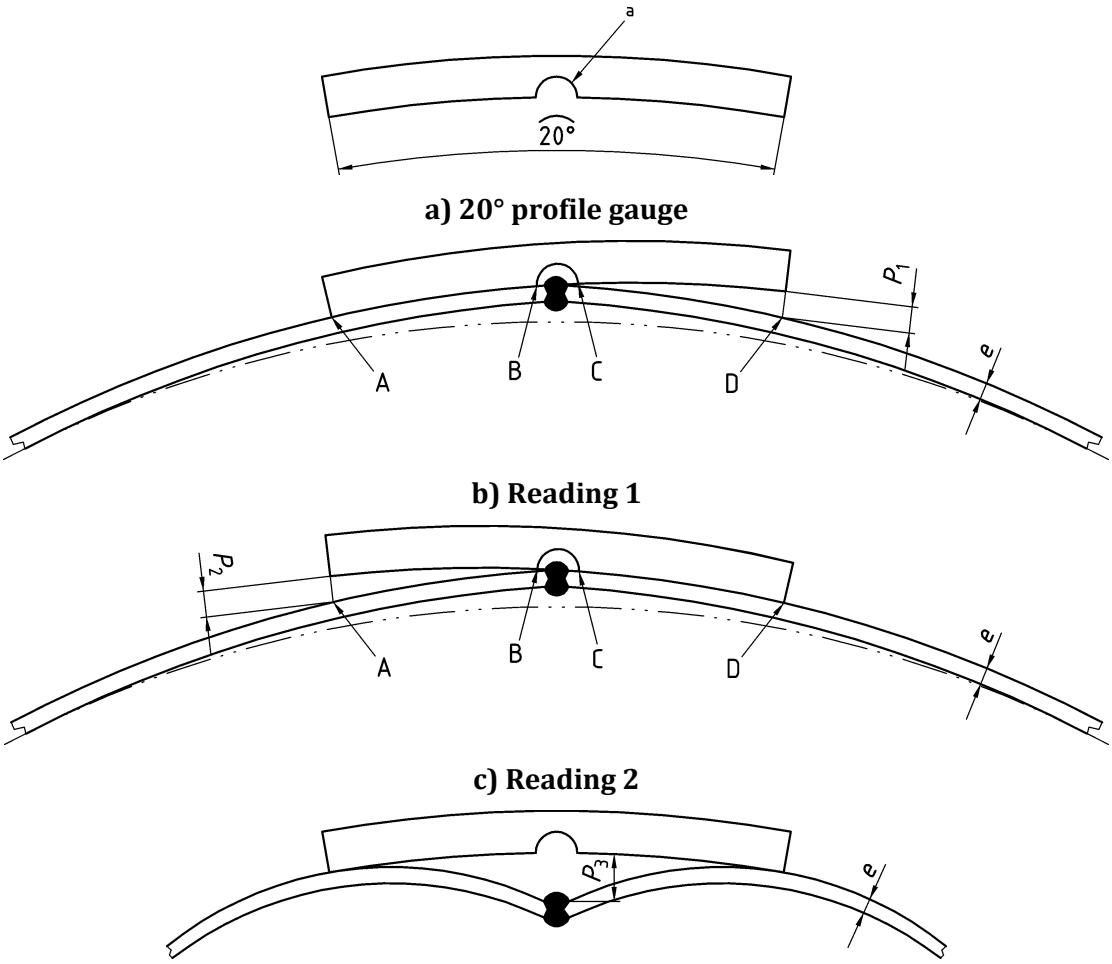
Full document details: BS EN 12953-4:2018



Key

a cut out in gauge to clear weld reinforcement

Figure 1 — Profile gauge and its method of use

c) Out of roundness

Out of roundness u shall be calculated in accordance with the following Formula (1):

$$u = \frac{2\left(\hat{d} - \check{d}\right)}{\hat{d} + \check{d}} \times 100 \text{ in } \% \qquad (1)$$

where

$\hat{d}$ is the maximum mean diameter of the shell;

$\check{d}$ is the minimum mean diameter of the shell.

The out of roundness u shall be ≤ 1,5 % for the concerned parts of the shell boiler except for corrugated furnace.

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