



BSI Standards Publication

Shell boilers

Part 2: Materials for pressure parts
of boilers and accessories

National foreword

This British Standard is the UK implementation of EN 12953-2:2012. It supersedes BS EN 12953-2:2002, which is withdrawn.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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Chaudières à tubes de fumée - Partie 2: Matériaux des parties sous pression des chaudières et des accessoires

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Foreword

This document (EN 12953-2:2012) 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of an identical text or by endorsement, at the latest by September 2012, and conflicting national standards shall be withdrawn at the latest by September 2012.

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 supersedes EN 12953-2:2002.

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.

Annex A provides details of significant technical changes between this European Standard and the previous edition.

The European Standard EN 12953 concerning 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 boiler;*
- *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;*
- *CR 12953 Part 14: Guideline for involvement of an inspection body independent of the manufacturer.*

Although these parts may be obtained separately, it should be recognized that 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 European Standard to be satisfactorily fulfilled.

For any questions arising when using these standards the Boiler Helpdesk of CEN/TC 269 may be contacted:

<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, 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 Scope

This European Standard specifies the following materials for the pressure bearing parts of shell boilers and equipment of shell boilers (e.g. valves), subjected to internal and external pressure including integral attachments (non pressure bearing parts):

- flat products (plate) and parts formed from flat products (e.g. shell, furnace, dished ends);
- tubes and parts formed from tubes (e.g. bending, elbows, reducers, fittings);
- forgings and cast products ;
- bolting materials;
- welding consumables.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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, *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 1561:1997, *Founding — Grey cast irons*

EN 1563:1997, *Founding — Spheroidal graphite cast irons*

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 10028-2:2009, *Flat products made of steels for pressure purposes — Part 2: Non-alloy and alloy steels with specified elevated temperature properties*

EN 10028-3:2009, *Flat products made of steels for pressure purposes — Part 3: Weldable fine grain steels, normalized*

EN 10204:2004, *Metallic products — Types of inspection documents*

EN 10213:2007, *Steel castings for pressure purposes*

EN 10216-1:2002, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 1: Non-alloy steel tubes with specified room temperature properties*

EN 10216-2:2002+A2:2007, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 2: Non-alloy and alloy steel tubes with specified elevated temperature properties*

EN 10217-1:2002+A1:2005, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 1: Non-alloy steel tubes with specified room temperature properties*

EN 10217-2:2002+A1:2005, *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+A1:2005, *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 10220:2002, *Seamless and welded steel tubes — Dimensions and masses per unit length*

EN 10222-2:1999, *Steel forging for pressure purposes — Part 2: Ferritic and martensitic steels with specified elevated temperature properties*

EN 12074:2000, *Welding consumables — Quality requirements for manufacture, supply and distribution of consumables for welding and allied processes*

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

EN 12953-4:2002, *Shell boilers — Part 4: Workmanship and construction of pressure parts of the boiler*

EN 13479:2004, *Welding consumables — General product standard for filler metals and fluxes for fusion welding of metallic materials*

EN 14394:2005+A1:2008, *Heating boilers — Heating boilers with forced draught burners — Nominal heat output not exceeding 10 MW and maximum operating temperature of 110 °C*

CEN ISO/TR 15608:2005, *Welding — Guidelines for a metallic material grouping system (ISO/TR 15608:2005)*

CEN ISO/TR 20172:2009, *Welding - Grouping systems for materials - European materials (ISO 20172:2009)*

3 General requirements for material selection

3.1 General

The materials for the boiler and the parts of the boiler selected by the manufacturer shall fulfil requirements specified in the order and the requirements of this European Standard.

3.2 Material specification

The selection of materials for pressure parts shall be in accordance with:

- a) Harmonized European Standards (see Clause 4);
- b) European approvals for materials (see 3.3);
- c) Particular Material Appraisals (see 3.4).

NOTE If relevant, the manufacturer will issue a technical specification with additional requirements such as tolerances, non-destructive examinations (NDE), etc.

Dimensions and tolerances for tubes are given in EN 10220, for flat plates in EN 10029 or EN 10051. Deviations to dimensional and tolerances aspects of these three standards are possible by agreement between the boiler manufacturer and the supplier.

The manufacturer shall specify:

- the type of inspection document (material certificate) according to EN 10204 (see also 4.7);
- any additional inspection requirements (e.g. second party/customer inspection).

3.3 European Approvals for Materials (EAM)

European approvals for materials are intended for repeated use.

NOTE 1 References of available EAM are published in the Official Journal of the European Union.

NOTE 2 EAM may be established in accordance with EN 764-4.

3.4 Particular Material Appraisals (PMA)

Particular material appraisals shall be applied for materials:

- used in special cases not covered in 3.2 a) and b),
- not intended for frequent use.

NOTE PMA may be established in accordance with e.g. EN 764-4.

4 Materials for pressure bearing parts

4.1 Shell boiler body

For typical components of the shell boiler body manufactured from flat products and tubes see EN 12953-1:2012, Figure 1.

Cast iron and cast steel are not permitted for these components.

The material shall be ordered and delivered in accordance with relevant harmonized European Standards given in Table 1, EAM or PMA. The additional requirements given in this standard shall be taken into account.

Table 1 — Grades of EN steels suitable for use on shell boilers

Product form	Standard	Grade ^a	Material number
Flat products (plate)	EN 10028-2	P235GH	1.0345
		P265GH	1.0425
		P295GH	1.0481
		P355GH	1.0473
		16Mo3 ^c	1.5415
	EN 10028-3	P275NH ^c	1.0487
		P355NH ^c	1.0565
Tube (Seamless)	EN 10216-1 ^b	P195TR2	1.0108
		P235TR2	1.0255
		P265TR2	1.0259
	EN 10216-2	P195GH	1.0348
		P235GH	1.0395
		P265GH	1.0425
		16Mo3	1.5415
Tube (Welded)	EN 10217-1 ^b	P195TR2	1.0108
		P235TR2	1.0255
		P265TR2	1.0259
	EN 10217-2	P195GH	1.0348
		P235GH	1.0345
			P265GH
	EN 10217-5	P235GH	1.0345
		P265GH	1.0425
Forging	EN 10222-2	P245GH	1.0352
		P280GH	1.0426
		16Mo3	1.5415
^a Groupings of metallic materials for welding see CEN ISO/TR 15608 and CEN ISO/TR 20172. ^b This material can only be used for smoke tubes (both plain and stay). ^c Not permitted for furnaces.			

For Low Pressure Boilers (LPB), material S235JR according to EN 10025-2 can be used with particular material appraisals under the conditions according to 5.2.1 of EN 14394:2005+A1:2008.

4.2 Valves and other forged or cast products

The materials for valves and other forged or cast products shall be suitable for their design and operating conditions.

Materials and limits of use are given in Table 2.

The limits determined by the manufacturer of the valves and other forged or cast products shall be taken into account.

Table 2 — Grades of materials for valves and other forged or cast products

Material	Standard	Grades	Limits
Grey cast iron (lamellar form)	EN 1561 ^a	EN-GJL-200 and 250	Max DN 200 PS max 13 bar TS max 220 °C
Spheroidal graphite cast iron	EN 1563	EN-GJS-350 and 400	Max DN 200 PS max 40 bar TS max 350 °C
Cast steel	EN 10213	GP240GH	According to the material Standard
Forged steel	EN 10222-2	P245GH P280GH 16Mo3	According to the material Standard
^a EN 1561 is not a harmonised European standard.			

However, the use of grey cast iron shall not be permitted for the following valves:

- For steam boilers:
 - Steam outlet stop valves;
 - Drain valves.

NOTE 1 When grey cast iron is used, it is important that the downstream piping on steam systems is fully drainable in order to avoid water hammer.

- For hot water boilers:
 - Safety valves;
 - All valves greater than DN 50.

NOTE 2 When selecting materials, attention is drawn up to the low temperature hazards to which cast materials may be exposed during normal operation (e.g. start-up conditions).

NOTE 3 The pressure and temperature limits for the pressure bearing parts of the hot water circulation pumps and feed water pumps are under the responsibility of the pump manufacturer.

4.3 Bolting material

Selection of bolting material shall be made in accordance with EN 1515-4.

4.4 Flange material

Selection of flange material shall be made in accordance with EN 1092-1:2007 or EN 1092-2:1997 or EN 1759-1:2004.

EN 1092-2:1997 and EN 1759-1:2004 are not harmonised European standards. Particular Material Appraisals shall be applied if these standards for materials are used.

4.5 Welding consumables

The welding consumables shall be ordered and delivered according to specifications approved in accordance with EN 12074 and EN 13479 and selected so that the mechanical and chemical properties of the weld metal are compatible with the relevant requirements of the base materials.

NOTE EN 12074 and EN 13479 are only supporting standards for the PED.

Welding requirements shall be in accordance with EN 12953-4.

4.6 Material acceptance tests

The number and the type of destructive and non-destructive examinations including the selection, preparation of samples and test pieces for acceptance tests shall be in accordance with the appropriate harmonized European standards for the material.

Acceptance tests for PMA material shall be carried out in compliance with applicable material specification and equivalent harmonized European standard for this type of materials.

4.7 Inspection documents

The manufacturer of the pressure equipment shall specify the required type of inspection document (2.2, 3.1 or 3.2) in accordance with EN 10204.

Inspection document type 2.2 is only acceptable for non pressure parts and welding consumables.

In the case of inspection document type 3.1, the material manufacturer shall operate a quality assurance system, certified by a competent Body established within the European Community and having undergone a specific assessment for materials.

In the case of inspection document type 3.2, the manufacturer of the pressure equipment shall notify the material manufacturer of the name and address of the Notified Body who is to carry out the inspection and produce the inspection document, and agree which party shall issue the certificate.

4.8 Marking for the main pressure-bearing parts

4.8.1 General

For reasons of traceability, each individual product shall be individually marked, or if delivered in bundles or boxes, marked with a label secured to the bundle or box.

4.8.2 Material supplied from the material manufacturer

The marking of the material supplied from the manufacturer shall be in accordance with the relevant material standards or EAM or PMA.

4.8.3 Material supplied from a supplier other than the material manufacturer

If transfer of the original manufacturer's markings is necessary then this shall be performed by the material supplier in accordance with a written procedure which forms part of the supplier's Approved Quality Management System (e.g. EN ISO 9001).

As a minimum, the following markings shall be transferred:

- material grade;
- cast number (heat number);

- direction of rolling, where applicable;
- manufacturer's name or supplier's name.

4.8.4 Material traceability during cutting and forming

The material traceability during cutting and forming shall be as a minimum:

- material grade;
- cast number (heat number).

The transfer of marking shall be performed in accordance with the manufacturer's approved procedure.

5 Materials for 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 %.

Annex A (informative)

Significant technical changes between this European Standard and the previous edition

Clause/Paragraph/Table/Figure	Change
1 / Scope	Redefinition of the scope
2 / Normative references	References updated.
3 / General requirements for material selection	Revision of the Clause.
4 / Materials for pressure bearing parts	Requirements for cast and steel which are more consistent with EN 12953-1 and with the PED 97/23/EC.
4.3 / Material bolting	New sub-clause added.
4.4 / Material flanges	New sub-clause added.
Annex ZA / Relationship between this European Standard and the Essential Requirements of EU Directive 97/23/EC	Revision of the Annex.
<p>NOTE The technical changes referred include the significant technical changes from the EN revised but is not an exhaustive list of all modifications from the previous version.</p>	

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Annex ZA (informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 97/23/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission to provide a means of conforming to Essential Requirements of the New Approach Directive 97/23/EC of the European Parliament and of the Council of 29 May 1997 on the approximation of the laws of the Member States concerning pressure equipment.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Directive for Pressure Equipment 97/23/EC

Clause(s)/subclause(s) of this EN 12953-2	Essential Requirements (ERs) of Directive for Pressure Equipment 97/23/EC Annex I	Qualifying remarks/Notes
4.8	3.1.5	Traceability
4	4.1 a)	Materials for pressure purposes
4.7	4.2 b)	Technical documentation

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

EN 764-4:2002, *Pressure equipment — Part 4: Establishment of technical delivery conditions for metallic materials*

EN 1503-1:2000, *Valves — Materials for bodies, bonnets and covers — Part 1: Steels specified in European Standards*

EN 1503-3:2000, *Valves — Materials for bodies, bonnets and covers — Part 3: Cast iron specified in European Standards*

EN 1515-1:1999, *Flanges and their joints — Bolting — Part 1: Selection of bolting*

EN 1515-2:2001, *Flanges and their joints — Bolting — Part 2: Classification of bolt materials for steel flanges, PN designated*

EN 1515-3:2005, *Flanges and their joints — Bolting — Part 3: Classification of bolt materials for steel flanges, class designated*

EN 10025-1:2004, *Hot rolled products of structural steels — Part 1: General technical delivery conditions*

EN 10028-1+A1:2009, *Flat products made of steels for pressure purposes — Part 1: General requirements*

EN 10029:2010, *Hot rolled steel plates 3 mm thick or above — Tolerances on dimensions and shape*

EN 10222-1:1998, *Steel forgings for pressure purposes — Part 1: General requirements for open die forgings*

EN 10253-1:1999, *Butt-welding pipe fittings — Part 1: Wrought carbon steel for general use and without specific inspection requirements*

EN 10253-2:2007, *Butt welding pipe fittings — Part 2: Non alloy and ferritic alloy steels with specific inspection requirements*

EN 10025-2:2005, *Hot rolled products of structural steels — Part 2: Technical delivery conditions for non-alloy structural steels*

EN 10051:2010, *Continuously hot-rolled strip and plate/sheet cut from wide strip of non-alloy and alloy steels — Tolerances on dimensions and shape*

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

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

EN 12953-6:2011, *Shell boilers — Part 6: Requirements for equipment for the boiler*

EN ISO 8493:2004, *Metallic materials — Tube — Drift-expanding test (ISO 8493:1998)*

EN ISO 8494:2004, *Metallic materials — Tube — Flanging test (ISO 8494:1998)*

EN ISO 9001:2008, *Quality management systems – Requirements (ISO 9001:2008)*

EU Guideline 7/2, *ESR on materials — Certification of the quality (assurance) systems of material manufacturers*

EU Guideline 7/16, *ESR on materials — Specific assessment of material producers*

Directive 97/23/EC of the European Parliament and of the Council of 29 May 1997 on the approximation of the laws of the Member States concerning pressure equipment; OJEC, L181

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