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**Mnogovodni kotli - 6. del: Zahteve za opremo kotla**

Shell Boilers - Part 6: Requirements for equipment for the boiler

Großwasserraumkessel - Teil 6: Anforderungen an die Ausrüstung für den Kessel

Chaudières à tube de fumée - Partie 6: Exigences pour l'équipement de la chaudière

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## Shell Boilers - Part 6: Requirements for equipment for the boiler

Chaudières à tube de fumée - Partie 6: Exigences pour l'équipement de la chaudière

Großwasserraumkessel - Teil 6: Anforderungen an die Ausrüstung für den Kessel

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 269.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a 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  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

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## European foreword

This document (prEN 12953-6:2023) has been prepared by Technical Committee CEN/TC 269 “Shell and water-tube boilers”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 12953-6:2011.

Annex H provides details of significant technical changes between this document and the previous edition.

The series 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 boiler feed water and boiler water quality*
- *Part 11: Acceptance tests*
- *Part 12: Requirements for firing systems for solid fuels for the boiler*
- *Part 13: Operating instructions*

Although these parts can be obtained separately, it should be recognized that the parts are inter-dependent. 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>.

This document has been prepared under a Standardization Request given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s) / Regulation(s).

For relationship with EU Directive(s) / Regulation(s), see informative Annex ZA, which is an integral part of this document.

**prEN 12953-6:2023 (E)****1 Scope**

This document specifies the minimum requirements for safety related equipment for shell boilers (generator and/or assemblies) as specified in EN 12953-1:2012, to ensure the boiler operates within the allowable limits (pressure, temperature, etc.) and if the limits are exceeded the energy supply is automatically interrupted and locked out, irrespective of the degree of intervention.

NOTE 1 For this document, the term “boiler” is applicable for generator and/or assemblies.

NOTE 2 The maximum time of operation without manual (human) intervention can be specified for each boiler system.

NOTE 3 Annex C gives recommendations of operation and testing of the boiler system with a maximum time of operation without manual (human) intervention of 24 h and 72 h.

**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 ISO 5167-1:2022, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 1: General principles and requirements (ISO 5167-1:2022)*

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 12953-7:2002, *Shell boilers - Part 7: Requirements for firing systems for liquid and gaseous fuels for the boilers*

EN 12953-8:2001, *Shell boilers - Part 8: Requirements for safeguards against excessive pressure*

prEN 12953-9:2023,<sup>1</sup> *Shell boilers — Part 9: Requirements for limiting devices of the boiler and accessories*

EN 12953-10:2003, *Shell boilers - Part 10: Requirements for feedwater and boiler water quality*

EN 12953-12:2003, *Shell boilers - Part 12: Requirements for grate firing systems for solid fuels for the boiler*

EN 12953-13:2012, *Shell boilers - Part 13: Operating instructions*

EN 14597:2012, *Temperature control devices and temperature limiters for heat generating systems*

EN 50156-1:2015, *Electrical equipment for furnaces and ancillary equipment - Part 1: Requirements for application design and installation*

EN 60529:1991,<sup>2</sup> *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989)*

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<sup>1</sup> At draft stage.

<sup>2</sup> Document impacted by A1:2000 and A2:2013.



EN 60730-1:2016, *Automatic electrical controls - Part 1: General requirements*

EN 60747-5-2:2001, *Discrete semiconductor devices and integrated circuits - Part 5-2: Optoelectronic devices - Essential ratings and characteristics*

EN 61140:2016, *Protection against electric shock - Common aspects for installation and equipment*

EN 61558-2-6:2009, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V - Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers*

EN 61558-2-16:2009, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V - Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units*

ISO 2186:2007, *Fluid flow in closed conduits — Connections for pressure signal transmissions between primary and secondary elements*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12953-1:2012 and the following apply.

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

— ISO Online browsing platform: available at <https://www.iso.org/obp>

— IEC Electropedia: available at <http://www.electropedia.org/>

#### 3.1

**controls** <https://standards.iteh.ai/catalog/standards/sist/c9a4cf02-49d8-4445-8960-> devices used for maintaining the variable to be controlled (pressure, temperature, etc.) at a specific value (set point)

#### 3.2

##### **monitoring system/devices**

system which checks given parameters and draws attention to those which are outside normal operating limits but which are below the limiting values determined by the hazard and risk analysis and described e.g. in the operation manual. Normal operating conditions of the process can be restored either directly by the system or by a boiler attendant depending on the individual requirements

#### 3.3

##### **safety accessories**

devices designed to protect pressure equipment against the allowable limits being exceeded, including devices for direct pressure limitation, such as safety valves, bursting disc safety devices, buckling rods, controlled safety pressure relief systems (CSPRS), and limiting devices, which either activate the means for correction or provide for shutdown or shutdown and lockout, such as pressure switches or temperature switches or fluid level switches and safety related measurement control and regulation (SRMCR) devices

Note 1 to entry: Taken from PED 2014/68/EU.

**prEN 12953-6:2023 (E)****3.4****pressure accessories**

devices with an operational function and having pressure-bearing housings

Note 1 to entry: Taken from PED 2014/68/EU.

**3.5****limiter****limiting device**

safety accessory which, on reaching a limiting value (water level, pressure, temperature, flow, water quality), is used to interrupt and lock out the energy supply

Note 1 to entry: A limiter is an element of a safety device and a safety accessory for shell boilers as specified in the Pressure Equipment Directive 2014/68/EU, Article 2, Clause 4. A limiter contains a sensor, possibly a sensor control unit and ends at the output contact. The following safety logic and actuating element are not components of this part of the standard, see prEN 12953-9:2023, Figure A.1.

Note 2 to entry: A limiting device comprises

- a measuring function and
- optional with a display and
- an activation function for correction, or shut-down, or safety shut-down and fault shut-down, and which is used to carry out safety related functions as specified in the PED, on its own or as part of a safety (protective) system (e.g. sensors, limiters). If this is achieved by multichannel systems, then all items or limiters for safety purposes are included within the safety (protective) system.

**3.6****lock-out**

safety shut-down condition of the protective device, such that a restart can only be accomplished by a manual reset of the limiter or by a manual reset of the safety logic on site and by no other means

**3.7****functional check**

testing of the safety device to ensure it performs its intended function

**3.8****electrically heated boilers**

boilers in which water is heated by an electric current flowing between electrodes or by immersion heaters

**3.9****expansion vessels**

vessels to compensate for temperature dependent changes in water volume of hot water boilers

- closed expansion vessels are pressurised
- open expansion vessels are vented to atmospheric pressure and are not pressurised

**3.10****allowable heat output**

maximum heat output (water mass flow times the difference between outlet and inlet enthalpy) that can be generated during continuous operation and at which hot water boilers can be operated

**3.11****maximum allowable temperature (TS)**

maximum temperature for which the pressure equipment is designed, as specified by the manufacturer

Note 1 to entry For hot water boiler, TS means the maximum allowable flow temperature measured at the outlet branch.

Note 2 to entry For steam generator, TS means the maximum allowable saturated steam temperature at PS.

Note 3 to entry For superheater, TS means the maximum allowable temperature of the hot steam measured at the outlet branch.

Note 4 to entry For economizer, TS means the maximum allowable flow temperature measured at the outlet branch.

Note 5 to entry TS corresponds to Pressure Equipment Directive 2014/68/EU, Article 2, indent (9).

**3.12****maximum allowable pressure (PS)**

maximum pressure for which the pressure equipment is designed, as specified by the manufacturer, and defined at a location specified by him, being either the connection of protective and/or limiting devices, or the top of equipment or, if not appropriate, any point specified

Note 1 to entry PS corresponds to Pressure Equipment Directive 2014/68/EU, Article 2, indent (8).

**3.13****maximum continuous rating (MCR)**

maximum continuous steam output that can be generated during continuous operation taking the specified steam condition into consideration

**3.14****internal steam cushion**

steam filled space located within the steam boiler to accommodate changes in volume

**3.15****external steam cushion**

steam filled space located outside the steam boiler to accommodate changes in volume

**3.16****gas cushion**

gas-filled space to accommodate changes in volume

**3.17****effective heat transfer**

for a hot water boiler, the energy supply is on and flow of water is greater than or equal to a specified minimum value

for a steam boiler, the energy supply is on, the start-up or steam valve is open and the temperature is greater than the saturation temperature at ambient pressure

**prEN 12953-6:2023 (E)****3.18****normal operation**

automatic operation, with all regulating circuits and controls (open loops/closed loops) in automatic mode and with the set points and parameters valid for normal operation

Note 1 to entry: Normal operation also includes the automatic switching on and off of the assigned actuators (e.g. burner).

**3.19****normal shut down**

controlled switch off of the boiler either operated manually or automatically

**3.20****make-up water**

water which compensates for losses of water and steam from the system

Note 1 to entry: Definition from EN 12953-10:2003.

**3.21****feed water**

mixture of returned condensate and/or make up water supplied to the boiler inlet

Note 1 to entry: Definition from EN 12953-10:2003.

**3.22****pressurization equipment**

external system for keeping the hot water system pressure within the required pressure limits

Note 1 to entry: In order to prevent corrosion caused by oxygen infiltration, systems that prevent the system water being in direct contact with air should be preferred.

**3.23****boiler attendant**

boiler operator skilled person appointed for operating the boiler plant

**3.24****temperature monitoring of the furnace shell**

measurement system for monitoring the temperature of the furnace shell in the area of the highest heat flux

**3.25****minimum flow rate**

minimum flow of water in the piping required for hot water boilers and economisers to avoid overheating of the boiler or economiser

**3.26****cold start**

starting the boiler from ambient pressure at room temperature to normal operating condition

## 4 General requirements for steam boilers and hot water boilers

### 4.1 Safeguards (safety valves) against excessive pressure

Each steam boiler and hot water boiler, except open vented hot water boiler, shall be equipped with safeguards (safety valves) against excessive pressure in accordance with EN 12953-8:2001.

Superheaters and economizers shall be protected in accordance with EN 12953-8:2001. Where a superheater or an economizer can be isolated a pressure gauge connection shall be provided.

### 4.2 Materials for valves, fittings, flanges and bolting

The conditions and requirements to select the material shall be in accordance with EN 12953-2:2012.

### 4.3 Protective systems

**4.3.1** All limiters and their installation shall be designed in accordance with prEN 12953-9:2023. Limiters shall function independently of each other and of controls unless their safety function cannot be affected by other such functions.

The protective systems shall be in accordance with EN 50156-1:2015.

**4.3.2** The application design and installation of the electrical safety circuit as well as the electrical and control equipment for the energy supply and its auxiliary equipment shall be in accordance with EN 50156-1:2015.

A hazard analysis SIL classification shall be carried out for each limiting device function and appropriate levels of functional safety implemented.

Typical Safety Integrity Level (SIL) requirements cannot be less than 2.

It should be possible to stop the boiler by additional devices outside the boiler such as shut-off valve, emergency stop device, fire detectors, etc.

**4.3.3** Functional check of all limiters shall be possible at any time during operation e.g. by simulation in accordance with operating instructions as specified in Clause 7.

**4.3.4** When a limiter mentioned in this document activates, information shall be given to indicate which limiter has activated.

**4.3.5** After lock out, the steam boiler/hot water boiler shall be physically checked by the boiler attendant (operator), before start-up (see 4.4.2).

**4.3.6** Any valves that may isolate a limiter or monitoring device from the boiler system during normal operation shall be prevented from unintended closure (e.g. by wire and seal, locked in open position or position switches integrated in a safety circuit, etc.).

**4.3.7** For purpose of function testing a bypassing of limiters at the boiler shall be allowed for a time not exceeding:

- for both channels of a two channels water level limiter, 30 s;
- for one channel of a two channels water level limiter, 5 min;
- for a maximum pressure limiter if there is a second channel in operation (e.g. safety valve or second pressure limiter), 5 min;
- for all other limiters, 5 min.

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In all cases above:

- if the above times are exceeded, the energy supply shall be shut down and locked-out.
- the bypassing system which is implemented shall not alter the safety integrity level SIL of the safety functions concerned.

**4.4 Energy supply****4.4.1 General**

The requirements for energy supply to steam boilers and hot water boilers shall be in accordance with either EN 12953-7:2002 or EN 12953-12:2003 depending on fuel type.

The combustion process shall be completed within the furnace.

The energy supply shall be automatically controlled and in all operating stages rapidly adapted to the variation of the heat demand. Steam pressure influences heat demand of steam boilers and hot water boilers with internal steam cushion. For other hot water boilers, heat demand is influenced by flow temperature.

NOTE For examples of steam and hot water boiler systems, see Figures A.1 to A.4.

In the event of normal shutdown or lock out, residual heat accumulated in the furnace and flue-gas passes shall not cause unacceptable metal or fluid temperatures (e.g. by evaporation of the water) in the steam boiler/hot water generator.

This requirement is fulfilled:

- a) if a fast acting combustion system is used e.g. oil, gas or pulverised fuel firing systems (except slag-tap firing or heavy brickwork in the furnace or flue-gas passes) or electrical heated system; or
- b) if it is proved that, after interruption of the energy supply from the full load steady-state condition, the fluegas temperature at the highest point of the heating surface (HHS) falls to below 400 °C before the water level has sunk from the lowest permissible water level (LWL) to 50 mm above the highest point of the heating surface (HHS); or
- c) if a reliable feed water supply is installed to ensure adequate cooling of the heating surfaces in case of a sudden loss of essential operational parameters (see e.g. 5.4.4); or

NOTE The minimum distance between the highest point of the heating surface (HHS) and the lowest water level (LWL) can not be less than the requirements specified in 5.1.3 a).

- d) if it is only heated with gases not exceeding a temperature of 400 °C; or
- e) in case of fully flooded hot water generators, if water temperature does not exceed the maximum allowable temperature (TS) with or without emergency cooling system, it is not allowed to relieve residual heat via the safety valve. The function of the emergency cooling system shall ensure that no adverse side effects can occur.

In case of a combination of energy supply, highest requirements of this European Standard shall be applied.

#### 4.4.2 Start up

When a boiler is started-up locally or remotely after lockout or from cold condition (cold start), the boiler attendant (operator) shall be present and remain with the boiler until it is operating correctly under normal operation.

When designing the controls for the start-up sequence, it shall be taken into account the effective heat transfer to avoid unacceptable local over heating or thermal stresses or other stresses of any pressurized parts of the boiler or parts connected to the boiler, with particular regard to the heating up sequence and flow rates. These controls shall be in the form of installed control systems and/or software and/or operating instructions.

The manual or automatic start-up sequence shall consider as a minimum the following points which shall be specified in the operating instructions:

- a) lock out by limiters;
- b) minimum flow of water for hot water boilers to avoid overheating and to reach effective heat transfer;
- c) minimum temperature of water for hot water boilers to avoid corrosion;
- d) minimum temperature of critical parts of boilers to avoid unacceptable thermal stresses;
- e) steam output as a function of pressure of steam boilers to improve internal mixing (flow) and to avoid thermal stresses (effective heat transfer);
- f) sequence shall contain times (or pressures) and burner loads for a gentle start-up to avoid thermal stresses;
- g) additional energy supply requirements like e.g. maximum permitted low loads, minimum number of burner steps for stepped burner or minimum burner adjustment time between low and high load for infinitely variable burners.

NOTE For remote system, see informative Annex E.

#### 4.4.3 Normal shutdown

The control sequence designed for normal shutdown shall involve the low load position of energy supply before switching off the boiler.

#### 4.5 Flue-gas heated economizers

Economizers shall be fitted with a temperature indicating device on the water outlet.

#### 4.6 Drain and blowdown devices

**4.6.1** Drain and blowdown equipment shall be installed to prevent accidents.

NOTE Drain and blowdown devices, see Annex D.

**4.6.2** Each steam boiler shall be fitted with drain lines placed at, or as near as practicable to, the lowest point of the steam boiler.

NOTE On some steam boilers, drain valves can be used for blowdown purposes.