



SLOVENSKI STANDARD

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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 a tubes de fumée - Partie 6: Exigences pour l'équipement de la chaudière

Ta slovenski standard je istoveten z: **EN 12953-6:2002**

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ICS:

27.060.30	Grelniki vode in prenosniki toplote	Boilers and heat exchangers
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EUROPEAN STANDARD
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Shell boilers - Part 6: Requirements for equipment for the boiler

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

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

This European Standard was approved by CEN on 15 May 2002.

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Contents

	page
Foreword.....	3
1 Scope	4
2 Normative references	4
3 Definitions.....	4
4 General requirements for steam and hot water generators	5
4.1 Safeguards against excessive pressure	5
4.2 Materials for valves, fittings, flanges and bolting	5
4.3 Limiting devices and safety circuits	5
4.4 Temperature measurement of the furnace wall	5
4.5 Boiler heat supply	5
4.6 Flue-gas heated economizers.....	6
5 Special requirements for steam boilers	6
5.1 Water level indication	6
5.2 Steam pressure and temperature indication.....	7
5.3 Drain and blowdown devices.....	8
5.4 Valves for connections.....	8
5.5 Feed water supply.....	9
5.6 Feed water control	9
5.7 Limiting devices	9
5.8 Heat supply	9
5.9 Electrically-heated boilers	9
6 Special requirements for hot water generators	10
6.1 Hot water generating systems (for example see annex A)	10
6.2 Expansion and feed lines for open vented systems	10
6.3 Water supply.....	11
6.4 Circulating pumps	11
6.5 Drain devices.....	11
6.6 Water level indication	12
6.7 Water supply control	12
6.8 Limiting devices	12
6.9 Vent valves	13
6.10 Steam pressure and temperature indication.....	13
6.11 Pressure controller	13
6.12 Discharge from safety valves	13
6.13 Heat supply	14
6.14 Electrically heated hot water generators.....	14
6.15 Parallel mode of operation of hot water generators.....	14
6.16 Safety equipment for hot water generators	14
7 Small shell boilers	17
7.1 Steam boilers.....	17
7.2 Hot water generators	17
Annex A (informative) Design examples for hot water generating systems.....	18
Annex B (normative) Dimensioning of Expansion Space.....	28
Annex C (informative) Operational aspects.....	31
Annex ZA (informative) Clauses of this European Standard addressing essential requirements or other provisions of EU Directives	32

Foreword

This document (EN 12953-6:2002) 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 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 standard.

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 November 2002, and conflicting national standards shall be withdrawn at the latest by November 2002.

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

CR 12953-14: Guidelines for the involvement of an inspection body independent of the manufacturer.

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.

Annex A is normative and Annexes B and C are informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

EN 12953-6:2002 (E)**1 Scope**

This Part of this European Standard specifies requirements for safety related equipment for shell boilers as defined in EN 12953-1, irrespective of the degree of supervisions.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 12953-1, *Shell boilers - Part 1: General.*

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

EN 12953-3:2002, *Shell boilers - Part 3: Design and calculation for pressure parts.*

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

prEN 12953-9, *Shell boilers - Part 9: Requirements for limiting devices and safety circuits of the boiler and accessories.*

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

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3 Terms and definitions

For the purposes of this Part of this European Standard, the terms and definitions given in EN 12953-1 apply in addition to the following.

3.1**controls**

devices used for maintaining the variable to be controlled (e.g. water level, pressure, temperature) at a specific value (set point)

3.2**limiters**

device that, on reaching a fixed value (e.g. pressure, temperature, flow, water level) is used to interrupt and lock-out the energy supply and lock-out requires manual unlocking before restart

3.3**independent**

ability to function as required without dependence upon other equipment

3.4**lock-out**

isolation of energy supply which requires a manual intervention to reinstate

3.5**functional check**

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

3.6**electrically heated boilers**

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

3.7**expansion vessels and tanks**

containers to compensate for temperature dependent volume changes of the water

- expansion vessels are pressurised
- expansion tanks are not pressurised

3.8**allowable heat output of a hot water generator**

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 generators can be operated

3.9**allowable flow temperature**

highest temperature, measured at the outlet branch at which the hot water generator can be operated (see 6.8.2.3)

3.10**maximum continuous rating (MCR)**

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

4 General requirements for steam boilers and hot water generators**4.1 Safeguards against excessive pressure**

Each steam boiler and hot water generator, except open vented hot water generators, shall be equipped with safeguards against excessive pressure in accordance with EN 12953-8.

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.

4.3 Limiting devices and safety circuits

4.3.1 All limiters and their installation shall be designed in accordance with prEN 12953-9. The electrical safety circuits shall be in accordance with prEN 50156-1:1999, Table 1 and Annex B.

4.3.2 Functional checking of all limiters shall be possible at any time during operation e.g. by simulation where appropriate.

4.3.3 If a limiter responds, a signal shall be given to indicate the reasons for boiler/generator malfunction.

4.3.4 After lock out, it shall only be possible to manually restart the boiler/generator from the boiler house.

4.4 Temperature measurement of the furnace wall

If in accordance with EN 12953-3:2002, 5.4 it is established that temperature measurement of the furnace wall is necessary, the temperature signal shall be transmitted to a temperature limiter. The limiting temperature shall be determined by the manufacturer.

4.5 Heat supply

4.5.1 The heat supply shall be automatically controlled in relation to heat demand and the combustion process shall be completed within the furnace. In the event of shutdown, residual heat shall not cause unacceptable metal temperatures (e.g. by evaporation of the water).

EN 12953-6:2002 (E)

4.5.2 The design of the heat supply system and the boiler/generator shall ensure that no excessive evaporation of the water inside the boiler/generator occurs due to the heat accumulation in the combustion chamber and in the boiler/generator passes upon "cut off" of the heat supply.

NOTE This requirement is deemed to have been met for oil and gas firing systems:

- if it is proved that, after switching off the heat supply system from full load steady state condition, the flue gas temperature at the highest point of the heated surface (HHS) falls to a value below 400 °C before the water level has sunk from the lowest water level (LWL) to 50 mm above the highest point of the heated surface (HHS), or
- if adequate feed water is ensured (see 5.5).

4.5.3 Automatic start-up of the boiler/generator and the system shall be permitted provided that equipment is installed to ensure that start-up is conducted safely. Automatic restarting after normal shut-down shall not be considered as a start-up.

4.6 Flue-gas heated economizers

Economizers shall be fitted with a temperature indicating device on the water outlet, and each economizer that can be isolated, shall be provided with a pressure gauge in addition to the safety pressure relief device (see EN 12953-8:2001, 4.1.4).

5 Special requirements for steam boilers**5.1 Water level indication**

5.1.1 Each steam boiler, except for low pressure boilers, shall have at least two independent means of indicating the water level, one of which shall be a gauge of transparent material directly connected to the boiler shell. The other device may be a remote water level indicator or alternate device

For low pressure boilers only one direct water level indicator shall be required.

5.1.2 The gauge(s) of transparent material shall be mounted so that the water level is visible in the gauge glass at the lowest alarm level, i.e. at the lowest permissible water level (LWL) which shall be marked on the gauge glass, and also at the maximum water level which shall be specified by the boiler manufacturer. The water level indicating device shall be so arranged that the value "50 mm below LWL" is visible unless otherwise dictated by the requirements in 4.5.2.

5.1.3 The (LWL) of the boiler (see Figure 5.1-1), which shall be permanently and legibly marked on the boiler, visible at all times, and identified by the letters "LWL", shall be the greater of:

- a) 100 mm above the highest point of the heated surface "HHS"; or
- b) if the flue gas temperature exceeds 400 °C, and the steam boiler has slow acting combustion equipment, a height above "HHS" shall be fixed to allow for a sinking time of not less than 7 min.

The sinking time t is the time during which the water level will sink from the lowest permissible water level to the highest point of the heated surface in the case of complete loss of feedwater supply and at maximum continuous rating, i.e.

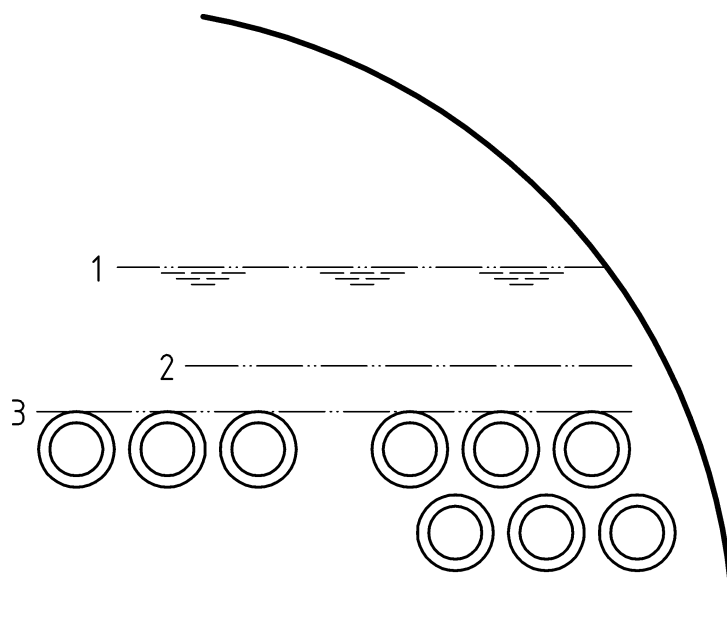
$$t = V/(Q_{st} v) \quad (5.1-1)$$

where

Q_{st} is the maximum continuous rating, in kg/min;

V is the water volume of the boiler between LWL and HHS, in m³;

v is the specific volume of water, in m³/kg.

**Key**

- 1 Controlled water level
- 2 LWL
- 3 HHS

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Figure 5.1-1 — Water level indication

5.1.4 Tubes and fittings connecting a water level gauge to a boiler shall be as short as possible and constructed so that no undrained pocket is formed between the boiler and the gauge. There shall be no outlet therefrom except for regulators, steam pressure gauges and drains or other similar apparatus which does not permit the escape of a significant amount of steam.

Tubes connecting a water level gauge to the boiler shall be not less than 25 mm bore, but it may be reduced to 20 mm at the connection with the gauges. Where the water gauge is fitted to the chamber of a safety control or alarm device, the connecting tubes to the boiler shall have a bore of not less than 40 mm.

5.1.5 Cylindrical water level gauge glasses shall be fitted with protectors.

5.1.6 Water level gauges shall be capable of isolation from the boiler and blowdown equipment. Where the valves used are cocks, the flow direction shall be indicated.

Blowdown equipment for water level gauges, regulators and limiters shall be so installed as to prevent accidents.

5.2 Steam pressure and temperature indication

5.2.1 Each boiler shall have a steam pressure gauge, with a minimum dial diameter of 100 mm, connected to the steam space either directly or through the water level gauge column or its steam connection.

5.2.2 The steam pressure gauge shall be connected to a siphon or similar device of sufficient capacity to keep the gauge tube filled with water. The pipe shall be of sufficient size and should have provision for blowing through, if possible.

5.2.3 Steam pressure gauge connections shall be made suitable for the design working pressure of the boiler.

5.2.4 Pressure gauges shall be graduated to indicate the pressure in bars. The maximum allowable pressure shall be indicated by a fixed and readily visible red mark on the pressure gauge.

EN 12953-6:2002 (E)

NOTE In addition, the operating pressure and the safety valve set pressure can also be indicated.

5.2.5 Each boiler shall be provided with a valve connection for the special purpose of connecting a test gauge when the boiler is in service so that the accuracy of the boiler steam gauge can be ascertained.

5.2.6 Temperature measuring instruments shall be installed at the outlet of each superheater stage.

5.3 Drain and blowdown devices

5.3.1 Each boiler shall be fitted with drain valves placed at, or as near as practicable to, the lowest point of the apparatus.

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

5.3.2 Where drain valves from two or more boilers are connected to a common discharge, two valves shall be fitted to each drain line, one being of a non-return type to prevent the contents of one boiler passing to another.

5.3.3 The drain pipe between the apparatus and the drain valve shall, if exposed to furnace heat, be protected by brickwork or other heat-resisting material so arranged that the pipe may be inspected and is not constrained against expansion.

5.3.4 Taper-plug valves where fitted, shall be of the bolted cover type with separately packed glands and shall not be used with design pressures over 13 bar.

5.3.5 Where drain valves are not self closing or capable of being locked in the closed position, a further shut-off device shall be installed in the line.

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5.4 Valves for connections

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5.4.1 Steam outlets

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The stop valve connecting the boiler to the steam pipe shall be attached directly to the boiler. In the case of a boiler with a superheater, the stop valve shall be located at the outlet from the superheater header. The valve should preferably be of a type which positively indicates whether it is open or closed.

Where more than one boiler is connected to a common header or steam manifold, the steam connections for each boiler shall be provided with two stop valves, one of which shall be of the non-return type, with a free blowing drain between them.

NOTE It is preferable that the valve nearest the boiler be a non-return type.

5.4.2 Feed connections

Each feed pipe to any boiler shall be provided with a non-return valve and a separate stop valve near the boiler. Where there is an integral economiser, the foregoing valves shall be placed at the inlet to the economiser.

If the stop valve and non-return valve are not installed in direct connection to each other, it shall be possible to relieve the pressure in the interconnecting piping.

The feed line and internal pipe connection to the boiler shall be so arranged that in the case of leakage of the non-return valve, the boiler cannot empty itself to a level less than 50 mm above the highest point of the heating surface containing gases at a temperature of more than 400 °C.

In the event of backflow through a feed pump, where the suction pipework is of a lower pressure rating than the discharge line, then pressure gauges shall be installed to clearly indicate the pressure head. Also, a warning notice shall be provided indicating the possible dangers of closing an isolating valve (if fitted) in the suction line.

5.5 Feed water supply

The boiler shall be provided with an adequate supply of feed water. Where feed water supply shall be ensured as required in 4.5.2, two feed water supplies shall be provided.

5.6 Feed water control

5.6.1 The water level shall be controlled automatically.

5.6.2 One automatic device shall be provided to prevent the maximum water level from being exceeded. This device does not have to be an additional device. Where the feedwater supply is interrupted, the heat supply shall be cut off simultaneously if the economisers are endangered due to the interrupted feed.

5.6.3 It shall be ensured that no harmful matter (oil, grease, seawater etc.) can enter the feed water or boiler system.

5.7 Limiting devices

5.7.1 Low water protection

Two independent (both mechanically and electrically) water level limiters shall be provided to cut off and lock out the heat supply when the water level falls to the "LWL" position.

NOTE It is not necessary for both limiters to act simultaneously.

5.7.2 Pressure and temperature limitation

For all boilers, a pressure limiter shall be provided to cut off and lock out the heat supply to ensure that the allowable pressure is not exceeded.

Where a control in accordance with 5.8.2 is required, a temperature limiter shall be provided to cut-off and lock out the heat supply to ensure that the allowable metal temperature is not exceeded.

5.8 Heat supply

5.8.1 The pressure of each boiler shall be controlled automatically by regulating the heat input.

5.8.2 The superheated steam temperature shall be controlled automatically unless the design metal temperature is higher than the maximum attainable metal temperature.

5.9 Electrically-heated boilers

5.9.1 Steam boilers heated by electric current flowing between electrodes

All the requirements of clause 5 shall apply except 5.4.2 paragraph 3, 5.5, 5.7.1 and 5.8.2.

Contrary to 5.1.1, only one means of indicating the water level is sufficient.

5.9.2 Steam boilers heated by immersion heaters

5.9.2.1 All the requirements of clause 5 shall apply except for 5.4.2 paragraph 3 and 5.1.3, where the water level shall not be allowed to fall below the uppermost surface of the immersion heaters.

Contrary to 5.1.1, only one means of indicating the water level is sufficient.

EN 12953-6:2002 (E)

5.9.2.2 The lowest water level (LWL) as defined in 5.1.3 shall be 30 mm above the uppermost surface of the immersion heaters.

Contrary to 5.7.1, only one safety device is sufficient.

6 Special requirements for hot water generators**6.1 Hot water generating systems** (for example see Annex A)

6.1.1 Open vented systems shall be directly connected to the atmosphere (see Figures A.3-1 and A.3-2)

6.1.2 Closed systems shall not be connected to the atmosphere. They are subdivided into:

a) internally pressurised systems where the pressure is generated by the saturation pressure corresponding to the flow temperature (see Figures A.3-3 and A.3-4);

and

b) externally pressurised systems where the pressure is generated by such systems as gas cushions, pressure pumps, or external steam cushions (see Figures A.4-1 to A.4-5).

6.1.3 The heated water is normally used in a closed cycle, but if steam discharge is intended, clause 5 shall additionally apply.

In the case of steam discharge, the pressure shall also be held under all operating conditions.

6.1.4 If required, provision shall be made that the temperature of the water returned to the hot water generator does not fall below a value to be determined by the manufacturer, except for start up and shut down.

6.1.5 Each hot water generator system shall be provided with an expansion space which shall be dimensioned in accordance with Annex B, and shall be capable of compensating temperature-dependent volume changes in hot water generating plant and the heat dissipation system to stay within the design limits. A separate expansion vessel or tank shall be used unless the steam space in the hot water generator is used as the expansion vessel. The plant and particularly these expansion vessels or tanks, including their lines, shall be protected against freezing.

6.1.6 The system shall be equipped with a protective device against back flow (non-return valves) and a shut-off device. The same shall apply to the make-up water line.

Where a shut-off device is installed between the hot water generator and the expansion vessel, it shall be capable of being locked in the open position.

6.2 Expansion and feed lines for open vented systems

To ensure safe operation of the generator the internal diameter of the feed and expansion lines shall be determined by the following (see also Figure 6.2-1):

Dimensions shall be deemed adequate if the internal diameter, d_i of the feed and expansion lines is determined by the following:

$$\text{expansion line: } d_i = 15 + 1,397 \sqrt{Q_h} \quad (6.2-1)$$

$$\text{feed line: } d_i = 15 + 0,9273 \sqrt{Q_h} \quad (6.2-2)$$

where

Q_h is the heat output from the boiler, in kW

In the case of a combined feed/expansion line the following formula shall be used: