

BS EN 12952-7:2012



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Water-tube boilers and auxiliary installations

Part 7: Requirements for equipment for the boiler

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National foreword

This British Standard is the UK implementation of EN 12952-7:2012.
It supersedes BS EN 12952-7:2002, which is withdrawn.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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English Version

**Water-tube boilers and auxiliary installations - Part 7:
Requirements for equipment for the boiler**

Chaudières à tubes d'eau et installations auxiliaires - Partie
7: Exigences pour l'équipement de la chaudière

Wasserrohrkessel und Anlagenkomponenten - Teil 7:
Anforderungen an die Ausrüstung für den Kessel

This European Standard was approved by CEN on 8 September 2012.

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Foreword

This document (EN 12952-7:2012) 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of an identical text or by endorsement, at the latest by April 2013, and conflicting national standards shall be withdrawn at the latest by April 2013.

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 12952-7:2002.

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 97/23/EC, see informative Annex ZA, which is an integral part of this document.

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

The European Standard series EN 12952 concerning water-tube boilers and auxiliary installations 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 of the boiler;*
- *Part 4: In-service boiler life expectancy calculations;*
- *Part 5: Workmanship and construction of pressure parts of the boiler;*
- *Part 6: Inspection during construction, documentation and marking of pressure parts of the boiler;*
- *Part 7: Requirements for equipment for the boiler;*
- *Part 8: Requirements for firing systems for liquid and gaseous fuels for the boiler;*
- *Part 9: Requirements for firing systems for pulverized solid fuels for the boiler;*
- *Part 10: Requirements for safeguards against excessive pressure;*
- *Part 11: Requirements for limiting devices of the boiler and accessories;*
- *Part 12: Requirements for boiler feedwater and boiler water quality;*
- *Part 13: Requirements for flue gas cleaning systems;*
- *Part 14: Requirements for flue gas DENOX-systems using liquified pressurized ammonia and ammonia water solution;*

- *Part 15: Acceptance tests;*
- *Part 16: Requirements for grate and fluidized-bed firing systems for solid fuels for the boiler;*
- *CR 12952 Part 17: Guideline for the involvement of an inspection body independent of the manufacturer;*
- *Part 18: Operating instructions.*

Although these parts may be obtained separately, it should be recognised that the parts are inter-dependent. As such, the design and manufacture of water-tube boilers requires the application of more than one part in order for the requirements of this European Standard to be satisfactorily fulfilled.

NOTE 1 Part 4 and Part 15 are not applicable during the design, construction and installation stages.

NOTE 2 A "Boiler Helpdesk" has been established in CEN/TC 269 which may be contacted for any questions regarding the application of 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 organisations 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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This part of this European Standard specifies the essential requirements for equipment and protective devices for a water-tube boiler plant as defined in EN 12952-1, to ensure the boiler operates safely within the allowable limits (pressure, temperature, etc.).

NOTE 1 Additional requirements specially needed for boilers without manual intervention are specified in Clause 7.

NOTE 2 Requirements for equipment for chemical recovery boilers are given in Annex A.

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 837-1, *Pressure gauges — Part 1: Bourdon tube pressure gauges — Dimensions, metrology, requirements and testing*

EN 12952-1:2001, *Water-tube boilers and auxiliary installations — Part 1: General*

EN 12952-3:2011, *Water-tube boilers and auxiliary installations — Part 3: Design and calculation for pressure parts of the boiler*

EN 12952-8:2002, *Water-tube boilers and auxiliary installations — Part 8: Requirements for firing systems for liquid and gaseous fuels for the boiler*

EN 12952-9:2002, *Water-tube boilers and auxiliary installations — Part 9: Requirements for firing systems for pulverized solid fuels for the boiler*

EN 12952-10:2002, *Water-tube boilers and auxiliary installations — Part 10: Requirements for safeguards against excessive pressure*

EN 12952-11:2007, *Water-tube boilers and auxiliary installations — Part 11: Requirements for limiting devices of the boiler and accessories*

EN 12952-12:2003, *Water-tube boilers and auxiliary installations — Part 12: Requirements for boiler feedwater and boiler water quality*

EN 12952-13, *Water-tube boilers and auxiliary installations — Part 13: Requirements for flue gas cleaning systems*

EN 12952-14, *Water-tube boilers and auxiliary installations — Part 14: Requirements for flue gas DENOX-systems using liquefied pressurized ammonia and ammonia water solution*

EN 12952-16:2002, *Water-tube boilers and auxiliary installations — Part 16: Requirements for grate and fluidized-bed firing systems for solid fuels for the boiler*

EN 12952-18, *Water-tube boilers and auxiliary installations — Part 18: Operating instructions*

EN 50156-1:2004, *Electrical equipment for furnaces and ancillary equipment — Part 1: Requirements for application design and installation*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12952-1:2001, EN 12952-8:2002, EN 12952-9:2002, EN 12952-11:2007, EN 12952-12:2003 and EN 12952-16:2002 and the following apply.

3.1

Types of steam boilers and hot water generators

3.1.1

natural circulation steam boilers and hot water generators

steam boilers and hot water generators in which the water to be evaporated/heated circulates due to the differences in density

3.1.2

forced or assisted circulation steam boilers and hot water generators

steam boilers and hot water generators in which the water to be evaporated/heated is circulated by means of pumps

3.1.3

once-through steam boilers and hot water generators

steam boilers, with or without separating vessels, where the water flow is determined by the feedwater pump, and the water is evaporated completely or in a major portion during one single passage

Note 1 to entry: Hot water generators, where the water flow is effected by the circulating pump of the heating system and is heated during one single passage, e.g. once-through hot water generator where there is no contact between hot and cold water in the drum (two-way drum) once-through hot water generator with header distributing water from below.

3.1.4

waste heat steam boilers and hot water generators

boilers and generators utilising heat recovered from outside sources, e.g. gas turbines, blast furnaces

3.2

limits of steam boilers and hot water generators

boundaries of the steam and water spaces located between the shut-off devices of the steam boilers and hot water generators in the inlet, outlet, pressure retaining, overflow, and drain lines

Note 1 to entry: The bodies of the shut-off devices are considered to be within these limits.

3.3

steam boiler and hot water generating plant

plant consists of one or more water-tube boilers and their equipment as defined in EN 12952-1

3.4

heat supply system

assembly of components in which the energy of the fuel (including electrical and waste-heat energy) is supplied to the steam boilers and hot water generators

3.5

classification of pressure generation systems (Hot water generators)

3.5.1

internally pressurised systems

systems where the pressure is generated by the saturation pressure corresponding to the flow temperature

3.5.2

externally pressurised systems

systems where the pressure is generated by methods such as gas cushion or pressure pumps

3.6

expansion vessels

containers to compensate for temperature related changes in water volume

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

3.7

maximum continuous rating (MCR)

maximum continuous steam output that can be generated during continuous operation

3.8

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 generators may be operated

3.9

maximum allowable pressure (PS)

maximum pressure for which equipment is designed, as specified by the manufacturer, and at a location specified by the manufacturer

Note 1 to entry: This may be the location of connection of protective and/or limiting devices or the top of equipment or, if not applicable, any point specified.

3.10

maximum allowable temperature (TS)

maximum temperature of the fluid for which equipment is designed by the manufacturer, and at a location specified by the manufacturer

Note 1 to entry: Typically, this is at the outlet of the generator.

3.11

controls

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

3.12

limiter

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

Limiting device requires:

- a measuring or detection function, and
- an activation function for correction, or shutdown, or shutdown and lockout,

and which is used to carry out safety related functions as defined in the Pressure Equipment Directive (PED) 97/23/EC [1], either on its own or as part of a protective system (e.g. sensors, limiters, etc.) (see also Figure 1). If this is achieved by multi-channel systems, then all items or limiters for safety purposes are included within the protective system.

Note 1 to entry: Manual resetting can be realised as a part of the limiter or as a part of the safety logic. This will be achieved by the responsible operator taking into account the physical situation.

Note 2 to entry: For limiters based on analogue measurements, see Annex D.

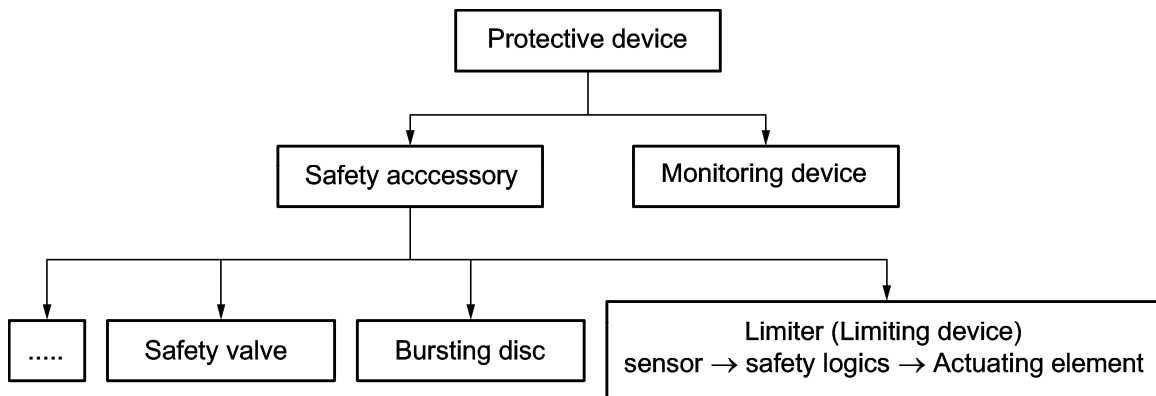


Figure 1 — Protective devices and safety accessories according to the Directive 97/23/EC (PED)

3.13

independent

ability to function as required without interference from other equipment

3.14

reliability

ability to perform a required function under specified conditions and for a given period of time without failing

3.15

functional check

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

3.16

boiler attendant

boiler operator

skilled person appointed for operating the boiler plant

3.17

normal shut down

controlled switch-off of the boiler operated either manually or automatically

3.18

normal operation

operation, with all regulating circuits and controls (open loops/closed loops) in normal mode and with the set points and parameters valid for normal operation. For operation without manual intervention, all regulating circuits and controls (open loops/closed loops) are in automatic mode

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

3.19

lock-out

safety shutdown condition of the protective system, such that a restart can only be accomplished by a manual reset of the limiter or by a manual reset of the safety logic by the boiler attendant and by no other means

4 General requirements for steam boilers and hot water generators

4.1 Safeguards against excessive pressure

Each steam boiler, hot water generator and each isolatable heated compartment shall be equipped with safeguards against excessive pressure in accordance with EN 12952-10.

4.2 Heat supply system

4.2.1 The requirements for heat supply to steam boilers and hot water generators shall be in accordance with:

- EN 12952-8 for firing systems for liquid and gaseous fuels;
- EN 12952-9 or EN 12952-16 for solid fuels.

4.2.2 The heat supply shall be adapted to the allowable heat output as well as to the intended mode of operation.

The heat supply shall be controlled and in all operating stages adapted to the variation of the heat demand.

4.2.3 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:

- if it is proved that, after interruption of the heat supply from the full load steady state condition, the flue-gas 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
- if a reliable feedwater supply is installed to ensure adequate cooling of the heating surfaces in case of a sudden loss of essential operational parameters (see e.g. 5.1.1.2); or
- by oil, gas or pulverised fuel firing systems (except slag-tap firing or heavy brickwork in the furnace or flue-gas passes); or
- if it is only heated with gases not exceeding a temperature of 400 °C.

4.3 Ash removal plants

Ash removal plant shall be in accordance with EN 12952-9 or EN 12952-16.

4.4 Flue-gas cleaning plants

Flue-gas cleaning plants shall be in accordance with EN 12952-13 and EN 12952-14.

4.5 Requirements for limiting devices and protective systems

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

Limiters and their installation shall be in accordance with Annex D or EN 12952-11.

The appropriate Safety Integrity Levels (SIL) identified according to EN 50156-1 shall be implemented.

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

NOTE If required, it should be possible to stop the boiler by additional devices outside the boiler such as shut-off valve, emergency shut-off, fire detectors, etc.

4.5.3 Functional check of all limiters shall be possible at any time during operation.

Where appropriate the functional check can be performed by simulation.

4.5.4 When a limiter activates, information shall be given to indicate which limiter has activated.

4.5.5 For waste heat boilers or generators, when a limiter activates, the heat supply shall be interrupted and locked-out or the waste gas flow shall be diverted to bypass the steam boiler or hot water generator. The bypass shall be manually reset by the boiler attendant.

NOTE If the waste gas flow is not completely diverted to the bypass within a defined time then the heat supply should be interrupted.

4.6 Feed lines and protection against feedwater backflow

4.6.1 Each feed line leading to the steam boiler or hot water generator shall be equipped with a protection device against backflow and a shut-off device. If the shut-off device and the protection device against backflow are not installed in direct connection to each other, pressure relieving shall be possible for the intermediate piping section.

A single once-through steam boiler in which the heat supply is cut off automatically in the case of feedwater failure, requires neither a shut-off device nor protection device against backflow if the feedwater pump is of the positive displacement type where it can be ensured that no dangerous backflow can occur.

4.6.2 Except for once-through boilers, the feed line shall be connected to the steam boiler or hot water generator in such a way that, in the case of leakage of the protection device against backflow, the steam boiler cannot be drained to below the highest point of the down comers.

4.6.3 Feedwater pumps shall be capable of isolation from common suction or pressure lines.

4.6.4 If an isolating valve is installed in the feedwater suction line, the isolating valve and the line between the isolating valve and the feed pump should be designed for the same conditions as the pressure line to the boiler or appropriate devices shall be installed to exclude the danger from overpressure if the isolating valve is closed.

4.7 Connection of steam boilers or hot water generators

Where a steam boiler or hot water generating plant has several steam boilers or hot water generators connected by common lines and the shut-off devices in the steam or hot water and feed lines remain permanently connected with these lines during inspection of the steam boilers or hot water generators, two shut-off devices with intermediate venting shall be installed in each line. The shut-off devices shall be lockable in the closed position and be protected against unintentional actuation.

4.8 Water quality

4.8.1 General

The water quality shall be at least in accordance with EN 12952-12 and the operating instructions.

4.8.2 Sampling

It shall be possible at any time during operation to safely take reliable samples of the boiler water, feedwater, make-up water and if relevant the condensate and/or the recirculation water.

Depending on the temperature of the media the samples shall be taken through one or more sample coolers.

4.8.3 Equipment for monitoring of the steam boiler water quality

Equipment for monitoring of the steam boiler water conductivity shall be installed.

If high conductivity can compromise the safety of the boiler or the operation of any limiter, the monitoring shall be continuous.

If the conductivity is outside the limits given by the operating instructions or specified by EN 12952-12, appropriate corrective actions shall be taken.

4.8.4 Condensate and make-up water in steam boiler plants

An assessment shall be carried out to identify if there is a risk that harmful matter (e.g. oil, grease, organic material, acid, lye, seawater, hardness, ion exchange resin etc.) can enter into the feed water system and/or into the boiler that will compromise the safety of the boiler or the operation of the limiters.

If it is assessed that this risk exists, then adequate monitoring shall be installed which is able to detect the harmful matter.

If harmful matter is detected that will compromise the safety of the boiler or the operation of the limiters, appropriate corrective actions shall be taken.

NOTE If the intermediate circuit of a double circuit system is filled with softened water, it is not considered that there is a hazard that harmful matter may enter the system.

4.8.5 Water circulating system in hot water generator plants

An assessment shall be carried out to identify if there is a risk that harmful matter (e.g. oil, grease, organic material, acid, lye, seawater, hardness, ion exchange resin etc.) can enter the water circulating system that will compromise the safety of the boiler or the operation of the limiters.

If it is assessed that this risk exists, then adequate monitoring shall be installed which is able to detect the harmful matter.

If harmful matter is detected that will compromise the safety of the generator or the operation of the limiters, appropriate corrective actions shall be taken.

NOTE If the intermediate circuit of a double circuit system is filled with softened water, it is not considered that there is a hazard that harmful matter may enter the system.

4.9 Access to internal parts

Access to internal parts for such tasks as cleaning, inspection, maintenance, shall be in accordance with Annex E.

4.10 Marking

Each water-tube boiler plant shall be provided with a durably marked nameplate.

The marking shall include the following:

- a) name and address of the manufacturer;
- b) serial number (unique identification);
- c) year of manufacture;
- d) maximum allowable pressure and temperature;
- e) maximum continuous rating (for steam boilers) or maximum heat output (for hot water generators);
- f) date of first hydrostatic test and test pressure, if applicable;
- g) number of this European Standard;
- h) reference number of the responsible third party organisation, if applicable;
- i) CE marking, if applicable.

5 Special requirements for steam boilers

5.1 Requirements for pumps

5.1.1 Number of feedwater pumps

5.1.1.1 One feedwater pump is sufficient if the requirements of 4.2.3, 1st, 3rd or 4th indent(s), are met. In the case of failure of the feedwater pump, e. g power source, the heat supply shall be cut off automatically.

5.1.1.2 Steam boilers that do not meet the requirements of 4.2.3, 1st, 3rd or 4th indent(s), shall be equipped with at least two feedwater pumps. If one feedwater pump fails, the heat supply shall be automatically reduced to fulfil the requirements of 4.2.3, 1st, 3rd or 4th indent(s). Otherwise the heat supply shall be cut off automatically.

5.1.2 Capacity of feedwater pumps

5.1.2.1 The steam boiler shall be provided with an adequate supply of feedwater.

The feedwater pumps shall be capable of supplying the feedwater to the steam boiler at 1,1 times the maximum allowable pressure, considering the geodetic height and the dynamic pressure losses in the feed-line and the boiler.

If it is proved that in the case of exceeding the maximum allowable pressure, the pressure relief devices are capable of discharging the steam generated at the maximum continuous rating to prevent the pressure reaching 10 % above the maximum allowable pressure a correspondingly lower factor than 1.1 can be used in the calculation.

5.1.2.2 If more than one feedwater pump is required according to 5.1.1.2, the following shall apply:

- a) In the case of failure of the feedwater pump with the highest capacity, the remaining feedwater pumps shall meet the requirements of 5.1.2.1;
- b) Two independent power sources shall be available. By exception, steam operation of all feedwater pumps from only one steam main shall be permissible. The feedwater pumps shall be connected to the power sources in such a way that in the case of failure of one power source the remaining feedwater pumps shall meet the requirements of 5.1.2.1. Where the pumps are electrically driven, one line per feedwater pump drive can suffice if the line can be switched over to a separate independent electrical supply;
- c) In the case of steam boiler plant of a unitised arrangement, it shall be permitted to rate the second feedwater pump for reduced capacity if it is ensured that in the case of failure of the feedwater pumps rated for the allowable steam output, the heat supply system is, at the same time, automatically adjusted to the reduced steam output. If water is blown down, the quantity of blow down water shall be fully considered when rating the second feedwater pump;
- d) For natural and assisted circulation steam boilers, the stand-by pump shall have been put into operation if the operating pump fails, before the water level has sunk below the lowest permissible water level (LWL, see 5.3);
- e) In the case of once-through steam boilers, the stand-by pump shall have been put into operation, within a time interval to be specified by the manufacturer, if the operating pump fails, or if the flow through the steam boiler has fallen to below the minimum flow required, thus ensuring that an unacceptable metal or fluid temperature is avoided.
- f) An alarm system shall activate in the case of failure of a feed water pump.

5.1.3 Circulating pumps

5.1.3.1 For forced circulation steam boilers one circulating pump shall suffice if in the case of failure of the circulating pump e.g. power source, the heat supply is cut off and: