BS EN 12952-7:2012

BSI Standards Publication

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 It supersedes BS EN 12952-7:2002, which is withdrawn.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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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Management Centre: Avenue Marnix 17, B-1000 Brussels

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Contents

Foreword 3
1 **Scope** 5
2 **Normative references** 5
3 **Terms and definitions** 6
4 **General requirements for steam boilers and hot water generators** 8
5 **Special requirements for steam boilers** 12
6 **Special requirements for hot water generators** 15
7 **Additional requirements for plants without manual intervention** 20
8 **Final inspection of the water tube boiler plant** 23
Annex A (normative) **Chemical recovery boilers (Black liquor recovery boilers)** 24
Annex B (informative) **Aspects of boiler operation** 26
Annex C (informative) **Alarms and monitoring from the boiler plant** 30
Annex D (normative) **Requirements for limiters based on analogue measurements** 31
Annex E (normative) **Access to internal parts** 35
Annex F (normative) **Final inspection of the water tube boiler plant** 38
Annex G (informative) **Drain and blowdown devices** 39
Annex H (informative) **Significant technical changes between this European Standard and the previous edition** 40
Annex ZA (informative) **Relationship between this European Standard and the Essential Requirements of EU Directive 97/23/EC** 41
Bibliography 42

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of an identical text or by endorsement, at the latest by April 2013, and conflicting national standards shall be withdrawn at the latest by April 2013.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 on analogue measurements, see Annex D.

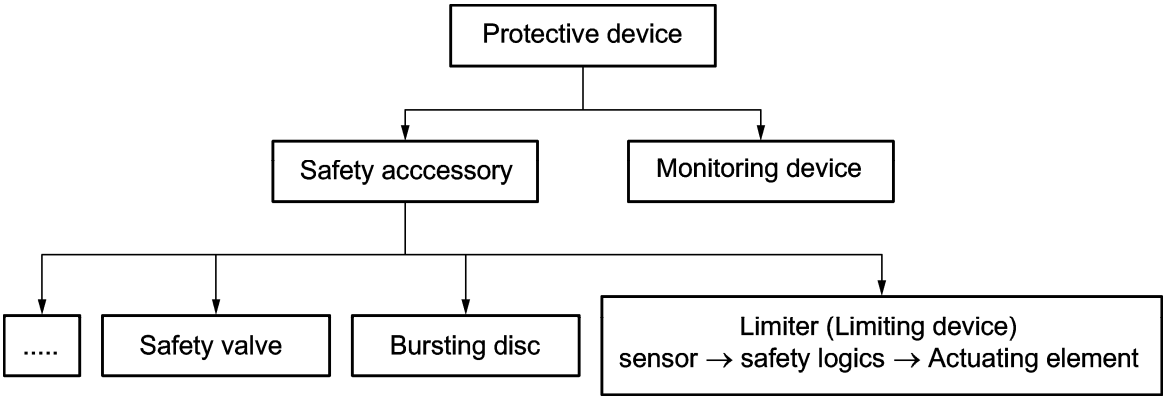


Figure 1 — Protective devices and safety accessories according to the Directive 97/23/EC (PED)

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 feed-water 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:

a) The requirements of 4.2.3, 1st indent, are met and there is no risk of local overheating of the circulation system; or

b) the requirements of 4.2.3, 3rd or 4th indent, are met.

5.1.3.2 Forced circulation steam boilers not corresponding to 5.1.3.1 shall be equipped with at least two circulating pumps. A common standby circulating pump can suffice for several forced circulation steam boilers of one steam boiler plant, if it can be connected to each steam boiler.

5.1.3.3 An alarm system shall activate in the case of failure of a circulating pump and when the flow rate in the circulation system has fallen to a specified minimum value.

5.1.3.4 For the power sources of the circulating pumps 5.1.2.2 b) shall apply.

5.2 Isolating and drain devices

5.2.1 Drain and blowdown equipment shall be installed to prevent accidents (see also Annex G).

5.2.2 Each steam boiler shall be provided with sufficient devices by which it can be positively isolated from the system. Except in the case of unitized arrangements, such devices shall be located as close as possible to the steam boiler.

Where duplicate isolating devices are installed in series, but not adjacent to each other, the intervening tubework shall be provided with means for venting and condensate removal.

5.2.3 Steam boilers shall be equipped with drains. Such drains and the nozzles thereof shall be protected against the effects of combustion gases. Self-closing blowdown devices shall be capable of being locked manually in the closed position unless a further shut-off device is installed in the line.

5.2.4 If automatic devices by which the water level may be lowered to below LWL (see 5.3) are fitted, the design of the heat supply system shall ensure that no unacceptable evaporation of the water inside the steam boiler occurs due to the heat accumulated in the boiler passes upon cut-off of the heat supply.

5.3 Lowest permissible water level (LWL)

5.3.1 For all steam boilers except once-through steam boilers, the lowest permissible water level (LWL) shall be determined and shall be permanently marked on the boiler.

5.3.2 The lowest permissible water level (LWL) shall be at least 150 mm above:

— the uppermost heated point of the drum and;

— the highest connection of the down comers (top edge) to the boiler drums.

In the case of two-drum boilers with an evaporator tube bundle between them, the outer tubes shall not be considered as down comers.

5.4 Water level and flow indicators

5.4.1 All steam boilers, except once-through steam boilers, shall have at least two devices for indicating the boiler water level:

— one device shall be a gauge, with an indicating column made of transparent material (the gauge glass); and either

  — two electronic or electrical devices for water level indication; or

  — a water level controller indicating the water level; or

— a water level limiter indicating the water level.

During operation, the boiler water level shall always be clearly indicated to the boiler attendant.

A water gauge glass that is not used to indicate the water level to the boiler attendant during operation, may be isolated from the boiler.

5.4.2 The connecting tubes between the steam boiler and the water level indicators shall have an inside diameter of at least 20 mm. If the water level indicators are connected by means of common connecting lines these shall have an inside diameter of at least 40 mm. Connecting tubes on the steam side shall be designed so that condensate does not accumulate. The water connection shall be horizontal or slope down towards the boiler.

However, when indirect measurement method is used, impulse tubes to sensors on the steam and water side shall be full of condensate and the sensors shall be below the water level. Each sensor shall have separate connecting tubes. Impulse tubes to sensors may have a smaller inside diameter.

5.4.3 Water level indicators shall be equipped with valves to allow isolation from the steam boiler for blow-down. Where cocks are used, the open position shall be indicated.

5.4.4 On each gauge according to 5.4.1, 1st indent, the lowest permissible water level (LWL) shall be permanently and clearly marked by the letters LWL at the height of the level mark in accordance with 5.3.1. The lower limit of the indicating range of the gauge shall be at least 30 mm below the lowest permissible water level (LWL).

5.4.5 If 4.2.3, 1st indent, applies a water level indicating device shall be so arranged to clearly indicate to the boiler attendant the water level until the temperature of the highest point of the heating surface (HHS) falls below 400 °C or the value “50 mm above HHS”, whatever is the greater. This may be an additional device.

5.4.6 During operation the water level shall always be within the range of the water level indicator.

5.4.7 The water level gauge shall be designed to prevent an excessive discharge of steam and water should breakage of the transparent glass occur during operation.

5.4.8 Blowdown systems on water level indicators, controllers and limiters shall be so installed as to prevent accidents. Any blowdown operation shall be detectable (see also Annex G).

5.4.9 Once-through steam boilers shall be equipped with at least one low-flow indicator device which will indicate water shortage to the coil. Indirect measuring methods may be used.

5.4.10 Forced circulation steam boilers shall be equipped with at least one low-flow indicator device in the circulating line.

5.5 Protective device against water shortage

5.5.1 In order to prevent the boiler from becoming overheated an appropriate limiter shall interrupt and lock out the heat supply if a shortage of water is detected:

— For all steam boilers, except once-through boilers, if the level drops below the lowest permissible water level (LWL);

— For all once-through boilers, if the feed water flow drops below the lowest permissible flow rate and/or the temperature of the steam at the outlet exceeds the permissible value.

5.5.2 The connecting lines to external chambers that contain the sensor for the limiter shall be in accordance with EN 12952-11:2007, 5.2.3.

5.5.3 If it is proved for waste heat boilers that the temperature of the waste-gas-flow entering the boiler is equal or lower than its design temperature, then protection against water shortage is not required.

5.6 Pressure indicators

5.6.1 Each steam boiler shall be provided with at least one pressure gauge with a direct connection to the steam space. The inside diameter of the connecting pipework shall be not less than 8 mm. It is important that the effects of blockage from corrosion products are taken into account. The connecting line shall be provided with a siphon seal and incorporate a facility to connect a test pressure gauge in the vicinity of the pressure gauge. It shall always be possible for the boiler operator to read the pressure gauge.

Pressure gauges shall comply with the requirements of EN 837-1.

5.6.2 The pressure gauge shall indicate the gauge pressure, in bar. The maximum allowable pressure shall be indicated by a permanent and readily visible red mark on the pressure gauge. The pressure gauge shall be so installed that it is protected against heat.

5.7 Monitoring and control of super-heater temperature

5.7.1 Temperature measuring instruments shall be installed at the outlet of the first stage super-heater and at the inlet and outlet (super-heater/re-heater) of the following stages.

5.7.2 For each super-heater (or re-heater) the outlet superheated steam temperature shall be monitored and controlled automatically, unless the design metal temperature cannot exceed the maximum calculated metal temperature under all operating conditions by a safety margin defined by the manufacturer.

5.7.3 An alarm system shall be provided for steam outlet temperatures exceeding the design (calculation) temperature.

NOTE Protection for the downstream system is not covered by this European Standard.

6 Special requirements for hot water generators

6.1 Requirements for hot water generating systems

6.1.1 The heated water is normally used in a closed cycle.

6.1.2 If required, provision shall be made to ensure the temperature of the water returned to the hot water generator will not fall below a value to be determined by the manufacturer. This requirement shall not be applicable during start-up and shutdown.

6.1.3 Pressure generation units shall be designed to prevent harmful steam generation (e.g. water hammer) occurring in the hot water generating plant.

6.1.4 Each hot water generating system shall be provided with an expansion space capable of compensating temperature dependent volume changes in the hot water generating plant and the heat dissipation system to ensure the system stays within the design limits. A separate expansion vessel shall be used unless the steam space in the hot water generator has sufficient capacity for expansion purposes. The plant, and particularly the expansion vessels including their lines, shall be protected against freezing.

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

6.1.6 Upon cut-out of the firing system provision shall be made that the pressure and temperature do not rise to an unacceptable extent. Excessive heat shall be safely discharged from the hot water generator.

a) For hot water generators with a steam cushion (internal pressure generation) the following requirements shall be met:

    1) Excessive heat may be dissipated via safety valves installed at the steam space if a sufficient quantity of water is available between the lowest water level (LWL) and the outlet of the hot water

supply pipe. A water level indication device shall be so arranged as to make the level "30 mm above the supply pipe outlet opening" visible, or

2) Should the quantity of water contained in the hot water generator not suffice for this purpose, make-up feeding shall be required. The requirement for additional make-up water shall be taken into consideration when specifying the capacity of the feedwater supply device (see 6.2.1.4), or

3) The hot water generator shall be supplied with a safety heat exchanger independent of the boiler heat transfer surfaces, which shall prevent the allowable pressure and temperature differentials from being exceeded.

b) For hot water generators with external pressure generation the following requirements shall be met:

1) Excessive heat shall not be dissipated via safety valves;

2) Special measures shall be adopted to dissipate excess heat, e.g. by provision of an independent safety heat exchanger as described in 6.2.1.4 a).

6.2 Requirements for pumps

6.2.1 Feedwater and pressure holding pumps

6.2.1.1 Each hot water generator shall be equipped with at least one feedwater pump or an alternative device except as indicated in 6.2.1.2 and 6.2.1.3.

6.2.1.2 For hot water generators with external pressure generation by pressure pumps, at least two pumps shall be provided.

6.2.1.3 The use of feedwater pump or an alternative device may be waived in the case of plant with quick adjusting heat supply systems provided with a pressure pump, if the latter meets the requirements of 6.2.1.4 a) or 6.2.1.4 b).

6.2.1.4 The feedwater pump (or pressure pump, if 6.2.1.3 applies) capacity (kg/h) required to cover water losses from the system (the generator plant and the connected hot water network) shall be dependent on the design of the system and the pressure holding system.

a) For hot water generators which are indirectly connected to the network by a heat exchanger, the feedwater pump capacity shall cover the losses in the hot water generator and the piping system connected to the primary side of the heat exchanger.

The feedwater pump capacity shall be 0,2 times the steam generated corresponding to the allowable heat output for the generator connected to the system.

For gravity heating systems the capacity may be reduced to 0,1 times the steam generated corresponding to the allowable heat output.

b) For hot water generators which are directly connected to the hot water network and where the pressure holding is made with a gas or steam cushion in an expansion vessel, the feedwater pump capacity shall be rated to cover the water losses in the total system.

c) Where the pressure pump arrangement in 6.2.1.2 applies, the pump arrangement shall have a capacity corresponding to the maximum water volume decrease in the directly connected circulating system as a result of cooling down.

Additional measures shall be taken if the water losses in the total system exceed the capacity of the largest pressure holding pump.

6.2.1.5 Where steam discharge is provided apart from hot water discharge for the closed heating system cycle, the quantities required for steam and hot water generation shall be calculated separately for the determination of the feedwater supply device capacity. The calculation for the required quantities and the design of the feedwater supply devices shall be in accordance with 5.1.

Venting and draining devices shall not be considered devices to be used for steam discharge purposes.

6.2.2 Circulating pumps

6.2.2.1 For once-through hot water generators one circulating pump shall suffice if:

a) in the case of failure of the power source the heat supply system is also cut off and no hazardous operating conditions can occur; or

b) the hot water generator is heated only with gases not exceeding a temperature of 400 °C; or

c) in the case of oil, gas or pulverised fuel firing systems (except slag-tap firing or heavy brickwork in the furnace or flue-gas passes), the burners are switched off automatically when the flow is reduced to below the specified value and it is proved that residual heat accumulated in the furnace and flue gas passes shall not cause unacceptable metal or fluid temperatures; or

d) several hot water generators of a hot water generating plant have one or more common standby circulating pump(s). It shall, however, be ensured in the case of failure of the drive unit provided for normal operation, that a sufficient number of circulating pumps required for cooling of the hot water generators can be kept in operation by means of a second drive unit.

6.2.2.2 Once-through hot water generators not corresponding to 6.2.2.1 shall be equipped with at least two circulating pumps. A common standby circulating pump can suffice for several once-through hot water generators of one hot water generating plant, if this standby pump is connected to each hot water generator.

6.2.2.3 An alarm system shall activate in the case of failure of a circulating pump and when the flow rate in the circulation system has fallen to a specified minimum value.

6.3 Shut-off and drain devices

6.3.1 The blowdown lines of water level indicators, controllers, and limiters as well as test gauge equipment shall be so installed as to prevent accidents (see also Annex G). Any blowdown operation shall be detectable.

6.3.2 Each hot water generator shall be provided with isolating devices by which it can be shut off from all line connections. Such devices shall be located as close as possible to the hot water generator.

6.3.3 Drums and header shall be provided with devices for draining. Where hot water generators can be drained through a lower header, one draining device at this header can suffice. Such drains and the nozzles thereof shall be protected against the effects of combustion gases. Self-closing blowdown devices shall be capable or being locked manually in the closed position unless a further shut-off device is installed in the line. Drain lines shall discharge to a safe position. The drain lines and the collecting line, if any, shall lead separately to the blowdown vessel for each hot water generator.

6.3.4 If automatic devices by which the water level may be lowered to below LWL (see 6.4) are fitted, the design of the heat supply system shall ensure that no unacceptable evaporation of the water inside the generator occurs due to the heat accumulated in the boiler passes upon cut-off of the heat supply.

6.4 Lowest permissible water level and installation of flow and return line

6.4.1 For each hot water generator, except for once-through designs, the lowest permissible water level (LWL) shall be determined and shall be indicated on the wall of each hot water generator, expansion vessel by a level mark with the letters LWL.

6.4.2 In hot water generators, except those with quick-adjusting heat supply systems, the lowest permissible water level (LWL) shall be at least 150 mm above the highest point of the heating surface measured from the water side. In the case of hot water generators with quick-adjusting heat supply systems this value may be lowered to 100 mm.

6.4.3 The flow and return line shall be equipped with a shut-off device. The system shall be equipped with a protective device against backflow.

6.5 Water level and flow indicators

6.5.1 Each hot water generator operated with a steam space shall have at least two devices for indicating the water level:

— one device shall be a gauge, with an indicating column made of transparent material (the gauge glass); and

— two electronic or electrical devices for water level indication; or

— a water level controller indicating the water level; or

— a water level limiter indicating the water level.

During operation the boiler water level shall always be clearly indicated to the boiler attendant.

A water gauge glass that is not used to indicate the water level to the boiler attendant during operation may be isolated from the boiler.

Where an expansion vessel is connected such as to ensure natural water circulation which permits pressure relief and temperature control exclusively at the steam space of the expansion vessel, the required devices may be installed on the expansion vessel.

6.5.2 Each hot water generator which is operated without a steam space shall be equipped with a vent valve at or in close proximity to its highest point.

6.5.3 Each expansion or collecting vessel shall be equipped with at least one water level indicator according to 6.5.1, 1st indent. During operation, the water level shall always be clearly indicated to the boiler attendant. An alarm system shall activate to indicate to the boiler attendant if the water level required for operation is not within the specified range.

The glass water gauge and the alarm system may be replaced by a water level limiter and a vent valve.

6.5.4 Water level indicators shall be equipped with valves to allow isolation from the hot water generator for blowdown. The valve open position shall be indicated.

6.5.5 On each gauge according to 6.5.1, 1st indent, the lowest permissible water level (LWL) shall be permanently and clearly marked by the letters LWL at the height of the level mark according to 6.4.1. The lower limit of the indicating range of the gauge shall be at least 30 mm below the lowest permissible water level (LWL).

6.5.6 During operation the water level shall always be within the range of the water level indicator.

6.5.7 Once-through hot water generators shall be provided with the following devices in lieu of the water level indicators:

a) at least one alarm system to indicate to the boiler attendant an imminent water shortage;

EXAMPLE A sensor in the form of a flow controller installed in the return line as close as possible to the hot water generator with an alarm output.

b) one vent valve at or in direct vicinity of the highest point of the hot water generator.

6.5.8 The connecting tubes between the hot water generator and the water level indicators shall have an inside diameter of at least 20 mm. If water level indicators are connected by means of common connecting lines these shall have an inside diameter of at least 40 mm. Connecting tubes on the steam side shall be designed so that condensate does not accumulate. The water connection shall be horizontal or slope down towards the boiler.

However, when indirect measurement method is used, impulse tubes to sensors on the steam and water side shall be full of condensate and the sensors shall be below the water level. Impulse tubes to sensors may have a smaller inside diameter.

6.6 Protective device against water shortage

6.6.1 In order to prevent the boiler from becoming overheated an appropriate limiter shall interrupt and lock out the heat supply if a shortage of water is detected:

— For all hotwater generators with an internal steam cushion, if the level drops below the lowest permissible water level (LWL);

— For all hotwater generators (and once-through boilers) with external expansion or pressure holding system if the level drops below the top of the hot water boiler.

For open expansion vessels or closed expansion vessels with a steam or gas cushion, an additional limiter shall be installed on the expansion vessel to protect the hot water system from gas or air penetration.

6.6.2 The connecting lines to external chambers that contain the sensor for the limiter shall be in accordance with EN 12952-11:2007, 5.2.3.

6.6.3 If it is proved for waste heat generators that the temperature of the waste-gas-flow entering the generator is equal or lower than its design temperature, then protection against water shortage is not required.

6.6.4 An alarm system shall indicate to the boiler attendant whenever the water level exceeds or falls below the water level specified for operation.

6.7 Protective devices against minimum pressure

Hot water generating plants with external pressure generation shall be provided with a limiter to cut off and lock-out the heat supply and switch off the circulating pump when the predetermined value of minimum pressure is reached. The circulating pump need not be switched off if it shall be ensured that, depending on plant type, where the pressure is less than the minimum pressure, additional measures are taken to prevent water hammer or steam generation.

6.8 Protective devices against excessive temperature

6.8.1 Each hot water generator shall be equipped with at least one temperature limiter. The temperature limiter shall respond, at the latest, when the maximum allowable temperature of the hot water generator is exceeded. The design of this limiter shall permit functional testing under all operating conditions.

The sensors of the temperature limiter shall be located so that the maximum temperature in the generator shall be positively measured under all operating conditions, even in the case of failure of the circulating pumps. It shall not be possible to render the sensors ineffective by means of shut-off devices.

6.8.2 For hot water generators with internal pressure generation, the temperature limiter may be replaced by a pressure limiter or by a safeguard against excessive pressure in accordance with 4.1.

6.9 Pressure and temperature indicating devices

6.9.1 Each hot water generator shall be provided with at least one pressure gauge with direct connection to the steam or water space. The inside diameter of the connecting pipework shall be not less than 8 mm. It is important that the effects of blockage from corrosion products are taken into account. The connecting lines leading to the steam space shall be provided with a water seal. It shall always be possible for the boiler operator to read the pressure gauge. The connecting pipework shall incorporate a facility to connect a test pressure gauge near to the pressure gauge.

Pressure gauges shall comply with the requirements of EN 837-1.

The pressure gauge shall indicate the gauge pressure, in bar. The maximum allowable pressure shall be indicated by a permanent and readily visible red mark on the pressure gauge. The pressure gauge shall be so installed that it is protected against heat.

6.9.2 A temperature indicator shall be installed in both the flow and inlet line of each hot water generator so that the actual flow or inlet temperatures are indicated. In addition, a temperature indicator shall be provided in each flowline downstream of the expansion vessel or in a collecting line, if any. The maximum allowable temperature shall be marked on the indicators. If the incoming water is added to the outgoing water, a temperature indicator shall be provided downstream of the mixing point. A temperature indicator shall be installed in the safety line leading to the expansion vessel if the temperature in this vessel is not to exceed a predetermined value which is lower than the maximum allowable temperature. If the hot water generating part is connected to an expansion vessel by one or more lines which may result in insufficient water circulation, the temperature in the hot water generating part shall be measured near its uppermost point.

6.9.3 It shall be possible to check the flow temperature indication and the set point of the temperature limiter. This shall be done in the vicinity of the sensors for flow temperature measuring and in the vicinity of the temperature limiter (e.g. thermowell).

7 Additional requirements for plants without manual intervention

7.1 General

Additional equipment and suitable procedures shall be in place to ensure the safety integrity of the boiler plant due to operation without manual intervention and that the boiler operates within the allowable limits (pressure, temperature, etc.) and if these limits are exceeded will interrupt and lock out the heat supply.

A maximum time of operation without manual intervention should be defined by the manufacturer.

NOTE Annex B (informative) gives recommendations of operation and testing of the boiler with a maximum time of operation without manual intervention of 72 hours.

7.2 Heat supply

The heat supply system shall be automatically controlled.

7.3 Start up

When a boiler is started up after normal shutdown or lockout, 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, the manufacturer shall take account of effective heat transfer to avoid unacceptable local over heating or thermal stresses or other stresses of any pressurised parts of the boiler or parts connected to the boiler, with particular regard to the heating up sequence and flow rates. These controls may be in the form of installed control systems and/or software and/or operating instructions.

The start-up sequence shall consider at minimum the following points which are to be defined by the manufacturer:

— lock out i.e. limiters;

— minimum flow of water for hot water boilers to avoid over-heating and to reach effective heat transfer;

— minimum temperature of water for hot water boilers to avoid corrosion;

— minimum temperature of critical parts of boilers to avoid unacceptable thermal stresses;

— steam output as a function of pressure of steam boilers to improve internal mixing (flow) and to avoid thermal stresses (effective heat transfer);

— sequence shall contain times (or pressures) and heat supply loads for a gentle start-up to avoid thermal stresses;

— additional heat supply requirements like i.e. 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.

7.4 Water quality

7.4.1 If it is assessed that a dangerous change of the total hardness value in the feed water, make-up water, condensate or other water return flows to the boiler may occur, the total hardness of the relevant water input to the boiler shall be monitored automatically. In the case of a demineralised water regime the conductivity value may be monitored instead of the total hardness. If the limit values prescribed by the manufacturer are exceeded, a suitable protection method shall be used. If the method of protection is a device which automatically interrupts the supply of, or diverts the water supply downstream, or ultimately cuts off and locks-out the heat supply to the boiler, then the device shall comply with the requirements of 4.5. The requirements regarding hardness monitoring of the make-up water may be met e.g. if the capacity of the water softening plant is automatically monitored for depletion. If the softening plant becomes depleted, the make-up water supply to the feed water system shall be interrupted automatically.

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.

7.4.2 If it is assessed that other harmful matter (e.g. oil, grease, organic material, acid, lye, seawater etc.) may enter the feed water, make-up water, condensate or other water return flows to the boiler that will compromise the safety of the boiler or the operation of the limiters within the period of operation without manual intervention, then a suitable monitoring system shall be installed. If the limit values prescribed by the manufacturer are exceeded, a suitable protection method shall be used. If the method of protection is a device which automatically interrupts the supply of, or diverts the concerned water supply downstream, or ultimately cuts off and locks-out the heat supply to the boiler, then the device shall comply with the requirements of 4.5.

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.

7.5 Steam boilers

7.5.1 General

7.5.1.1 The pressure of the steam boiler shall be controlled automatically.

7.5.1.2 A pressure limiter shall be provided to cut off and lock out the heat supply before the set pressure of each safeguard against excessive pressure (safety valve) is reached.

7.5.1.3 When a temperature controller is required according to 5.7.2, the alarm system required by 5.7.3 shall be replaced by a temperature limiter to cut-off and lock out the heat supply.

7.5.2 Natural and forced circulation steam boiler

7.5.2.1 The water level shall be controlled automatically (water level controller).

7.5.2.2 An additional limiter as required in 5.5.1 shall be provided as protective device against water shortage.

In addition, for forced circulation steam boiler, two limiters shall be provided which automatically cut off and lock out the heat supply system if the flow is reduced to the minimum flow rate (e.g. flow limiters or temperature limiters).

7.5.2.3 A limiter shall be provided to activate if the maximum water level is exceeded and interrupt and lock out the heat supply and interrupt the feed water supply.

Short-time delay of the aforementioned device by a timer is permitted. The maximum water level shall be specified by the boiler manufacturer and shall be within the visible indication range of the water level indicator.

7.5.3 Once-through steam boiler

7.5.3.1 The feedwater and fuel supply shall be controlled automatically and shall be interdependent (cross monitored).

7.5.3.2 An additional limiter as required in 5.5.1 shall be provided as protective device against water shortage.

7.6 Hot water generators

7.6.1 Care shall be taken to ensure that the temperature of the water returned to each hot water generator is not less than the lowest allowable value except during start-up and shut down.

7.6.2 Where temporary draining or feeding of water is required due to changes in water volume, the water level shall be controlled automatically by a control device (water level controller).

7.6.3 Where, in the case of boilers with automatic water level control, the maximum water level fixed individually for each boiler is exceeded, the heat supply shall be cut off and locked out, and additionally the feed water supply shall be cut off. This device need not be an additional unit.

7.6.4 Plants with internal pressure generation shall fulfil the following requirements:

a) The steam pressure in a hot water generator shall be controlled automatically by controlling the heat input;

b) A pressure limiter shall be provided to cut off and lock out the heat supply before the set pressure of each safeguard against excessive pressure (safety valve) is reached;

c) An additional limiter as required in 6.6.1 shall be provided as protective device against water shortage.

7.6.5 Plants with external pressure generation shall fulfil the following requirements:

a) The outlet temperature of each hot water generator shall be controlled automatically by controlling the heat input.

b) Each hot water generator shall be provided with one high pressure limiter to cut off and lock out the heat supply system if the maximum allowable pressure is exceeded.

One pressure relief valve per hot water generator each may suffice if the plant is equipped with an additional pressure limiter (e.g. at the outlet manifold). It shall be determined for each plant whether the circulating pumps shall be cut off in addition to the heat supply system.

7.7 Alarms and monitoring from the water tube boiler plant

The safety of the water tube boiler plant shall not rely on the effective operation of the remote alarm and monitoring system.

For information on alarms and monitoring, see Annex C.

8 Final inspection of the water tube boiler plant

Final inspection of the water tube boiler plant shall include a detailed test plan in accordance with Annex F in order to check full compliance with this part of this European Standard.

Annex A
(normative)

Chemical recovery boilers (Black liquor recovery boilers)

A.1 General

This annex defines special requirements for equipment installed in chemical recovery boilers (black liquor recovery boilers). These special requirements are additional to all other requirements of this Part of this European Standard, which shall continue to apply.

NOTE Any water leakage into the furnace will create a risk for a smelt-water explosion. The purpose of the rapid drainage is to prevent such smelt-water contact.

A.2 Additional requirements for equipment

A.2.1 Protection against explosions shall be considered in boiler house design.

A.2.2 The control room and at least one exit from it shall be so designed to be protected from hazards arising from the boiler and other equipment in the boiler house.

A.2.3 The furnace shall be equipped with explosion overpressure protection, such as weak corners, which shall discharge to a safe place.

A.2.4 The boiler shall be designed to protect persons entering the furnace during shut-down periods from falling objects.

A.2.5 The main steam line shall be equipped with a motorised shut off valve, which can be operated from the control room.

A.2.6 Covers for doors and openings to the furnace shall not be water cooled.

A.2.7 The upper part of covers for the smelt spouts shall only be cleaned by steam, compressed air or mechanical means. If aqueous solutions are used for cleaning the lower part of the smelt spout covers, special precautions shall be taken to prevent the solution from corroding the boiler wall tubes.

A.2.8 The cooling water system of the smelt spout shall be designed so that any water from leaks occurring in the spouts are prevented to reach the furnace.

A.2.9 Tubing systems for water washing of auxiliary equipment and the furnace of the chemical recovery boiler following shut-down shall be designed so that the supply piping for the wash water can be fully detached from the feed lines to the inlet nozzles or sootblowers used during the washing process.

A.2.10 The boiler plant shall always be supplied with a sufficient reserve of water to enable the plant to be shut down safely. Except in the case of rapid drainage, the design of the feed water reserve shall take into consideration the residual heat of the smelt-bed and the furnace and avoid overheating of the boiler tube material and the boiler structure. The quantity of water used from the feed water reserve for other purposes shall be considered when rating the feed water reserve.

A.2.11 The supply piping for sootblower steam and the sootblower lances shall be provided with reliable drains for steam condensate.

A.3 Equipment for the emergency shut-down and rapid drainage

A.3.1 Activation of the emergency shut-down system shall ensure that the boiler is made ready for rapid drainage. Once the emergency shut-down system is activated, the combustion in the furnace shall be stopped by shutting-off the supply of all fuel and the supply of air to the lower part of the furnace. The sootblower system shall be inactivated.

A.3.2 The boiler shall be equipped with a drainage system able to drain the water in the furnace tubes to a level not less than 3 m above the bottom of the boiler (or to the height defined by the boiler manufacturer) within 30 min from the start of rapid drainage after an emergency shutdown. The rapid drain valves shall be motor operated. The tubes of the water screen shall be drained within 10 min.

A.3.3 The emergency shut-down and the rapid drainage shall be activated individually by the operator pressing the emergency shut-down or the rapid drainage button. It must always be possible to interrupt the procedure if the risk can be avoided by other means.

A.3.4 The boiler shall be equipped for a residual full draining, which shall be activated by manual means. Full draining shall be only used when necessary.

A.3.5 The drainage system shall be so arranged that the function of the rapid drain valves in the drain lines can be safely tested during operation.

NOTE Testing is necessary to ensure that when the rapid drainage system is activated the drain valves will function as intended. In normal operation, the drain piping system may be locked open for rapid drainage.

A.3.6 The boiler shall be equipped with a water lever indicator which indicates the water level from the normal operational level all the way down to the bottom of the boiler.

A.3.7 The emergency shut-down and rapid drain systems shall be connected to the auxiliary power supply to enable a safe shut-down and rapid drainage during general power cut-outs. The flue gas and combustion draft fans do not need to be connected to the auxiliary power supply system.

Annex B
(informative)

Aspects of boiler operation

B.1 General

This annex gives recommendations of operation and testing of the boiler system with a maximum time of operation without manual (human) intervention of 72 hours.

B.2 Maintenance

B.2.1 All controls and safety devices should be properly maintained to ensure reliability. In addition, an inspection organisation or an appropriate maintenance service should be responsible for the checking and/or functional testing of this equipment at regular intervals, according to the instructions of the manufacturer, at least every six months or more frequently if problems are experienced.

B.2.2 All control and limiting devices should be functionally checked and/or tested during these checks. The method of checks or the functional tests of the limiting devices shall be established by the manufacturer with regards to the level of reliability and the operating requirements.

B.3 Boiler operation and testing

B.3.1 Before the boiler is left unsupervised, the boiler attendant/operator should ensure the proper condition of the boiler plant (including all limiters) in accordance with the manufacturer operating instructions and other relevant documents.

B.3.2 The following Tables B.1 and B.2 are recommendations for observation and testing of the boiler system. This information should be part of the boiler manufacturer's operating instructions together with fault finding guidance for the equipment supplied.

When using limiters according to EN 12952-11, supplied with a SIL declaration of conformity, the manufacturers specified test intervals (T), pos. F, H and I, can be increased accordingly. The intervals for these tests should be specified and can be a part of the testing of the protective systems, pos. K.

When using limiters with analogue sensors in accordance with Annex D, the checking and/or testing (T), pos. F, H and I, need not to be carried out as functional checks. The analogue measurements can conveniently be compared within the normal operation ranges. The intervals for these tests should be specified and can be a part of the testing of the protective systems, pos. K.

Table B.1 — Check list for steam boiler *(1 of 2)*

Pos	Observation and testing	Clauses	3 days	1 month	3 months	6 months	12 months	Remarks
A	Safeguards against excessive pressure (safety valves)	4.1	O			T		See NOTES 1 and 2
B	Water level indication	5.4	T					Compared with limiters and controls
C	Drain and blow-down devices	5.2	T					-
D	Valves	4.6 5.2	O			T		As per manufacturer instructions manual
E	Feed water control	5.1 7.5.3.1	O			T		-
F	Low water protection	5.5 7.5.2.2 7.5.3.2	O	T				Functional check by lowering the water level to the switching points
G	Steam pressure and temperature indication	5.6 5.7	O					Compared with limiters and controls
H	Pressure limitation	4.1 5.6.2 7.5.1.2	O	T				Functional check by increasing the pressure to the switching points
I	Temperature limitation	5.5.1 5.7.3 7.5.1.3	O	T				May be carried out by simulation according to 4.5.3
J	Devices for water quality protection	4.8 7.4	O	T (1)		T (2)		(1) Comparison of the measured values with the reliable samples (2) Performed by a suitably qualified and competent person
K	Protective systems	4.5	O			T (3)		(3) Electrical and mechanical testing performed by a suitably qualified and competent person
L	Pressure parts (pipes, inspection openings, flanges, gaskets, joints…)	-		O				

Table B.1 *(2 of 2)*

M	Pressure controller and temperature controller	5.7.2 7.5.1.1	O			T		
N	Feed water supply	5.1	O		T			
O	Water quality	4.8 7.4	T (4)					(4) see EN 12952-12
P	Heat supply	4.2 7.2	O				T (5)	(5) Performed by a suitably qualified and competent person as per manufacturer instructions manual
Q	Circulation limitation	5.1.3.3	O	T				Maybe carried out by simulation according to 4.5.3
(O) Observation of abnormal noises, smells or other noticeable factors. (T) Checking and/or testing the functional behaviour of equipment parts, including observation.								

Table B.2 — Check list for hot water generator *(1 of 2)*

Pos	Observation and testing	Clauses	3 days	1 month	3 months	6 months	12 months	Remarks
A	Safeguards against excessive pressure (safety valves)	4.1	O			T		See NOTES 1 and 2
B	Water level indication	6.5	O					-
C	Drain and blow-down devices	6.3	O					-
D	Vent valves	4.7 6.5.2 6.5.3	O			T		As per manufacturer's instructions manual
E	Low water protection	6.6.1 7.6.4	O		T			May be carried out by simulation according to 4.5.3
F	Pressure and temperature indication	6.9	O					Compared with limiters and controls
G	Pressure limitation	4.1 6.7 7.6.4.b 7.6.5.b	O		T			May be carried out by simulation according to 4.5.3
H	Temperature limitation	6.8	O		T			May be carried out by simulation according to 4.5.3

Table B.2 *(2 of 2)*

I	Circulation limitation	6.2.2.3	O	T				May be carried out by simulation according to 4.5.3
J	Devices for water quality protection	4.8.1 7.4	O	T (1)		T (2)		(1) Comparison of the measured values with the reliable samples (2) Performed by a suitably qualified and competent person
K	Protective systems	4.5	O			T (3)		(3) Electrical and mechanical testing performed by a suitably qualified and competent person
L	Pressure parts (pipes, inspection openings, flanges, gaskets, joints…)	-		O				-
M	Pressure controller and temperature controller	7.6.4 a 7.6.5 a	O			T		-
N	Water supply	6.6	O		T			-
O	Water quality	4.8 7.4		T (4)				(4) see EN 12952-12
P	Heat supply	4.2 7.2	O				T (5)	(5) Performed by a suitably qualified and competent person as per manufacturer instructions manual
(O) Observation of abnormal noises, smells or other noticeable factors. (T) Checking and/or testing the functional behaviour of equipment parts, including observation.								

NOTE 1 Additional function tests and observation can be required either by National Rules, third parties or the manufacturer.

NOTE 2 Deviations of periods or tests are possible with agreement of third parties if safety level will not be reduced.

NOTE 3 Consideration should be given to functional testing of additional devices outside the boiler.

B.3.3 The method of testing should be adapted according to the type of fuel, in particular for solid fuels.

B.3.4 The inspection intervals should be defined on the basis of the operating conditions and the water treatment products used.

B.3.5 Functional check as defined in 4.5.3 should be described by the manufacturer in the operating instructions.

B.3.6 Continuous supervision should be provided after a fault has been rectified until a suitable period of time has elapsed to ensure, by testing, that the boiler and its controls are operating normally.

B.3.7 The result of each check should be clearly demonstrated to the boiler operator.

B.3.8 Operating instructions covering operation, maintenance and testing of the boiler plant should be available for the boiler operator at any time.

B.3.9 Results of observations, testing, checking and faults should be recorded in a logbook and kept on site.

Annex C
(informative)

Alarms and monitoring from the boiler plant

C.1 General

This annex gives information on alarms and monitoring.

C.2 Conditions for alarms and monitoring

The conditions for alarms and monitoring a boiler at a site separated from the boiler location should be as follows:

— The remote alarm system should ensure that the boiler is attended before it is reset locally (in the boiler location) following a lockout condition;

— Remote systems can be used for the monitoring of boiler condition and alarms, but should not be used for controlling the operation of the plant;

— Remote alarm panels should provide sufficient information to determine which boiler(s) is (are) in operation or alarm condition and, where appropriate, an additional emergency stop facility;

— If remote emergency shutdown/lockout of the boiler is provided, then acknowledgement and completion of this command should be transmitted back to the remote system;

— If a rapid response is required to a lock-out to maintain the steam/hot water flow to the downstream process then duplicate or parallel systems should be provided;

— The remote system should be able to gain the attendants attention in the ambient conditions present at its location.

Annex D
(normative)

Requirements for limiters based on analogue measurements

D.1 General

This annex describes the principles that shall be applied to limiters based on analogue measurements with subsequent determination of the limit value in an electronic device.

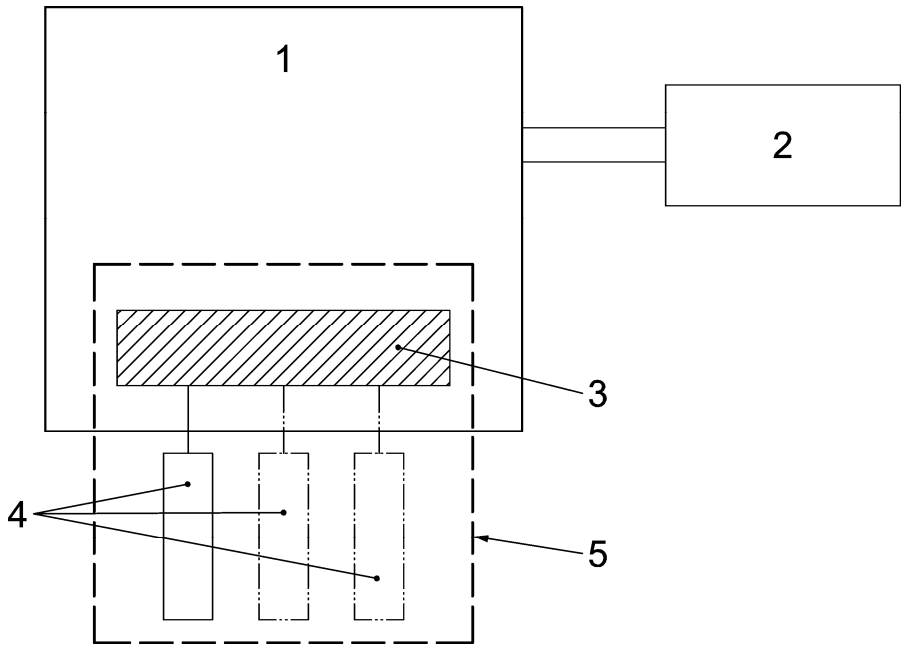
The requirements of this Annex applies to all components from the process connection up to and including the output of the binary limit signal e.g. analogue sensors, analogue transmitters, compensation logic, voting logic, etc.

NOTE 1 An advantage of using the analogue measurements is the continuous cross checking of the values, which is included when using analogue measurements because the measuring circuit is always live.

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

The measuring principle can be direct or indirect.

NOTE 2 Direct measurements are measuring the process value direct e.g. pressure, temperature or level sensors. Indirect measurements have compensation for the process condition applied before the process value is determined e.g. flow or level measured via a pressure difference, which are compensated for the temperature and/or pressure effect on density.



Key

1 logic unit
2 heat supply
3 electronic device
4 analogue sensors
5 limiter(s) for each physical property (e.g. water level)

Figure D.1 — Principle of limiter(s) based on analogue measurements

D.2 Specific requirements

D.2.1 Specification of the number of analogue sensors

If one or two limiters are required according to this Part of the European Standard, the following shall be used as a minimum:

— two analogue sensors with determination of limit value in a 1oo2 evaluation, or

— three analogue sensors with determination of limit value in a 2oo3 evaluation.

NOTE For information, definitions of 1oo2 and 2oo3 are specified in EN 50156.

D.2.2 Special requirements

The following requirements shall be met:

a) The installation of the analogue sensors shall avoid common cause failures i.e. by separate tapping points or chambers. A common in-line element such as an orifice plate may be used if stability of the element can be justified.

b) Each sensor shall have separate connecting tubes. Inner tube diameters shall not be less than 6 mm. It shall be possible to blow down the connecting tubes to ensure that they do not become blocked.

c) The analogue measurements shall be cross-checked allowing only a certain variance within a certain time defined by the boiler manufacturer.

d) The additional use of a signal for closed loop control shall not have any impact on the safety related system.

e) When calibrating sensors, procedures shall ensure that any calibration error is avoided

f) A channel fault shall be voted as a trip signal for that channel.

g) Material and climatic condition requirements in EN 12952-11 shall be applied.

h) When shut-off devices are installed in the connection lines of an analogue sensor, operation shall only be permitted if:

   — The open position of the shut-off devices are monitored (interlocked); or

   — The shut-off devices are encapsulated in a locked cabinet or locked in the open position and that operational procedures assure that the shut-off devices are open before starting the boiler. This can be done by the operator checking the reading of the sensors and acknowledge that the reading is correct.

i) If one channel trips or deviates from the other channels e.g. in “2oo3” voting, an alarm shall be activated.

The tolerable deviation from the true process value should be defined. Recommendations regarding pressure and temperature are given in EN 12952-11:2007, 6.5 and 7.2.

D.2.3 Additional requirements for indirect measurements

The following requirements shall be met:

a) The correction algorithm shall be verified, and the accuracy specified. The valid input measurement ranges for the correction algorithm shall be specified.

b) The measurements used for calculating the correction factor shall meet the requirements of EN 50156-1.

c) If the measurements used to calculate the correction factor are no longer valid, an alarm shall be activated and it shall be assured that the correction algorithm corrects the corresponding value in a safe way or the channel shall be tripped.

NOTE The invalid measurement might be replaced by a safe substitute value.

D.3 Examination of functionality

The test of the channel and the voting logic shall as a minimum be in accordance with Table D.1. All results of the check shall be recorded.

Table D.1 — Examination of functionality *(1 of 2)*

Pos.	Description	Verification	Acceptance criteria
A	Check of sensor and input channel accuracy	The sensor shall have applied process values corresponding to 0 %, 25 %, 50 %, 75 % and 100 % [a], while it is connected to the logic unit. The test may be performed on a test bench. The values in the logic unit shall be monitored.	The readings in the logic unit shall correspond to the process values applied within the tolerance range defined for the measurement.
B	Check of trip limit and hysteresis	The setting of the limit and the hysteresis for each channel shall be verified by applying values just below and just above the limit, taking the hysteresis into account and check that the channel responds as intended. This test shall be carried out in connection with test A. The definition of the hysteresis shall be verified. The hysteresis shall be defined in such a way, that the channel is reset when the process value is back in the safe range.	The channel shall respond at the process value defined by the manufacturer. The channel shall not be reset before the process value is in the safe range.
C	Check of linearization of indirect measurement	For measurements that need linearization, it shall be checked that the linearization is done according to the specification. This shall as a minimum to be performed at 0 %, 25 %, 50 %, 75 % and 100 % [a]. This test shall be performed in connection with test A.	The reading after the linearization in the logic unit shall correspond to the expected linearization within the tolerance range.

Table D.1 *(2 of 2)*

D	Check of the correction factor in case of indirect measurements.	For measurement that needs to be corrected according to the actual operating conditions (temperature and/or pressure) it shall be checked that the correction algorithm is according to the specification. This can be carried out by applying different process values to the correction measurements. This can be performed by simulation.	The result of the correction shall be according to the specification and within the tolerance limits.
E	Check response for fault in correction measurements in case of indirect measurements	It shall be tested that the channel is brought to a safe state if the measurements used for the correction has a channel fault. If it is possible to use a safe replacement value, an alarm shall be initiated, else the channel shall respond. This test can be performed by simulation.	The channel shall respond as described.
F	Check response for channel fault	It shall be verified that a channel fault causes the channel to initiate a trip signal. This can be carried out by disconnecting the sensor and observe the result.	The channel shall trip.
G	Check of the voting logic	It shall be tested that the voting logic is functioning properly. The test can be performed by simulation of the individual channels.	The voting logic is performing as described.
H	Check of deviation monitoring for allowable deviation and allowable deviation time	It shall be tested that the deviation monitoring for the individual channels are functioning properly. This test shall be performed for each channel. The following shall be tested: 1oo2 and 1oo3: If the deviation of the output value between the channels exceeds the specified limits for a time longer than allowed, the voting logic shall trip. 2oo3 and 2oo4: If the deviation of one channel output value from the other channels exceeds the specified limits for a time longer than allowed, an alarm shall be activated. The test can be performed by simulation of the individual channels.	The voting logic is performing as described.

[a] In case the measurement has a logarithmic or exponential scale, the process values corresponding to 20 %, 40 %, 60 % and 80 % shall be applied.

Annex E
(normative)

Access to internal parts

E.1 Access openings

E.1.1 Types

E.1.1.1 All drums, headers and other large parts of boilers shall be provided with manholes, head-holes, hand-holes, or other inspection openings as appropriate, to permit internal examination and effective cleaning. It is permissible to provide openings to facilitate manufacture and maintenance. Sufficient space shall be provided to permit access to the steam and water spaces and the combustion chamber as well.

Access may be gained for these purposes by cutting and re-welding tubes or blind nozzles. Inspection openings may, where necessary, be closed by nozzles with welded caps.

For calculation pressures exceeding 1,8 N/mm^2, openings in pressure parts with mechanical closures shall be of the internal door type. For calculation pressures of 1,8 N/mm^2 and below, circular external or elliptical doors of the blanked flange type are permitted.

E.1.1.2 Water or steam containing components with an inside diameter of more than 1 200 mm and components with a diameter of more than 800 mm and a length of more than 2 000 mm shall be so designed as to permit internal inspection. Internals shall be of such a design as not to obstruct inspection of the component walls, or it shall be possible to remove them.

E.1.1.3 Headers and similar components shall be provided with adequate access for inspection of their inner surface as follows:

— for inside diameters in excess of 80 mm where mud deposits can accumulate;

— for inside diameters in excess of 150 mm for any other cases.

E.1.1.4 Inspection access shall be designed as head, hand or inspection holes where manual inspection methods are to be used or, as inspection nozzles where inspection devices are used e.g. endoscopes. Sufficient number of access points shall be provided to inspect the required areas with adequate external clearance.

E.1.2 Size

E.1.2.1 Sizes of openings in water and steam spaces shall be:

a) Manholes shall not be smaller than 320 mm $\times$ 420 mm or have an inside diameter of at least 420 mm. The nozzle or ring height shall not exceed 300 mm, and 350 mm in the case of a tapered design. For structural or design reasons, the openings of manholes may be reduced to 300 mm $\times$ 400 mm clear width or to 400 mm inside diameter. In such cases, the nozzle or ring height shall not exceed 150 mm, or 175 mm in the case of a tapered design.

b) Head-holes shall not be smaller than 220 mm $\times$ 320 mm or have an inside diameter of at least 320 mm. The nozzle or ring height shall not exceed 100 mm, or 120 mm in the case of a tapered design.

c) Hand-holes shall not be smaller than 100 mm $\times$ 150 mm or have an inside diameter of at least 120 mm. The nozzle or ring height shall not exceed 65 mm, or 95 mm in the case of a tapered design.

d) Inspection holes shall have a diameter of 50 mm. However, they shall be provided only where a hand-hole is not possible for design reasons.

e) Inspection nozzles shall have an inside diameter of approximately 50 mm. They may be arranged in axial and/or radial direction. Radial inspection nozzles may be omitted, if connecting tubes can be used in lieu of such nozzles.

E.1.2.2 The following shall apply with regard to the size of openings on boiler plant spaces which are to be inspected and contain neither water nor steam:

a) Access openings for inspection by personnel using auxiliary or personal protective equipment shall have an inside diameter of at least 600 mm. For design reasons the minimum size of access openings may be reduced to an inside diameter of 500 mm in which case the nozzle or ring height shall not exceed 250 mm;

b) Access openings for inspection without use of auxiliary or personal protective equipment shall have a clear width of at least 320 mm $\times$ 420 mm. For design reasons the minimum size of access openings may be reduced to a clear width of 300 mm $\times$ 400 mm in which case the nozzle or ring height shall not exceed 150 mm, and 175 mm in the case of a tapered design;

c) Inspection openings shall have a width of 100 mm $\times$ 150 mm or an inside diameter of 120 mm;

d) Inspection nozzles shall have an inside diameter of approximately 50 mm.

E.1.3 Internal doors

Internal doors shall be made from steel in accordance with EN 12952-2 and constructed in accordance with the following:

a) Doors shall be formed to fit closely to the internal joint surface and shall be fitted with studs, nuts and crossbars;

b) Doors for circular openings larger than 250 mm diameter or elliptical or rectangular openings larger than 250 mm × 175 mm shall be provided with two studs. Doors for openings of these sizes and below may be provided with one stud. Doors for openings not larger than 123 mm diameter or 123 mm × 90 mm may have the stud forged integrally with the door;

c) Door studs shall be made from a weldable steel grade and have a minimum tensile strength of not less than 355 N/mm^2. Studs used for manhole doors shall not be less than 30 mm diameter. The studs shall be fixed to the door by one of the following methods:

    1) screwed through the door and fillet welded on the inside;

    2) let through the door and fillet welded each side of the door with a weld of leg length not less than 10 mm;

    3) attached to the door by an intermediate plate or lugs with the strength of the attachment not being less than that of the stud and designed to prevent the studs from turning;

    4) provided with an integral collar, screwed into blind holes in the door and shall be prevented from turning.

d) When the door is in a central position the spigots should have an all-round clearance of approximately 1,5 mm, but at no point shall the clearance exceed 3 mm. The spigot depth shall be sufficient to trap the gasket;

e) Nuts shall comply with the appropriate European Standard and be faced on the seating surface;

f) Crossbars shall be made from steel in accordance with EN 12952-2 having a minimum specified tensile strength of not less than 355 N/mm^2. The seating surface shall be faced.

Eyebolts with suitable lugs on the door plate, or headed bolts engaging with slotted sections on the door plate, may be used instead of studs.

E.1.4 External doors

Circular external doors of the blank flange type shall be designed in accordance with the requirements of EN 12952-3:2011, 10.4. The design shall incorporate a spigot and recess of sufficient dimensions to completely trap the gasket.

E.1.5 Gaskets

Access and inspection doors of the type in which the internal pressure forces the door against a flat gasket shall have a minimum gasket bearing width of 15 mm for manholes and headholes. For handholes the gasket bearing width may be reduced to 10 mm. The total clearance between the doorframe and the spigot or recess of such doors shall not exceed 3 mm, i.e. 1,5 mm all round, and the spigot depth shall be sufficient to trap the gasket.

The selection of the gasket material combined with the design of such doors shall be adequate to provide an effective and safe sealing assembly.

Annex F
(normative)

Final inspection of the water tube boiler plant

F.1 Equipment on the steam and water side

To ensure safe operation the following equipment shall be checked:

a) Water level, pressure, temperature, water and steam flow measuring and indicating devices:

   — Attachment, arrangement and function with respect to the mode of operation.

b) Devices specifically for operation without manual intervention:

   — Arrangement and function with regard to operational requirements.

c) Limiting devices, e.g. water level, pressure, and temperature limiters:

   — Assessment of suitability and determination of the tripping points.

d) Test that the residual heat accumulated in the furnace and flue-gas passes after a normal shut-down or an emergency shut-down does not cause unacceptable metal or fluid temperatures in the steam boiler/hot water generator (see 4.2.3 and 6.1.6).

e) Feed pumps:

   — Performance and net pressure according to marking and data sheets; type of drive; in the case of an electric drive, readiness and possibility to change over to a second circuit, if required; operational readiness of stand-by pumps.

f) Circulating pumps:

   — Performance and net pressures according to marking or data sheets; type of drive; response of the warning system when the flow is less than the required minimum flow; in the case of an electric drive; readiness and possibility to change over to a second circuit if required.

g) Suitability of the safety devices against excess of pressure shall be demonstrated in accordance with EN 12952-10.

h) Pressure generation devices in the case of hot water plants with external pressure generation:

   — Determination of trip points and, if necessary, testing of change-over.

F.2 Firing system equipment

To ensure safe operation the firing system shall be checked that it is in compliance with EN 12952-8 and/or EN 12952-9 and/or EN 12952-16.

F.3 Protective systems

The protective systems shall be checked that they are in compliance with EN 50156-1.

F.4 Operating instructions

Operating instructions in accordance with EN 12952-18 shall be provided.

Annex G
(informative)

Drain and blowdown devices

G.1 General

This annex gives guidelines related to the design of the drain and blowdown devices.

G.2 Design of the drain and blowdown devices

G.2.1 Blowdown vessels should be designed to take into account the worst possible blowdown condition for the boiler(s) to which it is connected, particularly the maximum momentary surge pressure occurring during a blowdown. If this pressure can exceed 0,5 bar then the vessel should comply with the requirements of the Directive 97/23/EC (PED).

This necessitates detailed analysis for the discharge condition, vessel size and vent diameter. In the absence of such analysis, the design pressure of the blowdown vessel should be 25 % of the maximum allowable pressure of the boilers and the design temperature should be steam saturation temperature at the design pressure. This ensures that the thickness of the vessel incorporates some provision for corrosion and/or erosion in service.

G.2.2 The blowdown vessel should have sufficient strength to withstand the shock loading of intermittent blowdown and external loading from pipes and attachments.

G.2.3 The blowdown pipework should be designed to withstand the rapid pressurisation, high velocity, thermal shock and vibration associated with blowdown. The pipework should be suitably supported.

G.2.4 The size of the blowdown vessel and the quantity of standing water in the tank should be sufficient to ensure adequate cooling of the blowdown water (at the maximum blowdown rate and duration) before it enters the drain. The space above the standing water should be sufficient to allow for expansion of flash steam.

G.2.5 The inlet pipe can either discharge into the standing water or above the water line. In the latter case, areas of the shell which are exposed to water impingement from the inlet flow should be protected from erosion/corrosion.

G.2.6 The vent pipe should be designed so that:

— the accumulation pressure during blowdown does not exceed the vessel design pressure, in the absence of such analysis the diameter of the vent pipe should be 4 times the diameter of the inlet pipe;

— flash steam is vented safely and there is no carry-over of water at the exit of the vent pipe;

— it is as straight as possible with no valve or other obstruction to prevent free flow.

G.2.7 The drain pipe should:

— be designed so it is of sufficient size to prevent excessive accumulation of water during blowdown, in the absence of such analysis the outlet should have an internal diameter of at least 1,5 times the internal diameter of the inlet pipe;

— be connected so that the blowdown vessel remains approximately half full of water after each blowdown and flash steam is prevented from entering the drain.

G.2.8 The external surface of the blowdown vessel should normally be left without insulation to permit cooling of the standing water. The installation should therefore incorporate barriers or other means of protection to prevent accidental contact with the hot surfaces.

Annex H
(informative)

Significant technical changes between this European Standard and the previous edition

Clause/Paragraph/Table/Figure	Change
General	The revision of EN 12952-7:2002 was dedicated to fulfil the European Guidelines 8/15 and 9/20 related to the essential safety requirements of Annex I of the Directive 97/23/EC (PED) regarding boilers intended for operation without continuous supervision.
2 / Normative references	References updated.
4 / General requirements for steam boilers and hot water generators	Revision of the clause.
4.10 / Marking	New clause related to marking of the water tube boiler plant.
5 / Special requirements for steam boilers	Revision of the clause.
6 / Special requirements for hot water generators	Revision of the clause.
Annex B / Aspects of boiler operation	New annex introduced giving recommendations for operation and testing of the boiler system with a maximum time of operation without manual (human) intervention of 72 h.
Annex D / Requirements for limiters based on analogue measurements	New annex introduced specifying requirements for limiters based on analogue measurements.
Annex E / Access to internal parts	New annex introduced specifying requirements for access to internal parts.
Annex F / Final inspection of the water tube boiler plant	New annex introduced specifying requirements for the final inspection of the water tube boiler plant.
Annex ZA / Relationship between this European Standard and the Essential Requirements of EU Directive 97/23/EC	Revision of the annex.
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.	

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 97/23/EC

Clauses of this European Standard	Essential Safety Requirements (ESRs) of Directive 97/23/EC, Annex I	Content
5.2, 6.3	2.5	Means of draining and venting
4, 5.1, 5.4, 6.1, 6.2	2.10, 2.10(a), 2.10(b), 5(d)	Protection against exceeding the allowable limits - Safety accessories - Adequate monitoring devices
5.4 to 5.7, 6.5 to 6.9, Annex D	2.10, 5(a)	Protection to restrict operating parameters
4.8, 7.4	5(b), 5(c)	Properties of the fluids to avoid risks related to deposits and/or corrosion
8	3.2.3	Safety accessories

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

Bibliography

[1] Council Directive 97/23/EC of 29 May 1997 on the approximation of the laws of the Member States concerning pressure equipment (Pressure Equipment Directive "PED").

[2] EN 764-7:2002, Pressure equipment — Part 7: Safety systems for unfired pressure equipment

[3] EN 809:1998, Pumps and pump units for liquids — Common safety requirements

[4] EN 1151-1:2006, *Pumps — Rotodynamic pumps — Circulation pumps having a rated power input not exceeding 200 W for heating installations and domestic hot water installations — Part 1: Non-automatic circulation pumps, requirements, testing, marking*

[5] EN 12952-5:2011, *Water-tube boilers and auxiliary installations — Part 5:Workmanship and construction of pressure parts of the boiler*

[6] EN 12952-6:2011, *Water-tube boilers and auxiliary installations — Part 6: Inspection during construction; documentation and marking of pressure parts of the boiler*

[7] CEN CR 12952-17:2002, *Water-tube boilers and auxiliary installations — Part 17: Guideline for the involvement of organizations independent of the manufacturer*

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