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Interested committees:

Title: Draft BS EN 15502-1 Gas-fired heating boilers. Part 1: General requirements and tests.

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

English Version

Gas-fired heating boilers - Part 1: General requirements and tests

Chaudières de chauffage central utilisant les
combustibles gazeux - Partie 1: Exigences générales et
essais

Heizkessel für gasförmige Brennstoffe - Teil 1:
Allgemeine Anforderungen und Prüfungen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 109.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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European foreword

This document (prEN 15502-1:2019) has been prepared by Technical Committee CEN/TC 109 "Central heating boilers using gaseous fuels", the secretariat of which is held by NEN.

This document is currently submitted to the CEN Enquiry.

This document supersedes EN 15502-1:2012+A1:2015.

The main technical changes compared to EN 15502-1:2012+A1:2015 are the following:

- a) Technical changes related to ecodesign and energy labelling for appliances ≤ 400 kW:
 - 1) Deletion of the requirements that can be found in the legislation itself.
 - 2) Modification of the Annexes ZC and ZD
 - b) New or generally reworded requirements:
 - 1) Separation between requirements and test methods in to different clauses;
 - 2) Moving additional common parts from EN 15502-2-1:2012+A1:2016 and/or EN 15502-2-2:2014 to this standard (for example all definitions used in the parts 2 are moved to part 1);
 - 3) Definitions added for Instructions for installation, Instructions for use and Technical documentation and consequently applied throughout the document;
 - 4) Improved wording of definitions related to the air supply and combustion products circuit;
 - 5) Improved the references of the annexes Z. The annex Z referring to the GAD has been removed and an annex Z referring to the GAR has been inserted;
 - 6) Only "technical instructions" and "users instructions" are defined.
- Therefore these are the only instructions to be used in this standard;
- 7) Improved definitions 'ducts / circuits';
 - 8) Definition weighted value of the NO_x concentration added. With regard to Ecodesign, it is clarified that the emissions declared are the emissions when using the references gases.
- c) Limitation of the scope compared to the standards superseded by the EN 15502 series (that were cited in the OJEU under the GAD):
 - 1) Types B₁₄ and B₄ appliances, as covered in EN 297:1994 /A4:2004 are not covered by this standard as there seems to be a limited market for these appliances due to the introduction of the Ecodesign Directive that only has an exemption for B₁₁ appliances.

NOTE B₁₄ and B₄ are non condensing appliances;

- 2) This document does not cover all the requirements for appliances designed and constructed to burn gas containing toxic components. In the past it was always considered that the gases were not toxic, however this was never clearly indicated in the scope. In effect this is not a change of scope, but a clarification of the scope;

- 3) This document is not intended to cover appliances intended for connection to gas grids where the quality of the distributed gas is likely to vary to a large extent over the lifetime of the appliance (see Annex EE). In the past no big variation in gas quality occurred. Due to the EASEE-gas CBP wide variations of gas quality are considered. As these were never covered the scope now makes clear that these variations are not covered. In effect this is not a change of scope, but a clarification of the scope.
- 4) This document does not cover all the requirements for appliances above 1000 kW. In effect this is not a change of scope, but a clarification of the scope;

EN 15502 consists of the following parts under the general title "Gas-fired heating boilers":

- *Part 1: General requirements and tests (this standard);*
- *Part 2-1: Specific standard for type C appliances and type B2, B3 and B5 appliances of a nominal heat input not exceeding 1 000 kW;*
- *Part 2-2: Specific standard for type B1 appliances.*

This document is to be used in conjunction with the specific Part 2.

This document has been prepared under mandates M89/6 and M066, given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements as meant in article 3 of EU Directive 2009/142/EC, relating to appliances burning gaseous fuels and the verification methods valid for production and measurements, as meant in article 5.2 of EU Directive 92/42/EEC, relating to the efficiency requirements for new hot water boilers fired with liquid or gaseous fuels, with an output of 4 – 400 kW.

This document has been prepared under the mandates M/534 and M/535, given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to:

- requirements of Commission Regulation (EC) No 813/2013 of 2 August 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for space heaters and combination heaters;
- requirements of Commission Delegated Regulation (EC) No 811/2013 of 18 February 2013 supplementing Directive 2010/30/EC of the European Parliament and of the Council with regard to energy labelling of space heaters, combination heaters, packages of space heater, temperature control and solar device and packages of combination heater, temperature control and solar device.

For relationship with EU Directive(s) and Commission Regulations, see informative Annexes ZB, ZC and ZD, ZE which are integral parts of this document.

Introduction

The basic function of gas-fired heating boiler is to generate heat by direct heat transfer in a heat exchanger, from the combustion gasses to the water.

The boiler can include in one design more than one function. It can include for example:

- a sanitary hot water function;
- a function to supply the combustion air from the outside/open air;
- a function to dispose the combustion products to the outside/open air.

The boiler design can be supplied to the market in more than one part. If the boiler is supplied to the market in multiple parts, the boiler is the assembly of various parts according to the instructions for installation.

Boilers can be designed to be connected to specific parts of a building. Connection to a chimney and the means of combustion air supply is particularly relevant.

This European Standard is a first part of a series of standards that will describe the special requirements for specific boiler types. This European Standard contains the common requirements that are applicable for the majority of the specific boiler types.

Matters related to quality assurance systems, tests during production, and certificates of conformity of auxiliary devices are not dealt with in this series of European Standards.

1 Scope

This document specifies the common requirements and test methods, as well as the classification, marking and energy labelling of gas-fired central heating boilers that are fitted with atmospheric burners, fan assisted atmospheric burners or fully premixed burners, and are hereafter referred to as "boilers".

This document is to be used in conjunction with the specific Parts 2 (Part 2-1 and following ones).

This document applies to boilers of types B and C:

NOTE For further background information on appliance types see CEN/TR 1749:2014 [1].

- a) that use one or more combustible gases of the three gas families at the pressures stated in EN 437;
- b) where the temperature of the water does not exceed 105 °C during normal operation;
- c) where the maximum operating pressure in the water circuit does not exceed 6 bar;
- d) which can give rise to condensation under certain circumstances;
- e) which are declared in the instructions for installation to be either a "condensing" boiler or a "low temperature boiler" or a "standard boiler" or an "other boiler". If no declaration is given the boiler is to be considered both a "standard boiler" and an "other boiler";

NOTE The Ecodesign Directive defines "other boilers", "low temperature boilers" and "condensing boilers". The Boiler Efficiency Directive defines "standard boilers", "low temperature boilers" and "condensing boilers". Depending on the legislation applied, a boiler can be both "a standard boiler" and an "other boiler".

- f) which are intended to be installed inside a building or in a partially protected place;

- g) which are intended to produce also hot water either by the instantaneous or storage principle as a single unit.

This document applies to boilers designed for sealed water systems or for open water systems.

NOTE This general standard and the specific standards (see Part 2) provide requirements for boilers with known constructions. For boilers with any alternative constructions, which might not fully be covered by this standard or a specific standard, the risk associated with this alternative construction will need to be assessed.

An example of an assessment methodology, based upon risk assessment, is given in Clause 11.

This document is not intended to cover appliances intended for connection to gas grids where the quality of the distributed gas is likely to vary to a large extent over the lifetime of the appliance (see Annex EE).

This document does not cover all the requirements for :

- a) appliances above 1000 kW;
- b) appliances designed and constructed to burn gas containing carbon monoxide or other toxic components.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 88-1:2011+A1:2016, *Pressure regulators and associated safety devices for gas appliances - Part 1: Pressure regulators for inlet pressures up to and including 50 kPa*

EN 125:2010+A1:2015, *Flame supervision devices for gas burning appliances - Thermoelectric flame supervision devices*

EN 126:2012, *Multifunctional controls for gas burning appliances*

EN 161:2011+A3:2013, *Automatic shut-off valves for gas burners and gas appliances*

EN 298:2012, *Automatic burner control systems for burners and appliances burning gaseous or liquid fuels*

EN 437:2018, *Test gases - Test pressures - Appliance categories*

EN 1057:2006+A1:2010, *Copper and copper alloys - Seamless, round copper tubes for water and gas in sanitary and heating applications*

EN 1092-1:2018, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated – Part 1: Steel flanges*

EN 1092-2:1997, *Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN designated - Part 2: Cast iron flanges*

EN 1092-3:2003, *Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN designated - Part 3: Copper alloy flanges*

EN 1092-4:2002, *Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN designated - Part 4: Aluminium alloy flanges*

- EN 10029:2010, *Hot-rolled steel plates 3 mm thick or above - Tolerances on dimensions and shape*
- EN 10226-1:2004, *Pipe threads where pressure tight joints are made on the threads - Part 1: Taper external threads and parallel internal threads - Dimensions, tolerances and designation*
- EN 10226-2:2005, *Pipe threads where pressure tight joints are made on the threads - Part 2: Taper external threads and taper internal threads - Dimensions, tolerances and designation*
- EN 12067-2:2004, *Gas/air ratio controls for gas burners and gas burning appliances - Part 2: Electronic types*
- EN 13203-1:2015, *Gas-fired domestic appliances producing hot water — Appliances not exceeding 70 kW heat input and 300 l water storage capacity — Part 1: Assessment of performance of hot water deliveries*
- EN 13203-2:2018, *Gas-fired domestic appliances producing hot water — Part 2: Assessment of energy consumption*
- EN 13611:2019, *Safety and control devices for gas burners and gas burning appliances - General requirements*
- EN 14459:2015, *Control functions in electronic systems for gas burners and gas burning appliances - Methods for classification and assessment*
- EN 15036-1:2006, *Heating boilers — Test regulations for airborne noise emissions from heat generators - Part 1: Airborne noise emissions from heat generators*
- EN 50090 (all parts), *Home and Building Electronic Systems (HBES)*
- EN IEC 60335-1:2012, *Household and similar electrical appliances - Safety - Part 1: General requirements (IEC 60335-1:2010, modified)*
- EN IEC 60335-2-102:2016, *Household and similar electrical appliances — Safety — Part 2-102: Particular requirements for gas, oil and solid-fuel burning appliances having electrical connections (IEC 60335-2-102:2004,MOD; IEC 60335-2-102:2004/A1:2008,MOD; IEC 60335-2-102:2004/A2:2012, modified)*
- EN IEC 60529:1992, *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989+A1:2001+A2:2013/C2:2015,IDT)*
- EN IEC 60730-2-9:2019, *Automatic electrical controls for household and similar use — Part 2-9: Particular requirements for temperature sensing controls (IEC 60730-2-9:2015,IDT)*
- EN ISO 228-1:2003, *Pipe threads where pressure-tight joints are not made on the threads - Part 1: Dimensions, tolerances and designation (ISO 228-1:2000)*
- EN ISO 2553:2019, *Welding and allied processes — Symbolic representation on drawings — Welded, brazed and soldered joints (ISO 2553:2019,IDT)*
- EN ISO 3166-1:2014, *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes (ISO 3166-1:2013,IDT)*
- EN ISO 4063:2010, *Welding and allied processes — Nomenclature of processes and reference numbers (ISO 4063:2009, Corrected version 2010-03-01)*
- ISO 857-1:1998, *Welding and allied processes — Vocabulary — Part 1: Metal welding processes*

ISO 857-2:2005, *Welding and allied processes — Vocabulary — Part 2: Soldering and brazing processes and related terms*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 437:2018 and the following apply.

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

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1.1

gas supply

3.1.1.1

aeration adjuster

device enabling the primary aeration of a burner to be set to the desired value according to the supply conditions

3.1.1.2

gas circuit

assembly of parts of the boiler that carry or contain the combustible gas between the boiler gas inlet connection and the point at which air is admitted

3.1.1.3

gas inlet connection

part of the boiler intended to be connected to the gas supply

3.1.1.4

gas rate adjuster

component allowing the gas rate of the burner to be brought to a predetermined value according to the supply conditions

Note 1 to entry: The action of operating this device is called “adjustment of the gas rate”.

3.1.1.5

injector

component that admits gas into the burner

3.1.1.6

putting an adjuster or a control device out of service

action intended to put an adjuster or control (rate, pressure, etc.) out of service

3.1.1.7

range-rating device

component on the boiler intended to be set at installation to adjust the nominal heat input of the boiler within the range of maximum and minimum heat inputs stated in the instructions for installation, to suit the actual heat requirements of the installation

3.1.1.8 restrictor

device (with one or more orifices if any), which is placed in the gas circuit so as to create a pressure drop and thus bring the gas pressure at the burner to a predetermined value for a given supply pressure and a given rate

3.1.1.9 sealing an adjuster or a control

arrangements made to make evident any attempt to change its adjustment (e.g. breakage of a device or of a sealing material)

Note 1 to entry: A sealed adjuster or control is considered to be non-existent.

3.1.2 burners

3.1.2.1 alternating ignition burner

ignition burner that is extinguished as soon as ignition of the main burner is effected and re-igniting at the main burner flame just before the latter extinguishes

3.1.2.2 automatic ignition system

automatic system which ignites the ignition burner or the main burner directly

3.1.2.3 ignition burner

burner intended to ignite a main burner

3.1.2.4 ignition device

any means (flame, electrical ignition device or other device) used to ignite the gas admitted to the ignition burner or the main burner

3.1.2.5 intermittent ignition burner

ignition burner that is ignited before and extinguished at the same time as the main burner

3.1.2.6 interrupted ignition burner

ignition burner that operates only during the ignition period

3.1.2.7 main burner

burner that assures the thermal function of the boiler

Note to entry Generally called "the burner"

3.1.2.8 manual ignition device

device by means of which the ignition burner is ignited following manual intervention

3.1.2.9

pre-mixed burner

burner in which the gas and a quantity of air at least equal to that theoretically necessary for complete combustion are mixed before the flame ports

3.1.2.10

permanent ignition burner

ignition burner that operates continuously throughout the whole period that the boiler is in use

3.1.3

air supply and combustion products circuit

3.1.3.1

combustion circuit

circuit from the air inlet to the combustion products outlet

Note 1 to entry: This will include for example depending on the appliance type and construction, the air supply circuit, the gas/air mixture fan, the burner, the combustion chamber / heat exchanger and the combustion products circuit.

3.1.3.2

air supply circuit

circuit from the air inlet to the point where gas is admitted to the combustion air

Note 1 to entry: This will include for example depending on the appliance type and construction, the inlet terminal, the connection to the inlet terminal, the air supply duct, the air supply fitting piece, the air supply fan and the damper.

3.1.3.3

combustion products evacuation duct

channel or tube for conveying the products of combustion

3.1.3.4

air supply duct

channel or tube for conveying combustion air

3.1.3.5

damper

device placed in the air inlet duct or the combustion products outlet duct to control the volume flow

3.1.3.6

ducts support

accessory used to fix, or transfer the load of, air supply and combustion products evacuation ducts to structural elements (building, etc.)

3.1.3.7

overheat combustion products temperature

maximum temperature of the combustion products in case of overheat, at the exit of the boiler where it is intended to be connected to a duct, flue or chimney

3.1.3.8**nominal working combustion products temperature**

maximum temperature of the combustion products in case of normal functioning, at the exit of the boiler where it is intended to be connected to a duct, flue or chimney

Note 1 to entry: Normal functioning is considered to reflect the situation of running the boiler at inlet/outlet temperatures of 70/90 °C, or just at the point that the control thermostat is switching.

3.1.3.9**condensing operation mode of flue system**

operation mode where, under normal operation conditions, condensate is produced in the combustion products circuit

3.1.3.10**terminal**

part of the combustion circuit fitted external to the building which has the function of the air supply inlet and/or combustion products outlet of the appliance

3.1.3.11**fitting piece**

device which allows connection to ducts

Note to entry Some examples of connections are:

- a) the air supply and combustion products evacuation ducts to a single common duct for type C2 boilers;
- b) the air supply and combustion products evacuation ducts to two ducts of a common duct system for type C4, C10 boilers and for type C11 boiler modules;"
- c) type C6 boilers to a system for air supply and combustion products evacuation that is approved and marketed independently from the boiler;
- d) the combustion products evacuation duct to a chimney that is part of the building for type C8 boilers;
- e) the air supply duct to a chimney that is part of the building for type C9 boilers;
- f) type B2 boilers to a system for combustion products evacuation that is approved and marketed independently from the boiler;
- g) the combustion products evacuation duct to a shared duct system for type B3 boilers

3.1.3.12**terminal guard**

device that protects the terminal from mechanical damage from outside influences

3.1.3.13**secondary flue**

part of the flue of a type C₇ boiler between the draught diverter/air inlet in the roof space loft and the combustion products outlet above the roof

3.1.3.14

roof space loft

ventilated part of a building between the uppermost inhabitable space of the building and the roof

3.1.3.15

modular boiler

boiler consisting of an assembly of two or more generally identical modules, each of which consists of a heat exchanger, burner, control and safety devices

Note 1 to entry: The assembly has a single flue outlet and a common gas connection, common electricity supply connection and common flow and return water temperature connections. Each module is capable of independent operation.

3.1.3.16

combustion chamber

enclosure inside which combustion of the air-gas mixture takes place

3.1.3.17

completely surrounded combustion circuit

combustion circuit where the air supply circuit completely surrounds the combustion gas carrying part of the combustion circuit

3.1.3.18

separate combustion and air supply circuits

combustion circuit where the air supply circuit does not completely surround the combustion gas carrying part of the combustion circuit

3.1.3.19

flue outlet

part of the boiler through which the combustion products are evacuated to the flue system

3.1.3.20

combustion products circuit

circuit from the combustion chamber to the combustion products outlet of the appliance

3.1.3.21

protected combustion chamber

combustion chamber which is constructed such that an ignition in the combustion chamber does not ignite an gas/air mixture outside the combustion chamber

3.1.3.22

common duct

duct to which multiple boilers or boiler modules are connected

3.1.3.23

draught diverter

device, placed in the combustion products circuit of a boiler, that is intended to maintain the quality of combustion within certain limits and to keep the combustion stable under certain conditions of updraught and downdraught

3.1.4 adjusting, control and safety devices

3.1.4.1 adjustable control thermostat

control thermostat that permits the user to obtain setting temperatures between a minimum and a maximum value

3.1.4.2 adjustable pressure regulator

pressure regulator fitted with a means of adjusting the downstream pressure

Note 1 to entry: This means is considered as an “adjusting device”.

3.1.4.3 automatic burner control system

system that comprises a programming unit and all the elements of a flame detector

Note 1 to entry: All the functions of an automatic burner control system may be assembled in one or more housings.

3.1.4.4 automatic valve

device that automatically opens, closes or varies a rate on a signal from the control circuit and/or the safety circuit

3.1.4.5 closure member

movable part of the valve or the thermoelectric device that opens, varies or shuts off the gas way

3.1.4.6 control knob

component intended to be moved by hand in order to act on a boiler control (tap, thermostat, etc.)

3.1.4.7 control thermostat

device enabling the water temperature to be kept automatically within a given range at a predetermined value

Note 1 to entry: This definition is dedicated to this standard and its scope, but correlates in principle with the definition of EN 60730-1:2011, 2.2.6, which reads "cycling temperature sensing control, which is intended to keep a temperature between two particular values under normal operating conditions and which may have provision for setting by the user".

3.1.4.8 diaphragm

flexible component that operates the valve by means of a force resulting from a pressure difference

3.1.4.9 external soundness

soundness, with respect to the atmosphere, of an enclosure containing gas

3.1.4.10

fault tolerating time

time between the occurrence of a fault and the shut-down of the burner which is tolerated by the application without creating a hazardous situation

3.1.4.11

flame detector

device which detects and signals the presence of a flame. It may consist of a flame sensor, an amplifier and a relay for signal transmission

Note 1 to entry: These parts, with the possible exception of the actual flame sensor, may be assembled in a single housing for use in conjunction with a programming unit.

3.1.4.12

flame signal

signal given by the flame detector, normally when its sensor reacts to a flame

3.1.4.13

flame supervision device

device that, in response to a signal from the flame detector, keeps the gas supply open and shuts it off in the absence of the supervised flame

3.1.4.14

frost protection system

system that actively protects the water in the boiler against freezing

Note 1 to entry: An anti-freeze solution is not considered as an active frost protection system.

3.1.4.15

gas/air ratio control

device that automatically adapts the combustion air rate to the gas rate or vice versa

3.1.4.16

ignition interlock

part which prevents the operation of the igniter as long as the main gasway is open

3.1.4.17

internal soundness

soundness of a closure member in the closed position and isolating an enclosure containing gas from another enclosure or from the outlet of the valve

3.1.4.18

maximum allowable working temperature

temperature the material can withstand over a long period of time under working conditions

3.1.4.19

maximum water service pressure

maximum pressure declared to be permitted in the domestic water circuit of combinations boilers

3.1.4.20

multi-functional control

device having at least two functions, one of which is a shut-off function, integrated in one housing, whereby the functional elements cannot operate if separated

3.1.4.21**nominal voltage**

voltage or range of voltages at which the boiler is declared to operate normally

3.1.4.22**overheat cut-out device**

device that causes safety shutdown and non-volatile lockout at a preset value before the boiler is damaged and/or before safety is put in question

Note 1 to entry: This definition is dedicated to this standard and its scope, but correlates in principle with the definition of EN 60730-1:2011, 2.2.8, which reads "temperature sensing control intended to keep a temperature below or above one particular value during abnormal operating conditions and which has no provision for setting by the user".

3.1.4.23**pressure regulator**

device which maintains the downstream pressure constant to within fixed limits independent of variations, within a given range, of the upstream pressure and the gas rate

3.1.4.24**proportional control of the domestic hot water operation**

means of control in which the gas rate is subordinated proportionally to the domestic hot water rate

Note to entry the proportioning factor can be adjustable

3.1.4.25**recycling**

automatic process by which, after loss of flame during operation, the gas supply is interrupted and the full start procedure is re-initiated automatically

3.1.4.26**remote control function**

function providing automatic and normal operation by means of a control intended to be actuated with or without line of sight of the boiler

Note to entry Some examples of embodiments of remote control functions are:

- a) communication lines/protocols;
- b) additional hardware and/or software;
- c) ultra-sonic;
- d) infra red (IR) / radio frequency (RF) transmission;
- e) all kind of combinations of a) to c) via Internet using e.g. modems, portable telephones

3.1.4.27**remote control**

device that performs the remote control function, by wires or wireless, with or without line of sight of the boiler

3.1.4.28

remote reset

device that performs a specific remote control function, being reset from lock-out to allow a restart attempt

3.1.4.29

re-start interlock

mechanism which prevents the re-opening of the gasway to the main burner or to the main burner and the pilot burner until the armature plate has separated from the magnetic element

Note 1 to entry: This has to do with the dropout time of a thermocouple.

3.1.4.30

tank

reservoir of combination boilers for domestic hot water

3.1.4.31

temperature holding thermostat

device which maintains the water in the tank or the thermal store at a given temperature

3.1.4.32

temperature limiter

device that shuts off the gas supply when a limit value of the temperature is reached, and automatically reopens the gas supply when the temperature returns below the fixed limit

Note 1 to entry: This definition is dedicated to this standard and its scope, but correlates in principle with the definition of EN 60730-1:2011, 2.2.7, which reads "temperature sensing control which is intended to keep a temperature below or above one particular value during normal operating conditions and which may have provision for setting by the user".

3.1.4.33

temperature relief valve of the domestic hot water circuit

valve that opens automatically at a given temperature to discharge the domestic hot water

3.1.4.34

temperature sensing element

component that detects the temperature of the environment to be supervised or controlled

3.1.4.35

thermal store

heat reservoir sited mainly in heating water, as opposed to the domestic hot water storage in the tank

3.1.4.36

thermostatic control of the domestic hot water operation

means of control in which the gas rate is subordinated to a thermostatic device controlling the domestic hot water temperature, the set point of the device may be adjustable

3.1.4.37

combustion products discharge safety device

device that at least causes safety shutdown of the main burner when there is an unacceptable spillage of combustion products at the draught diverter

3.1.5**operation of the boiler****3.1.5.1****ignition rate**

average heat input during the ignition safety time

Symbol: Q_{ign}

Unit: kilowatt (kW)

3.1.5.2**lock-out**

complete interruption of the gas supply with lock-out

3.1.5.3**non-volatile lockout**

shutdown condition such that a restart can only be accomplished by a manual reset

3.1.5.4**safety shutdown**

process which is effected immediately following the response of a protection device or the detection of a fault and puts the burner out of operation; the resulting state of the system is defined by deactivated terminals for the shut-off valves and the ignition device

Note to entry Source EN 298:2012, 3.17

3.1.5.5**spark restoration**

automatic process by which, following flame failure, the ignition device is switched on again without total interruption of the gas supply

3.1.5.6**summer operating mode**

operating mode in which the combination boiler only provides heating of the domestic water

3.1.5.7**useful efficiency**

ratio of the useful output to the heat input, expressed as a percentage

Symbol: η_u

Unit: percent (%)

3.1.5.8**volatile lockout**

shutdown condition such that a restart can also be accomplished by restoration of the electrical supply after its loss

3.1.6**outputs****3.1.6.1****nominal output**

declared useful output in kW, corresponding to the operation of the boiler in a nominal (like 80 °C/60 °C) water temperature regime

3.1.6.2

nominal condensing output

declared useful output in kW, corresponding to the operation of the boiler in a condensing (like 50 °C/30 °C) water temperature regime

3.1.6.3

useful output

heat output transmitted to the heat carrier in kW

3.1.7

combustion

3.1.7.1

complete combustion

combustion with no more than traces of combustible constituents (hydrogen, hydrocarbons, carbon monoxide, carbon etc.) in the combustion products

3.1.7.2

condensate

liquid formed from the combustion products during the condensation process

3.1.7.3

flame stability

characteristics of flames that remain on the burner ports or in the flame retention zone

3.1.7.4

flame lift

phenomenon characterised by the total or partial lifting of the base of the flame away from the burner port or the flame retention zone

3.1.7.5

incomplete combustion

combustion at which at least one combustible constituent is present in significant proportions in the combustion products

3.1.7.6

light-back

phenomenon characterised by the entry of a flame into the body of the burner

3.1.7.7

sooting

phenomenon appearing during incomplete combustion and characterised by deposits of soot on the surfaces or parts in contact with the combustion products or with the flame

3.1.7.8

yellow tipping

phenomenon characterised by the yellowing of the tip of the blue cone of an aerated flame

3.1.8

times

3.1.8.1

extinction delay time (T_{IE})

time that elapses between disappearance of the supervised flame and interruption of the gas supply for a thermoelectric flame supervision device

3.1.8.2**extinction safety time (T_{SE})**

time that elapses between extinction of the supervised flame and the order to shut off of the gas supply to the burner

3.1.8.3**ignition opening time (T_{IA})**

time that elapses between ignition of the supervised flame and the moment when the closure element is held open by the flame signal for a thermoelectric flame supervision device

3.1.8.4**ignition safety time (T_{SA})**

time that elapses between the order to open and the order to close the gas supply to the burner in the event of ignition not taking place

3.1.8.5**purge**

mechanical introduction of air into the combustion circuit in order to displace any gas/air mixture which could remain there;

Note to entry a distinction is made between:

- a) pre-purge: the purge that takes place between the start-up command and the ignition device being energised;
- b) post-purge: the purge that takes place following burner shutdown

3.1.9**auxiliary energy****3.1.9.1****electric auxiliary energy**

electric energy consumed by the system components such as pump, fan, valves, heating elements and control unit that enables the heat generator's designed operation

3.1.9.2**rated power input**

power input assigned to the appliance as declared in the instructions for installation, see EN 60335

3.1.9.3**rated voltage**

voltage assigned to the appliance as declared in the instructions for installation, see EN 60335-1

3.1.9.4**stand-by**

operating mode without heat demand. The system immediately starts up in the required mode however, when there is a heat demand

3.1.10**design types of boilers****3.1.10.1****combination boiler**

boiler designed both for central heating and for the production of domestic hot water

Note 1 to entry: Depending on its type of domestic hot water production, the combination boiler is declared in the technical documentation as instantaneous type or storage type.

3.1.10.2

condensing boiler

boiler in which, under normal operating conditions and at certain operating water temperatures, the water vapour in the combustion products is partially condensed, in order to make use of the latent heat of this water vapour for heating purposes

3.1.10.3

low temperature boiler

boiler which can work continuously with a water supply temperature of 35 °C to 40 °C, producing condensation in certain circumstances

3.1.10.4

appliance

device burning gaseous fuels used for cooking, refrigeration, air-conditioning, space heating, hot water production, lighting or washing, which includes forced draught burners and heating bodies to be equipped with such burners

Note to entry This is a copy with minor modifications of the definition of appliance given in article 2 of the GAR (REGULATION (EU) 2016/426)

3.1.10.5

boiler

appliance using gaseous fuel designed to heat water with the purpose of providing heat to a building (or portion of a building) from one point to multiple rooms using heat emitters such as radiators and convectors to transmit the heat from the water to the room

NOTE 1 to entry The boiler design can be supplied to the market in more than one part. If the boiler is supplied to the market in multiple parts, the boiler is the assembly of various parts according to the instructions for installation.

NOTE 2 to entry The legal entity (i.e. installer) mounting the different parts of the appliance together according to the instructions for installation is not responsible as "Manufacturer"

3.1.10.6

boiler category

Appliance category of the boiler

3.1.10.7

appliance type

classification of appliances based on the method of evacuating the products of combustion and the method of supplying the combustion air.

Note to entry: For further background information on appliance types see CEN/TR 1749:2014 [1].

3.1.10.8

Boiler type

appliance type of the boiler

3.1.10.9**type C₍₁₀₎ boiler**

type C appliance connected via its two ducts to a common duct system¹⁾ which is designed for more than one appliance and which consists of two ducts connected to a terminal, which at the same time admits fresh air to the burner and discharges the products of combustion to the outside through orifices that are either concentric or close enough to come under similar wind conditions

Note 1 to entry: The C₍₁₀₎ appliance is designed to become connected to a common duct system that is designed to operate under the conditions where the static pressure in the common flue duct might exceed the static pressure in the common air duct.

3.1.10.10**type C₍₁₁₎ boiler**

assembly of two or more generally identical boiler modules, connecting ducts, a common flue duct, a common air duct, where the static pressure in the flue ducts might exceed the static pressure in the air ducts and where the orifices of air duct and the flue duct to the outside are either concentric, or close enough to come under similar wind conditions

Note 1 to entry: A C₍₁₁₎ boiler is designed to be assembled by connecting its boiler modules via its connecting ducts to its common ducts. These common ducts consist of two ducts connected to their terminals, which at the same time admit fresh air to the burner of each boiler module, and discharges the products of combustion of each boiler module to the outside through orifices that are either concentric or close enough to come under similar wind conditions. The assembly has a single air inlet and a single flue outlet.

Note 2 to entry: The C₍₁₁₎ boiler is designed as a single appliance. The technical instructions specify how the various parts need to be assembled. The C₍₁₁₎ boiler is evaluated and certified under the GAD (in analogy with the types C₁, C₃, C₅).

Note 3 to entry: Each C₍₁₁₎ boiler module consists of a heat exchanger, burner, control and safety devices. Each C₍₁₁₎ boiler module has an independent gas connection, electricity supply connection and flow and return water connections. Each module is capable of independent operation.

Note 4 to entry: This definition is a modification of the definition of C₍₁₁₎ given in CEN/TR 1749:2014.

3.1.10.11**range rated boiler**

boiler whose nominal heat input can be adapted within a declared range by setting (or by adjusting) the range-rating device of the boiler

3.1.10.12**standard boiler**

boiler that is neither a condensing boiler nor a low temperature boiler.

Note to entry The word standard boiler is used in relation to the Boiler Efficiency Directive (BED) 92/42/EEC

3.1.10.13**on/off boiler**

boiler that can operate only on a single rate, that is at nominal heat input, Q_n

1) This common duct system is part of the building and not a part of the appliance.

3.1.11 installation

3.1.11.1 boilers intended to be installed in a partially protected place

boilers intended to be installed in the open air, not exposed to the direct action and infiltration of rain, snow or hail

Note 1 to entry: If the instructions for installation instruct to mount a specific casing to provide protection in case the boiler is to be installed in a partially protected place, this casing is an integral part of the boiler.

3.1.11.2 minimum declared installation temperature for boilers in partially protected places minimum ambient temperature as declared in the in the instructions for installation, at which the boiler is designed to operate and at which all materials and devices shall operate properly and safely

3.1.12 operation of the boiler

3.1.12.1 heat input (Q)

quantity of energy used in unit time corresponding to the volumetric or mass flow rates, the calorific value used being either the net or gross calorific value

Symbol: Q

Unit: kilowatt (kW)

3.1.12.2 nominal heat input (Q_n) value of the heat input declared in the instructions for installation

Symbol: Q_n

Unit: kilowatt (kW)

3.1.12.3 nominal domestic hot water heat input (Q_{nw}) value of the heat input in the domestic hot water mode declared in the instructions for installation

Symbol: Q_{nw}

Unit: kilowatt (kW)

3.1.12.4 permanent ignition burner heat input The heat input of the permanent ignition burner expressed in NCV Symbol: Q_3

Unit: kilowatt (kW)

3.1.12.5**tapping rate**

volume flow of hot water per unit of time

Note to entry: the tapping rate is expressed in [l/min]

3.1.12.6**nominal heat input for central heating**

value of the heat input for the central heating function as declared in the technical instructions

Symbol: Q_{nh}

Unit: kilowatt (kW)

3.1.12.7**maximum nominal heat input**

highest value of the maximum nominal heat input for central heating (Q_{nh}) and the nominal domestic hot water heat input (Q_{nw})

Symbol: $Q_{n,max}$

Unit: kilowatt (kW)

3.1.12.8**minimum adjustable heat input**

minimum value to which the nominal heat input can be adjusted according to the technical instructions for boilers or boiler modules fitted with a range-rating device

Symbol: $Q_{min,a}$

Unit: kilowatt (kW)

3.1.12.9**minimum controlled heat input**

minimum value of the heat input which is allowed by the control system for modulating boilers or boiler modules

Symbol: $Q_{min,c}$

Unit: kilowatt (kW)

3.1.12.10**minimum heat input allowed by the controls**

lowest value of the minimum adjustable heat input $Q_{min,a}$ and the minimum controlled heat input $Q_{min,c}$

Symbol: Q_{min}

Unit: kilowatt (kW)

3.1.12.11

maximum safety pressure difference at maximum heat input

maximum pressure difference between combustion products outlet and air inlet for safety aspects, when all boilers or boiler modules (n) are running at maximum nominal heat input ($Q_{n,max}$), at a flue gas temperature of 25 °C

Symbol: $\Delta p_{max, saf(max)}$

Unit: Pascal (Pa)

3.1.12.12

maximum safety pressure difference at minimum heat input

maximum pressure difference between combustion products outlet and air inlet for safety aspects, when all boilers or boiler modules except one (n-1) are running at maximum nominal heat input ($Q_{n,max}$) and 1 appliance at the minimum heat input allowed by the controls (Q_{min}), at a flue gas temperature of 25 °C

Symbol: $\Delta p_{max, saf(min)}$

Unit: Pascal (Pa)

3.1.12.13

maximum safety pressure difference at start

maximum pressure difference between combustion products outlet and air inlet for safety aspects, when all boilers or boiler modules except one (n-1) are running at maximum nominal heat input ($Q_{n,max}$) and 1 appliance off, at a flue gas temperature of 25 °C

Symbol: $\Delta p_{max, saf(start)}$

Unit: Pascal (Pa)

3.1.12.14

maximum functional pressure difference at maximum heat input

maximum pressure difference between combustion products outlet and air inlet for functional aspects, when all boilers or boiler modules (n) are running at a mix of inputs created by heating function (Q_{nh}) and hot water function (Q_{nw}), at a flue gas temperature of 25 °C

Symbol: $\Delta p_{max, func(max)}$

Unit: Pascal (Pa)

3.1.12.15

minimum safety pressure difference

minimum (most negative) pressure difference between combustion products outlet and air inlet for safety aspects, at maximum flue gas temperature under most severe wind conditions

Symbol: $\Delta p_{min, saf}$

Unit: Pascal (Pa)

3.1.12.16

number of boilers or boiler modules connected to the common flue duct

total number of boilers or boiler modules connected to the common flue duct

Symbol: n

Unit: [-]

3.1.12.17**minimum adjustable heat input** $Q_{min,a}$

minimum value to which the nominal heat input can be adjusted according to the technical instructions for boilers fitted with a range-rating device

Note 1 to entry: Unit: kilowatt (kW).

3.1.12.18**minimum controlled heat input** $Q_{min,c}$

minimum value of the heat input which is allowed by the control system for modulating boilers

Note 1 to entry: Unit: kilowatt (kW).

3.1.12.19**minimum heat input allowed by the controls** Q_{min}

lowest value of the minimum adjustable heat input $Q_{min,a}$ and the minimum controlled heat input $Q_{min,c}$

Note 1 to entry: Unit: kilowatt (kW).

3.1.13**relevant eco-design and labelling regulations terms****3.1.13.1****electric auxiliary energy for eco-design and labelling regulations**

electric energy consumed by the system components such as fan, valves, heating elements required for the heat generator's designed operation, but no circulation pump

3.1.13.2**seasonal space heating energy efficiency**

ratio between the space heating demand for a designated heating season, supplied by the boiler and the annual energy consumption based on GCV required to meet this demand

Symbol: η_s

Unit: percent (%)

3.1.13.3**water heating energy efficiency**

ratio between the useful energy in drinking or sanitary water provided by a combination boiler and the energy required for its generation based on gross calorific value (GCV)

Symbol: η_{WH}

Unit: percent (%)

3.1.13.4**sound power level**

A-weighted sound power level, indoors

Symbol: LWA

Unit: dB(A)

3.1.13.5

package

package of boilers or combination boilers, temperature control and solar devices means a package offered to the end-user containing one or more boilers or combination boilers combined with one or more temperature controls and/or one or more solar devices

Note 1 to entry: Definition based on Labelling Regulation 811/2013 Article 2 - (19) and (20).

3.1.13.6

maximum load profile

load profile for combination water boilers with the greatest reference energy that a combination boiler is able to provide while fulfilling the temperature and flow rate conditions of that load profile

3.1.13.7

weighted value of the NO_x concentration

weighted value of the NO and NO₂ concentration determined on measurements at different loads according to table 5 in clause 8.13, measured at reference conditions using a reference gas

Note to entry The actual NO_x concentration depends on the ambient conditions and the actual gas used during operation, and can deviate from the weighted value.

3.1.13.8

ignition burner power consumption

power consumption of the permanent ignition burner expressed in GCV

Symbol: P_{ign}

Unit: kW

3.1.13.9

rated heat output

declared useful output in kW, corresponding to the operation of the boiler in a nominal (80 °C/60 °C) water temperature regime

Symbol: P_{rated}

Unit: kW

Note to entry: rated heat output is used for ErP and Energy Labelling and is identical to 3.1.6.1

3.1.14

Types of instructions and documentation

3.1.14.1

instructions for installation

instructions that accompany the appliance for installation, intended to be used during the installation procedure

3.1.14.2

instructions for use

instructions that accompany the appliance for use and servicing, intended to be used during use and service

3.1.14.3

technical documentation

(design) documentation containing the information that is needed for assessing the appliance's or fitting's conformity with the applicable requirements

Note to entry: This documentation is not needed for installation, use or service of the appliance and contains data to establish compliance with both technical and legal criteria.

3.2 Symbols

Table 1 — Main symbols and abbreviations used

Definition	Symbol/abbreviation
Net calorific value [MJ/kg]	NCV
Gross calorific value [MJ/kg]	GCV
Net calorific value per cubic meter [MJ/m ³]	H_i
Gross calorific value per cubic meter [MJ/m ³]	H_s
Relative density of test gas [-]	d
Relative density of reference gas [-]	d_r
Net Wobbe index [MJ/m ³]	W_i
Gross Wobbe index [MJ/m ³]	W_s
Normal test pressure [mbar]	P_n
Minimum test pressure [mbar]	P_{min}
Maximum test pressure [mbar]	P_{max}
Gas pressure at the meter [mbar]	P_g
Atmospheric pressure (absolute) [mbar]	$mbar$
Volume gas rate under test conditions [m ³ /h]	V
Volume gas rate under reference conditions [m ³ /h]	V_r
Volume gas rate, nominal [m ³ /h]	V_n
Mass rate [kg/h]	M
Nominal mass rate [kg/h]	M_n
Heat input [kW]	Q
Nominal heat input [kW]	Q_n
Heat input at the arithmetic mean of the maximum and minimum nominal heat input [kW]	Q_a

Definition	Symbol/abbreviation
Corrected heat input [kW]	Q_c
Heat input of the permanent ignition burner [kW]	Q_3
Nominal domestic hot water heat input [kW]	Q_{nw}
Useful output [kW]	P
Nominal output [kW]	P_n
Useful output at the arithmetic mean of the maximum and minimum nominal useful output [kW]	P_a
Condensing output [kW]	P_{nc}
rated heat output [kW]	P_{rated}
Useful efficiency [-]	η_u
Seasonal space heating energy efficiency based on Gross calorific value (GCV)	η_s
Water heating energy efficiency based on Gross calorific value	η_{WH}
Weighted value of the NO _x concentration in milligrams per kilowatt-hour [mg/kWh] based on Gross calorific value	$NO_{x,pond Hs}$
Weighted value of the NO _x concentration in milligrams per kilowatt-hour [mg/kWh] based on Nett calorific value	$NO_{x,pond}$
The useful efficiency at 30 % of the nominal heat input based on Gross calorific value [-]	η_1
The useful efficiency at nominal heat input based on Gross calorific value [-]	η_4
The useful efficiency at 30 % of the nominal heat input based on Nett calorific value [-]	η_{30}
The useful efficiency at nominal heat input based on Nett calorific value [-]	η_{100}
Auxiliary electricity consumption at nominal heat input [kW]	$e_{l,max}$
Auxiliary electricity consumption at 30 % of the nominal heat input [kW]	$e_{l,min}$
Auxiliary electricity consumption at stand-by [kW]	P_{SB}
Ignition burner power consumption based on Gross calorific value [kW]	P_{ign}
Maximum waterside operating pressure (heating water) [bar]	PMS
Maximum water service pressure (sanitary water) [bar]	PMW

Definition	Symbol/abbreviation
Ignition opening time [s]	T_{IA}
Ignition safety time [s]	T_{SA}
Extinction delay time [s]	T_{IE}
Extinction safety time[s]	T_{SE}
Gas temperature [°C]	t_g

4 Classification

4.1 Gases and categories

Gases are classified into families, groups and ranges in accordance with EN 437.

Boilers are classified into categories in accordance with EN 437.

4.2 Mode of air supply and evacuation of the combustion products

The types of boilers are classified according to the mode of air supply and evacuation of the combustion products (see 12.1.1.i).

NOTE Classification of gas appliances according to the method of supplying combustion air and of evacuation of the combustion products are described in prEN 1749:2018

4.3 Maximum water-side operating pressure

Boilers are classified according to their maximum water-side operating pressure (PMS) as:

- a) pressure class 1: PMS = 1 bar;
- b) pressure class 2: PMS = 3 bar;
- c) pressure class 3: 3 bar < PMS ≤ 6 bar.

5 Construction

5.1 General

Except where otherwise stated, the constructional requirements are verified by inspection of the boiler and tank where incorporated and its technical documents.

For boilers intended to be installed in a partially protected place, all materials employed in the construction, including seals, gaskets and sealing pastes, if any, shall function properly in the environmental conditions under which they are expected to operate. The minimum and maximum ambient temperatures at which the boiler is designed to operate (see 12.4.1) shall be declared in the instructions for installation.

Where the word boiler is used, it shall be read as the boiler including its connecting ducts, ducts and terminals, if any.

5.2 Conversion to different gases

The following operations are allowed in order to convert from a gas of one family or group to a gas of another family or group:

- a) adjustment of the gas rate of the main burner and ignition burner;
- b) change of injectors or restrictor;
- c) change of the ignition burner or its components;
- d) change of the gas rate modulation system;
- e) putting out of service and sealing a gas rate adjuster and/or a regulator;
- f) changes of configuration parameters by data exchange (for requirement see EN 14459).

For each of the operations mentioned above the appliance shall be tested with each of the gases. These operations shall be possible without having to interfere with the connections of the boiler to its pipe-work (gas, water, duct system).

5.3 Materials

5.3.1 General

5.3.1.1 General related to the use of materials in gas appliances

The quality and thickness of the materials used in the construction of the boilers, and the method of assembling the various parts, shall be such that the constructional and operational characteristics are not significantly altered during a reasonable life and under normal conditions of installation and use.

If there is a risk of condensation in the combustion products circuit it shall comprise materials which comply with the requirements of 5.4.13.1. Other materials may be used when evidence is provided of their suitability for conditions in which condensation can occur.

Materials downstream of the heat exchanger shall be corrosion-resistant or be effectively protected against corrosion.

Requirements for materials and characteristics used for combustion product evacuation ducts, fitting pieces and terminals are specified in the Specific Standard, Part 2.

5.3.1.2 General related to other aspects

The use of materials containing asbestos is forbidden.

Hard solder containing cadmium shall not be used in the construction of boilers.

5.3.2 Materials and thicknesses of walls or tubes with water side operating pressure for boilers of pressure class-3

5.3.2.1 General

The characteristics of the materials and the thicknesses of walls under pressure shall comply with the requirements of 5.3.2.2, 5.3.2.3 and 5.3.2.4. If other materials and/or other thicknesses are used, technical documentation shall contain appropriate justification in respect of fitness for purpose.

5.3.2.2 Materials

Materials for parts under pressure shall be appropriate for their duty and envisaged use.

The following materials satisfy these criteria:

- a) steels that have the properties and chemical composition detailed in Annex A;
- b) cast irons that have the mechanical properties detailed in Annex B;
- c) the non-ferrous materials detailed in Annex C and Annex D.

For other materials, the technical documentation shall provide proof of the suitability of that material.

5.3.2.3 Thicknesses

The minimum wall thicknesses are given in Annex E and Annex F.

For rolled steel, the tolerances are given in EN 10029:2010.

The thicknesses of cast walls given in the production drawings shall not be less than the nominal minimum thickness given in Annex F for parts of cast iron or of cast materials which are subjected to pressure.

The actual minimum thickness of the boiler sections and of parts subjected to pressure shall be greater than 0,8 times those given in the drawings.

5.3.2.4 Welded seams and welding fillers

Materials shall be suitable for welding. The welded joints given in Annex G may be used and do not require additional heat treatment for welding.

Welded seams shall show no cracks or bonding faults and butt welded seams shall be faultlessly welded over the whole cross-section.

Single-sided fillet welds and half Y-welds without full penetration into the base metal shall not be subjected to bending stresses. Flue pipes, set-through stays and similar components need not to be welded from both sides. Double fillet welds are permissible if sufficiently cooled.

Projections into the flueways in areas of high thermal stresses shall be avoided.

Corner welds, edge welds and similar welds which are subject to considerable bending stresses under unfavourable manufacturing or operating conditions are to be avoided.

For welded-in longitudinal stays, stay tubes or stay bolts, the shearing cross-section of the fillet weld shall be at least 1,25 times the required cross-section of the bolt or stay tube.

Details of the welds mentioned are given in Annex G. Welding fillers shall permit a joint appropriate to the base material to be made.

The terms given in Annex G are in accordance with prEN ISO 2553; the reference numbers of welding processes are respectively in accordance with ISO 857-1:1998, ISO 857-2:2005 and EN ISO 4063.

5.3.3 Domestic water connections

Threaded connections shall comply with EN ISO 228-1:2003, EN 10226-1:2004 or EN 10226-2:2005.

If copper tubes are used for the connection, the end of the tube shall comply with EN 1057:2006+A1:2010.

In accordance with the instructions for installation and instructions for use, the domestic water circuit shall be able to be drained, without the discharge of water compromising electrical safety.

5.3.4 Thermal Insulation

The insulation shall withstand the normally expected thermal and mechanical stresses, without deformation and shall retain its insulating properties under the influences of heat and ageing.

The insulation shall be of non-combustible material. However, inflammable materials are permitted provided that:

- a) the insulation is applied to surfaces in contact with water;
- b) or the temperature of the surface to which it is applied does not exceed 85 °C in normal operation;
- c) or the insulation is protected by a non-combustible case having an appropriate wall thickness.

If flames can come into contact with the insulation or if the insulation is applied close to the combustion products outlet, the insulation shall be non-combustible or protected by a non-combustible case having an appropriate wall thickness.

5.3.5 Materials in contact with water for human consumption

5.3.5.1 Materials and method of construction of components of the domestic water circuit for combination boilers

Materials shall be appropriate for their use, under intended application and at the maximum water pressure stated in the instructions for installation.

The requirements relating to thermal insulation and its use specified in 5.3.4 only apply to parts of the domestic water circuit likely to come into contact with flames or sited close to the combustion products outlet.

The materials of the parts containing domestic water shall not affect the quality of the domestic water in respect of either health or taste.

The whole of the domestic hot water circuit shall be made up of corrosion resistant materials or shall be protected against corrosion.

5.3.5.2 Requirements for Metallic materials

Metallic materials that come into contact with water intended for human consumption shall comply with Annex FF.2 and FF.3.

Metallic materials that come into contact with water intended for human consumption that do not comply with Annex FF.2 and FF.3 the following requirements shall be met:

- The materials shall withstand the mechanical, chemical and thermal stresses to which they are exposed during the service life of the water heater and shall not contaminate the water supplied.
- Metallic materials shall be corrosion-resistant. Metallic materials are considered to satisfy the requirements with respect to corrosion protection:
 - if the material used is enamelled (one or more layers) and equipped with cathodic corrosion protection, or
 - where types of stainless steel containing a minimum of 16 % chrome are used, or
 - where they are assessed as acceptable to the national regulations in force.

5.3.5.3 Requirements for plastic materials

Plastic materials that come into contact with water intended for human consumption shall comply with Annex FF.4.

Plastic materials that come into contact with water intended for human consumption that do not comply with Annex FF.4 the following requirements shall be met:

In the construction of water heaters and their components, only those plastic materials that meet mechanical, chemical and thermal demands as well as physiological and hygiene requirements throughout the life of the equipment shall be used in contact with water intended for human consumption. This means they shall be suitable for coming into direct contact with food and not pose any health threat. Special attention shall be paid to the microbiological properties of the plastic materials used and to the prevention of substances leaching out.

NOTE Due to the many different types of plastic in components used in the drinking water sector, many different material properties need to be taken into consideration e.g. longitudinal expansion, joining and fixing techniques, temperature effects, effect of light (UV resistance), ageing, internal pressure, internal and external corrosion (for example as a result of using cleaning products) and also transport and storage conditions.

5.3.5.4 Requirements for other operating and auxiliary materials

These materials include rubber, sealant, adhesives and also lubricants on moving parts that come into contact with the water intended for human consumption. Only those materials that meet mechanical, chemical and thermal demands as well as physiological and hygiene requirements throughout the life of the equipment shall be used in contact with water.

5.3.6 Durability against corrosion of metallic combustion product circuits

The durability against corrosion of the combustion product circuit is demonstrated by fulfilling either:

- a) the requirements in Table 2, or
- b) the corrosion requirements from either subclause A1.2, A 2.2 or A 3.2 of normative Annex A of EN 1856-1:2009:

Table 2 — Metallic combustion products circuit material specifications

Material	Symbol	Minimum Nominal Thickness non- condensing^b mm	Minimum nominal Thickness condensing^b mm
EN 573-1 Aluminium designation			
EN AW – 4047A	EN AW Al Si 12 (A), and CU <0,1 %, Zn<0,15 % (cast aluminium)	0,5	1,5

Material	Symbol	Minimum Nominal Thickness non- condensing ^b mm	Minimum nominal Thickness condensing ^b mm
EN AW – 1200A	EN AW-AL 99,0 (A)	0,5	1,5
EN AW-6060	EN AW-Al MgSi	0,5	1,5
EN 10088-1 Steel number	EN 10088-1 Steel name		
1.4401	X5CrNiMo 17-12-2	0,4	0,4
1.4404 ^a	X2CrNiMo 17-12-2	0,4	0,4
1.4432	X2CrNiMo 17-12-3	0,4	0,4
1.4539	X1NiCrMoCu 25-20-5	0,4	0,4
1.4401	X5CrNiMo 17-12-2	0,11 ^c	0,11 ^c
1.4404 ^a	X2CrNiMo 17-12-2	0,11 ^c	0,11 ^c
1.4432	X2CrNiMo 17-12-3	0,11 ^c	0,11 ^c
1.4539	X1NiCrMoCu 25-20-5	0,11 ^c	0,11 ^c
^a Equivalent for material N° 1.4404 = 1.4571 (symbol X6CrNiMoTi 17-12-2). ^b The condensing column shall be used if, under normal operation conditions, condensate is produced in the combustion products circuit (according to 3.1.3.8). ^c Flexible liners (when installed in an existing chimney).			

The actual minimum thickness of the materials shall always be greater than 90 % of the minimum nominal thicknesses.

5.4 Method of construction

5.4.1 Design

The boiler shall be designed such that when it is installed and used in accordance with the instructions for installation and instructions for use, it shall be possible to vent the air from the boiler waterways, if it is not self-venting.

Constructional parts accessible during use and servicing, in accordance with the instructions for installation and instructions for use, shall be free from sharp edges and corners that might cause damage or personal injury during use and servicing.

5.4.2 Checking the state of operation

It shall be possible to observe visually the ignition and operation of the burner(s) and also the length of the flame(s) of the ignition burner, if any.

In addition, mirrors, sight glasses, etc., shall continue to retain their optical properties. However, when the main burner is fitted with its own flame detector, an indirect means of indication (e.g. an indicator light) is allowed.

The indication of flame presence shall not be used to indicate any fault, except for a fault in the operation of the means of checking the flame itself, which shall result in an indication that there is no flame.

It shall be possible, perhaps after opening a door, to check at any time that the boiler is operating, either by visual observation of the flame or by some other indirect means.

If the indirect signal of flame presence is only available on a remote control, this remote control shall be supplied and tested with the appliance (see also 5.7.9.2.2.).

5.4.3 Use and servicing

5.4.3.1 general

It shall be possible to gain access to and operate all control knobs, buttons, etc., necessary for normal use of the boiler without having to remove any part of the case. However, part of the case may be removable provided that:

- a) this part can be handled easily and safely; and
- b) this part can be removed without the use of tools; and
- c) incorrect replacement is difficult (e.g. by the provision of stops).

All markings shall be easily visible and shall be made in a clear and indelible manner.

Parts which are required to be inspected or removed for servicing shall be easily accessible, possibly after removal of the case, in accordance with the instructions for installation.

Removable parts shall be designed or marked so that they are difficult to re-assemble incorrectly.

In accordance with the instructions for installation, it shall be possible to clean the burner, combustion chamber and parts in contact with combustion products easily and/or remove them easily for servicing with the use of commercially available tools. This shall not involve disconnection of the boiler from the gas or water pipes. The gas circuit shall be designed to permit separate removal of the burner or of the burner and control assembly.

For boilers connected to an air supply system and/or combustion products evacuation system that forms part of the construction of the building, it shall be possible to carry out servicing of the boiler without dismantling the permanent connections to the duct.

5.4.3.2 Soundness after reassembly

The soundness of the combustion circuit shall be maintained after reassembly and, if necessary, in accordance with the instructions for installation, after replacement of the seal(s) following cleaning and servicing operations.

5.4.4 Connections to the gas and water pipes

5.4.4.1 General

The boiler connections shall be easily accessible. They shall be clearly identified in the instructions for installation and possibly on the boiler. The clearance around the connections, after removing the case if necessary, shall allow use of the tools required to make the connection. It shall be possible to make all the connections without special tools.

5.4.4.2 Connection to the gas pipe

It shall be possible to connect the boiler by rigid metallic or flexible metallic means to the gas supply pipe.

If the boiler has no flanges, pipe connection shall comply with EN ISO 228-1:2003, EN 10226-1:2004, EN 10226-2:2005, or EN 1057:2006+A1:2010. In the first case (EN ISO 228-1:2003), the end of the boiler inlet connection shall offer a sufficiently flat annular surface to allow the use of a sealing washer.

If flanges are used, they shall comply with EN 1092 and the counter-flanges and sealing gaskets shall be provided together with the boiler and be declared under the service parts clause in the instructions for installation .

5.4.4.3 Connections to the central heating circuit

Threaded connections shall comply with EN ISO 228-1:2003, EN 10226-1:2004 or EN 10226-2:2005.

If copper connections are used, the connecting end of the tube shall comply with EN 1057:2006+A1:2010.

If other than the above connections are used, the technical documentation shall provide justification for their suitability of use.

5.4.5 Soundness

5.4.5.1 Soundness of the gas circuit

The gas circuit shall consist of metallic parts.

Holes for screws, studs, etc., intended for the assembly of parts shall not open into gas-ways. The wall thickness between drillings and gas-ways shall be at least 1 mm. This does not apply to orifices for measurement purposes. It shall not be possible for water to penetrate into the gas circuit.

The soundness of parts and assemblies making up the gas circuit and likely to be dismantled for routine maintenance in situ shall be achieved by means of mechanical joints, e.g. metal to metal joints, gaskets or toroidal seals, i.e. excluding the use of all sealing materials such as tape, paste or liquid. However, the sealing materials mentioned above may be used for permanent assemblies. These sealing materials shall remain effective under normal conditions of boiler use.

Where parts of the gas circuit are assembled without threads, soundness of the assembly shall not be achieved by means of soft solder or by means of adhesives.

5.4.5.2 Soundness of the combustion circuit

The combustion circuit shall be constructed so as to prevent any leakage of combustion products.

Any means used to achieve soundness of the combustion circuit shall be such that it remains effective under normal conditions of use and servicing.

Parts, which have to be removed during routine service and affect the soundness of the boiler and/or its ducts, shall be sealed by mechanical means, excluding pastes, liquids and tapes. The need for replacement of the seal(s), following a cleaning or servicing operation as stated in the instructions for installation , is permitted.

Where the boiler case forms part of the combustion circuit and it can be removed without the use of tools, either the boiler shall not operate, or there shall be no leakage of combustion products into the room where the boiler is installed when the case is replaced incorrectly.

However, parts of the assembly that are not intended to be dismantled for maintenance may be joined in such a way, that permanent soundness is assured during continuous service under normal conditions of use.

The ducts, bends, if any, and the terminal or fitting piece shall fit together correctly and shall form a stable assembly. Parts intended to be dismantled for periodic servicing shall be designed and arranged so that soundness is assured after reassembly.

Any fitting piece shall allow a sound connection to be made to the system intended for the evacuation of combustion products and supply of air.

5.4.6 Supply of combustion air and evacuation of the combustion products

The boiler shall be designed so there is an adequate supply of combustion air during ignition and over the whole range of possible heat inputs stated.

5.4.7 Dampers

For boilers with heat inputs in excess of 70 kW it is permissible to incorporate control dampers in the air or combustion products circuit.

Moveable components of the damper shall interlock and shall have no relative motion with respect to one another.

Any limit switch shall be designed and arranged so that incorrect signals about the open position of the damper are eliminated.

The damper system shall be provided with a means of proving that the position of any interlocks is correct prior to the damper being operated. This requirement is deemed to be met by limit switches which are protected against the effects of short circuits by suitable protective devices. These devices shall operate before the short circuit current exceeds 50 % of the rated current of the switches.

At the start-up and at every operating state, it shall be ensured that the damper is or has been moved to a position in which the air flow rate and heat input are in the specified ratios.

If the ratio of heat input to air flow rate is not as specified or if there is a fault in the switching system:

- a) either the damper shall be moved to a position which increases the excess air;
- b) or, there shall be a safety shutdown of the gas supply to the main burner.

5.4.8 Air proving

Boilers with fans shall be fitted with a system for air proving.

Except for boilers with gas/air ratio controls, before each fan start it shall be checked that there is no simulation of air flow in the absence of air flow.

The system for supervision of the combustion air rate or combustion products rate is activated directly by the flow of combustion air or combustion products. This is also valid for boilers with more than one fan speed in which the flows associated with each fan speed are monitored.

The supply of combustion air shall be checked by one of the following methods:

- a) gas /air ratio controls;
- b) continuous supervision of the combustion air rate or combustion products rate;
- c) start up supervision of the combustion air rate or combustion products rate provided that:
 - 1) The combustion products circuit is completely surrounded by the air supply circuit, or the leakage rate of the combustion products circuit meets the requirements of 8.2.2.102.2 and
 - 2) There is a shutdown at least every 24 h²⁾ and

2) Some boilers will be used in a way that it is very likely they will shut down at least once per 24 h without having a specific function to ensure this.

- 3) There is an indirect system for air proving (e.g. fan speed supervision) during operation.

5.4.9 Gas/air ratio controls

Gas/air ratio controls shall be designed and constructed so that reasonably foreseeable damage does not give rise to a change capable of affecting safety.

Pneumatic gas/air ratio controls shall comply with the relevant requirements of EN 88-1.

Electronic gas/air ratio controls shall comply with the relevant requirements of EN 12067-2.

If the installation instructions state (see 12.2.1.2) that the gas/air ratio control settings are not intended to be adjustable by a gas operative during installation, appliance service or when the gas valve is replaced then the appliance shall incorporate additional provisions to discourage unauthorised interference with the gas/air ratio control settings.

The following examples are considered to be suitable additional provisions:

- a) physical removal of the adjustment screws (or other method of rendering these inoperative);
- b) physically preventing access to the adjustment screws (e.g. filling access holes);
- c) addition of a suitably worded warning label affixed to the gas valve and/or in close proximity to the adjuster screws; this label shall be clearly visible to any gas operative whilst gaining access to the adjuster screws.

NOTE 1 Gas/air ratio controls typically have two adjustments ("throttle" and "offset") and the requirements of this clause apply to both.

If the appliance installation instructions indicate that the valve can be adjusted, by a suitably qualified gas operative using appropriate instruments, a provision shall be made to indicate that the valve setting has been changed.

NOTE 2 An example of a suitable provision is to use a paint spot on the adjusting device.

The appliance installations shall include instructions on how the settings shall be checked if, at the time of installation or service, there is an indication that the gas/air ratio control settings have been altered. The appliance installation instructions shall indicate the action to be taken if the settings are found to be incorrect.

If the appliance installation instructions allow the gas/air ratio controls to be adjusted then the method for adjustment shall be described.

5.4.10 Fan

Direct access to the rotating parts of a fan shall be prevented. Parts of a fan in contact with combustion products shall be effectively protected against corrosion unless they are made of corrosion resistant material; they shall withstand the temperature of the combustion products.

5.4.11 Drainage

If it is not possible to drain the boiler by means of its water connections, it shall carry a device that enables it to be drained and can be operated by means of a tool such as a spanner or screwdriver. Suitable directions for drainage shall be included in the instructions.

5.4.12 Operational safety in the event of failure of the auxiliary energy

If the boiler uses auxiliary energy, its design shall be such that no risk can occur in the event of failure of the auxiliary energy or following its restoration.

5.4.13 Special provision for Low Temperature Boilers and Condensing Boilers

5.4.13.1 Materials in contact with condensate

All parts of the heat exchanger(s) and other parts of the boiler likely to come into contact with condensate shall be constructed of sufficiently corrosion resistant materials or materials protected by a suitable coating in order to ensure a reasonable life for a boiler that is installed, used and maintained in accordance with the instructions for installation.

5.4.13.2 Discharge of condensate

5.4.13.2.1 Requirements

Condensing boilers shall be fitted with a condensate discharge system of corrosion-resistant material or covered by a durable protection against corrosion.

Where disposal of condensate from the boiler is by gravity the internal diameter of the condensate discharge connection shall be at least 13 mm. If the boiler incorporates some form of pump assisted condensate disposal the size of the discharge from the boiler and connection to any point of gravity discharge shall be specified in the technical instructions. The disposal system, forming part of the boiler or supplied with the boiler, shall be such that:

- a) it can be easily inspected and cleaned in accordance with the technical instructions; and
- b) it cannot transmit combustion products into the room where the boiler is installed; this requirement is met if the disposal system incorporates a water trap.

The water trap shall meet 2 requirements:

- 1) The water trap should have a seal of at least 25 mm water column.
- 2) The functional operation of the water trap will be tested under the blockage tests b) of 8.11.101.2 or 8.11.101.3.2. In that condition there shall be no leakage of combustion products into the room where the boiler is installed.

Surfaces in contact with condensates (except purpose provided drains, water traps and siphons) shall be designed to prevent condensate retention.

It shall be possible to service and clean the system easily. There may be a common condensate drain for flue gas exhaust and the condensing boiler.

5.4.13.2.2 Test conditions

By measurements, visual inspection or manual tests it is checked whether the requirements for the condensate discharge are fulfilled.

5.4.13.3 Control of the combustion products temperature

If the combustion products circuit contains materials that are likely to be affected by heat the boiler shall incorporate a device to prevent the combustion products temperature exceeding the maximum allowable working temperature for the material as declared in the technical documentation.

If the boiler is intended to be connected to a flue (including seals) that is likely to be affected by heat from the combustion products, the boiler shall incorporate a device to prevent the combustion products temperature exceeding the maximum allowable working temperature for the material as declared in the instructions for installation

The device for limiting the combustion products temperature shall be non-adjustable and shall not be accessible without tools.

5.4.13.4 Chemical composition of the condensate

If the chemical composition of the condensate is declared, the declared composition shall be verified at the end of the test of 9.3.

5.4.13.5 Design

5.4.13.5.1 Requirement regarding condensation in the appliance

If condensation takes place, this shall not:

- a) affect the operational safety;
- b) drop outside the appliance. This requirement does not apply to the flow of condensate which is produced at the outlet of the combustion products evacuation duct.

5.4.13.5.2 Test methods

After the test of 8.15.2 it is verified by visual inspection that the requirement is met.

5.5 Burners

The cross-section of the flame ports and also the burner and ignition burner injectors shall not be adjustable.

Every removable injector and/or removable restrictor shall carry an indelible means of identification preventing any confusion. In the case of non-removable injectors and/or restrictors, the marking may be on the manifold.

It shall be possible to change injectors and restrictors without the need to disconnect the boiler. When the injectors and restrictors are removable, their position shall be well defined and their method of fixing shall be such that it is difficult to position them incorrectly.

Burners shall be accessible without the need to dismantle a major part of the boiler. If the burners or a part of the burners are removable, their position shall be well defined and their method of fixing shall be such that it is difficult to position them incorrectly.

Up to 70 kW aeration adjusters shall not be used.

5.6 Pressure test points

Boilers shall be fitted with at least two pressure test points permitting measurement of the inlet pressure and the burner pressure. These shall be arranged in a position carefully selected so as to permit easy access.

Each of the test points shall have an external diameter of 9,0 (+0, -0,5) mm and a useful length of at least 10 mm to enable a tube to be fitted. The minimum diameter of the bore of the test point shall not exceed 1 mm. It shall be possible to measure the gas pressure without disturbing the operating condition of the boiler.

5.7 Requirements for the application of control and safety devices

5.7.1 General

NOTE Requirements for control and safety devices are specified in Clause 7.

Adjusting and control devices shall not overrule the operation of safety devices.

The design of the control and safety system shall be such that it is not possible to perform two or more actions which are unacceptable in combination. The order of the actions shall be fixed in such a manner that it is not possible to change it.

When there are several control knobs (taps, thermostats, etc.), they shall not be interchangeable if this could lead to confusion and their function shall be clearly indicated.

5.7.2 Adjusters and range-rating devices

5.7.2.1 General

5.7.2.1.1 Appropriate protection of factory settings

Any parts of a boiler, which are not intended to be altered during installation, use and maintenance, shall be protected in an appropriate manner. Paint may be used for this purpose provided that it withstands the temperature to which it is subjected during normal operation of the boiler.

5.7.2.1.2 Other requirements

The adjusting screws shall be arranged in such a way that they cannot fall into the gas-ways.

The soundness of the gas circuit shall not be put at risk by the presence of adjusters and range-rating devices.

Adjustment of the adjuster and/or of the range rating device may be continuous (e.g. use of an adjusting screw) or discrete (e.g. change of restrictors).

5.7.2.2 Adjuster

Gas rate adjusters shall be used for boilers using several groups of 1st family gas and optional for other boilers.

An adjuster shall:

- a) be sealed if adjustment is made during production;
- b) be able to be sealed if adjustment is carried out as a part of the installation or servicing procedure.

For boilers in an appliance category which includes a “+” sign, the adjusters shall be sealed.

5.7.2.3 Range-rating devices

The boiler may have a range-rating device.

If this device and the gas rate adjuster are one and the same, the instructions for installation shall specify the use of the adjuster.

5.7.3 Gas circuit

5.7.3.1 Control devices

Every boiler shall be provided with at least one device to enable the user to control the gas supply to the burner and to the ignition burner, if any.

The shut-off shall be effected without delay, for example it shall not be subject to the delay time of the thermoelectric flame supervision device.

No markings are required if incorrect operation is impossible, for example when a single button controls a flame supervision device for the burner and ignition burner. However, where it is necessary to use markings, the following symbols shall be used:

Off	Full disc	
Ignition	Stylised star	
Full rate of the burner	Stylised flame	

If the boiler has two distinct gas rate controls, one for the burner and one for the ignition burner, the operation of these devices shall be interlocked in such a way that it is impossible for the burner to be supplied before the ignition burner.

If the burner and ignition burner are served by a single tap, the position for ignition of the latter shall have a stop or notch making this position clearly perceptible to the user. It shall be possible to carry out the unlatching operation (if any) with one hand.

If the only gas shut-off device operates by turning, it shall turn off in a clockwise direction as seen by an observer facing the knob.

5.7.3.2 Composition of the gas circuit

The gas circuit shall meet the requirements of Table 3. The classification of the valves is according to EN 161:2011+A3:2013.

For individual gas lines > 0,250 kW, safety devices which require non-volatile lockout to occur shall give rise to simultaneous signal to close the two valves. However, for a thermoelectric device, the safety devices may act only on this device.

In the case of direct ignition of the main burner and if the order to close in response to a control device is not given simultaneously to the two valves, the two valves shall comply with the requirements of class C. (B for > 150 kW and A for > 300 kW).

In response to a control device, if the delay between the signals to close the two valves is not greater than 5 s, the signals are considered to be simultaneous.

Illustrations of the composition of the gas circuit are given in Annex H.