

BS EN 15502-1:2012+A1:2015

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BSI Standards Publication

Gas-fired heating boilers

Part 1: General requirements and tests

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National foreword

This British Standard is the UK implementation of EN 15502-1:2012+A1:2015. It supersedes BS EN 15502-1:2012 which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by **A1** **A1**.

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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

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CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 15502-1:2012+A1:2015) has been prepared by Technical Committee CEN/TC 109 “Central heating boilers using gaseous fuels”, the secretariat of which is held by NEN.

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of an identical text or by endorsement, at the latest by December 2015, and conflicting national standards shall be withdrawn at the latest by December 2015.

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 includes Amendment 1, approved by CEN on 2015-04-24.

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A1** **A1**.

This document supersedes EN 15502-1:2012.

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

- Technical changes related to ecodesign and energy labelling:in:
 - Clause 8, Operational requirements;
 - Clause 9, Useful efficiencies;
 - Clause 10, Electric auxiliary energy.
- Additions related to ecodesign and energy labelling:
 - Clause 13, Requirements for Eco-design Regulation (No 813/2013) and Energy Labelling Regulation (No 811/2013);
 - AnnexAA;
 - Annex BB;
 - Annex CC;
 - Annex DD;
 - Annex ZC;
 - Annex ZD.
- Changes to solve the inconsistencies identified in the letter 13-215 'GAD 2009 142 EC issues of 7 Nov 2013 by Mr Gwenole Cozogou of the commission to CEN:
 - Annex ZA. **A1**

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.

[A1] This document has been prepared under mandate M/495, 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. **[A1]**

[A1] For relationship with EU Directive(s) and Commission Regulations, see informative Annexes ZA, ZB, ZC and ZD which are integral parts of this document. **[A1]**

Annex V lists which existing standards are intended to be replaced by this standard in combination with the relevant Part 2. The standards listed in Annex V are to be used until the relevant Part 2 cover the types indicated. This European Standard by itself does not replace any European Standard.

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.

Introduction

A gas-fired heating boiler is an appliance using gas as 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. The boiler may also be used to provide domestic hot water via an indirect hot water storage tank.

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 may include in one design more than one function. It may include for example:

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

The boiler design may 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 installation instructions.

Boilers may 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 was established to deal with aspects related to:

- a) safety;
- b) rational use of energy;
- c) fitness for purpose.

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.

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

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 European Standard specifies the common requirements and test methods concerning, in particular the construction, safety, fitness for purpose, and rational use of energy, as well as the classification^{A1}, marking and energy labelling^{A1} 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 European Standard is to be used in conjunction with the specific Parts 2 (Part 2-1 and following ones).

This European Standard applies to boilers of types B and C ^{A1} ~~deleted text~~ ^{A1}.

^{A1} NOTE For further background information on appliance types see CEN/TR 1749:2014 [1]. ^{A1}

- 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 heat transfer fluid 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) ^{A1} which are declared in the installation instructions 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". ^{A1}

- f) which are intended to be installed inside a building or in a partially protected place;
- g) which are intended to produce hot water either by the instantaneous or storage principle, the whole being marketed as a single unit.

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

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 European Standard 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.

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 88-1:2011, *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, *Flame supervision devices for gas burning appliances - Thermoelectric flame supervision devices*

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

EN 161:2011, *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 437:2003+A1:2009, *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 1092-1:2007, *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*

[A1] *deleted text [A1]*

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 13203-1:2006, *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*

[A1] EN 13203-2:2015 **[A1]**, *Gas-fired domestic appliances producing hot water — Part 2: Assessment of energy consumption*

EN 13611:2007+A2:2011, *Safety and control devices for gas burners and gas burning appliances - General requirements*

EN 14459:2007, *Control functions in electronic systems for gas burners and gas burning appliances - Methods for classification and assessment*

[A1] EN 15036-1:2006, *Heating boilers — Test regulations for airborne noise emissions from heat generators - Part 1: Airborne noise emissions from heat generators [A1]*

EN 50090 (all parts), *Home and Building Electronic Systems (HBES)*

EN 60335-1:2002, *Household and similar electrical appliances - Safety - Part 1: General requirements (IEC 60335-1:2001, modified)*

EN 60335-2-102:2006, *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, modified)*

EN 60529:1991, *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)*

EN 60730-2-9:2010, *Automatic electrical controls for household and similar use — Part 2-9: Particular requirements for temperature sensing controls (IEC 60730-2-9:2008, modified)*

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)*

prEN ISO 2553:2011, *Welding and allied processes — Symbolic representation on drawings — Welded, brazed and soldered joints (ISO/DIS 2553:2011)*

EN ISO 3166-1:2006, *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes (ISO 3166-1:2006)*

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 437:2003+A1:2009 and the following apply.

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 used by the installer to adjust the nominal heat input of the boiler within the range of maximum and minimum heat inputs stated by the manufacturer, 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 is intended to assure the thermal function of the boiler, 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 of the appliance

Note 1 to entry: This will include the combustion chamber and heat exchanger and depending on the type includes the air supply duct, the combustion products evacuation duct, the fitting piece, the connection to the terminal, the inlet terminal, the outlet terminal.

3.1.3.2

air supply circuit

means for transporting combustion air to the burner

3.1.3.3

combustion products evacuation duct

means for transporting combustion products to the outlet of the appliance or to the terminal

3.1.3.4

damper

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

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 permitted in the domestic water circuit of combinations boilers, as declared by the manufacturer

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 stated by the manufacturer at which the boiler can 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; the proportioning factor may 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 e.g. through:

- 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

3.1.5

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 (Comparable to 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

useful output stated by the manufacturer 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

useful output declared by the manufacturer 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



3.1.6.4

rated heat output

Prated

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

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})

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

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})

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

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;

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 required for the heat generator's designed operation

3.1.9.2

rated power input

power input assigned to the appliance by the manufacturer, see EN 60335

3.1.9.3

rated voltage

voltage assigned to the appliance by the manufacturer, 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 classified in accordance with the manufacturer's declaration 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

3.1.11

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 a boiler is sold with a casing intended to provide protection, 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 by the manufacturer, 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 by the manufacturer

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 indicated by the manufacturer

Symbol: Q_{nw}

Unit: kilowatt (kW)

A1

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 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 

3.2 Symbols

Table 1 — Main symbols and abbreviations used

Net calorific value	H_i
Gross calorific value	H_s
Density of test gas	d
Density of reference gas	d_r
Net Wobbe index	W_i
Gross Wobbe index	W_s
Normal test pressure	p_n
Minimum test pressure	p_{min}
Maximum test pressure	p_{max}
Gas pressure at the meter	p_g
Atmospheric pressure	p_a
Volume gas rate under test conditions	V
Volume gas rate under reference conditions	V_r
Volume gas rate, nominal	V_n
Mass rate	M
Nominal mass rate	M_n
Heat input	Q
Nominal heat input	Q_n
$\square_{A1}$ Heat input at the arithmetic mean of the maximum and minimum nominal heat input	$Q_a \square_{A1}$
Corrected heat input	Q_c
Nominal domestic hot water heat input	Q_{nw}
Useful output	P
Nominal output	P_n
$\square_{A1}$ Useful output at the arithmetic mean of the maximum and minimum nominal useful output	$P_a \square_{A1}$
Condensing output	P_{nc}
Useful efficiency	η_u
$\square_{A1}$ Seasonal space heating energy efficiency GCV	η_s
Water heating energy efficiency GCV	η_{wh}

Weighted value of the NO _x concentration, in milligrams per kilowatt-hour (mg/kWh) GCV	$NO_{x,pond\ Hs}$
Weighted value of the NO _x concentration, in milligrams per kilowatt-hour (mg/kWh) NCV	$NO_{x,pond}$
The useful efficiency at 30 % of the nominal heat input GCV	η_1
The useful efficiency at nominal heat input GCV	η_4
The useful efficiency at 30 % of the nominal heat input NCV	η_{30}
The useful efficiency at nominal heat input NCV	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]	$P_{SB} \langle A_1 \rangle$
Maximum waterside operating pressure (heating water)	PMS
Maximum water service pressure (sanitary water)	PMW
Ignition opening time	T_{IA}
Ignition safety time	T_{SA}
Extinction delay time	T_{IE}
Extinction safety time	T_{SE}
Gas temperature	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

$\langle A_1 \rangle$ The types of boilers are specified on the boiler (see 12.1.1.i). $\langle A_1 \rangle$

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 manufacturer shall declare in the technical instructions for the installer the minimum and maximum ambient temperatures at which the boiler is designed to operate (see 12.2.1).

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

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.

In particular, all parts of the boiler and the combustion circuit shall withstand the mechanical, chemical and thermal conditions to which they may be subjected when the boiler is used normally.

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

The use of materials containing asbestos is forbidden.

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

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

5.3.2 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, the manufacturer shall provide 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 manufacturer shall provide proof 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.

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.

5.3.2.5 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 by the manufacturer.

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.

5.3.3 Domestic water connections

Threaded connections shall comply with EN ISO 228-1, EN 10226-1 or EN 10226-2.

If copper tubes are used for the connection, the end of the tube shall comply with EN 1057.

In accordance with the manufacturer's instructions, 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.

5.4 Method of construction

5.4.1 Design

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

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.

Constructional parts accessible during use and servicing, in accordance with the manufacturer's instructions, 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

The installer shall be able 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 for the user, 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

The user and/or the operator shall be able 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 by the operator; 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 intended for the user and/or the operator 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 manufacturer's instructions.

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

In accordance with the manufacturer's instructions, 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.

The soundness of the combustion circuit shall be maintained after reassembly and, if necessary, in accordance with the manufacturer's instructions, 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 installation instructions 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 or flexible metallic means to the gas supply pipe.

If the boiler has no flanges, pipe connection shall comply with EN ISO 228-1, EN 10226-1, EN 10226-2, or EN 1057. In the first case (EN ISO 228-1), 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 manufacturer shall provide the counter-flanges and sealing gaskets.

5.4.4.3 Connections to the central heating circuit

Threaded connections shall comply with EN ISO 228-1, EN 10226-1 or EN 10226-2.

If copper connections are used, the connecting end of the tube shall comply with EN 1057.

If other than metallic materials are used, the manufacturer shall provide the appropriate 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 by the manufacturer, 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 manufacturer shall design the boiler so that 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.

Before each fan start it is checked that there is no simulation of air flow; this requirement is deemed to be met if the boiler is fitted with a gas/air ratio control.

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

- a) supervision of the combustion air pressure or the combustion products pressure;
- b) supervision of the combustion air rate or the combustion products rate;
- c) automatic gas/air ratio control;
- d) indirect supervision (e.g. fan speed supervision) when there is an air proving device which proves the air rate at least once at each start up and provided that there is a shutdown at least once every 24 h.

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.

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 manufacturer's instructions.

5.4.13.2 Discharge of condensate

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 by the boiler manufacturer. 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 manufacturer's instructions;
- b) it cannot transmit combustion products or let enter air into the room where the boiler is installed; this requirement is met if the disposal system incorporates a water trap.

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.

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 or 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 by the manufacturer.

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 manufacturer states the chemical composition of the condensate, the composition shall be verified at the end of the test of 9.3.

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 are forbidden.

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

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

5.7.1 General

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

Any parts of a boiler, which are not intended to be altered by the user or the installer, 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.

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 are mandatory for boilers using several groups of 1st family gas and optional for other boilers.

An adjuster shall:

- a) be sealed if adjustment is made by the manufacturer;
- b) be able to be sealed if adjustment is carried out by the installer.

For boilers in a category which includes a "+" sign, the adjusters shall be sealed by the manufacturer.

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 installation instructions 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 2. The classification of the valves is according to EN 161:2011.

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 be 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.

Table 2 — Composition of the gas circuit

	BOILER WITHOUT FAN	BOILER WITH FAN		
Heat input of the Individual gas line within the gas circuit 				

5.7.4 Gas pressure regulator

Boilers intended to operate with first family gases shall have a gas pressure regulator in accordance with EN 88-1; boilers with heat inputs above 70 kW operating on second family gases shall also be fitted with a gas pressure regulator according to EN 88-1.

For other boilers a gas pressure regulator is optional.

A gas pressure regulator intended for operation with a pressure couple shall be, or shall be able to be adjusted in a manner such that it cannot operate between the two normal pressures.

However, when operating with a pressure couple, a non-adjustable gas pressure regulator for the ignition burner is permitted.

The design and accessibility of the gas pressure regulator shall be such that it can be easily adjusted or put out of operation when another gas is supplied, but precautions shall be taken to make unauthorised interference with the adjuster difficult.

5.7.5 Ignition devices

5.7.5.1 Ignition of the ignition burner

It shall be possible to ignite the ignition burner, without interfering in the combustion circuit.

Ignition devices for the ignition burner shall be designed and fitted in such a way that they are located correctly in relation to the components and the ignition burner. It shall be possible to fit or remove the ignition device for the ignition burner, or the ignition burner-ignition device assembly, using commonly available tools.

5.7.5.2 Ignition device for the main burner

5.7.5.2.1 General

The main burner shall be fitted with an ignition burner or a device for direct ignition. Direct ignition shall not cause deterioration of the burner.

5.7.5.2.2 Ignition burners

Ignition burners shall be designed and fitted in such a way that they are located correctly in relation to the components and to the burners which they ignite. If different ignition burners are used for the different gases, they shall be marked, easy to substitute for one another and easy to fit. The same applies to injectors where only they have to be changed.

If the rate of the ignition burner is not governed, a gas rate adjuster is mandatory for boilers operating on first family gases and optional for second family and third family gases. However, it is forbidden for second and third family gases if a pressure couple is used. The adjuster may be omitted if ignition burners and/or injectors suiting the characteristics of the gas used can be changed easily.

Admission of gas to the ignition burner ($Q_{IB} \leq 0,250 \text{ kW}$) during the pre-purge is permitted, if ignition is effected after the pre-purge period.

5.7.5.2.3 Direct ignition

Devices for direct ignition shall ensure safe ignition even if the voltage is varied from 85 % to 110 % of the nominal voltage. The order to energise ignition devices shall be given no later than the order to open the automatic valve controlling the gas to be ignited.

Excluding flame detection, the ignition device shall be de-energised no later than at the end of the ignition safety time.

5.7.6 Flame supervision devices

5.7.6.1 General

The presence of a flame shall be detected:

- a) either by a thermoelectric flame supervision device;

NOTE See also Table 2 regarding valve requirements.

- b) or by the flame detector of an automatic burner control system.

At least one flame detector is required.

If the main burner is ignited by an ignition burner, the presence of flame at the ignition burner flame shall be detected before gas is released to the main burner.

5.7.6.2 Thermoelectric flame supervision device

The device shall cause non-volatile lockout of the boiler in the event of flame failure, and in the event of damage to the sensing element or to the connection between the sensing element and the device responding to its signal.

The device shall incorporate either an ignition interlock or a re-start interlock.

5.7.6.3 Automatic burner control system

Automatic burner control systems shall comply with the appropriate requirements of EN 298.

In case of flame failure, the system shall cause at least:

- a) spark restoration;
- b) or restart;
- c) or volatile lockout.

In the case of spark restoration or restart, an absence of flame at the end of the ignition safety time (T_{SA}) shall result in, at least, volatile lockout.

5.7.7 Gas/air ratio control tubes

Control tubes may be made of metal with suitable mechanical connections or of other materials with at least equivalent properties and in this case are considered immune to breakage, accidental disconnection and leakage after initial soundness checks. As such, they are not subject to specific tests.

Control tubes for air or combustion products shall have a minimum cross-sectional area of 12 mm² with a minimum internal dimension of 1 mm. They shall be located and fixed so that any retention of condensate is avoided and positioned such that creasing, leakage or breakage is prevented. Where more than one control tube is used the relevant connection position for each shall be obvious. Provided that evidence is given and precautions are taken to avoid condensation in the control tubes, the minimum cross sectional area of air control tubes shall be 5 mm².

5.7.8 Thermostats and water temperature limiting devices

5.7.8.1 General

Boilers shall be fitted with a fixed setting or adjustable control thermostat complying with 7.3.2.1. In addition, boilers shall be fitted with additional temperature limiting devices specified below.

Alternatively an electronic temperature control system can be used to control the temperature at a fixed or adjustable set point. Such a system shall comply with requirements for a class A device according to EN 14459:2007, Annex K.

5.7.8.2 Boilers intended exclusively for central heating systems with an open expansion vessel

Temperature limiting devices are not required when the boiler is designed to be installed exclusively with an open expansion vessel and when a failure of the control thermostat does not cause a dangerous situation for the user or damage to the boiler. Appropriate information shall be given in the technical instructions.

5.7.8.3 Boilers intended for central heating systems with open or sealed expansion vessels

5.7.8.3.1 Boilers with electromechanical controls

Boilers shall be fitted with:

- a) Either a temperature limiter complying with 7.3.2.2, having a preset limit of maximum 110 °C and an overheat cut-out device complying with 7.3.2.3 is required, having a preset limit that causes non-volatile lockout before the boiler is damaged and/or before a dangerous situation occurs. For boilers of pressure

class 1 and 2 instead of a temperature limiter, other devices (e.g. water rate monitoring device, low water detector safety device) are possible in as much as all the requirements of 8.11.8 and 7.3 are met;

- b) Or an overheat cut-out complying with 7.3.2.3, having a preset limit of maximum 110 °C causing non-volatile lockout before the boiler is damaged and/or before a dangerous situation occurs.

The temperature limiter shall cause at least safety shut-down before the water flow temperature exceeds the preset value. When the water temperature falls below the preset value, the gas supply to the burner may be restored automatically. The overheat cut-out device shall cause non-volatile lockout before the boiler is damaged and/or a dangerous situation for the user occurs.

5.7.8.3.2 Boilers with electronic controls

Boilers shall be fitted with systems either a) or b):

- a) An electronic temperature control system can be used to control and limit the temperature in combination with an electromechanical overheat cut-out according to the requirements from this standard. This electronic temperature control system shall have two different settings, being: control temperature and limiting temperature, and should meet the requirements for a class A device according to EN 14459:2007, Annex K. At a limit temperature set point of maximum 110 °C the system shall shut down, restoring normal operation when the temperature drops below the limit value.
- b) An electronic temperature control system can be used to control and limit the temperature and provide the overheat cut-out function. Such a control system shall meet the requirements of the class C Temperature Control Function as specified in EN 14459:2007, Annex K. The system shall have at least three levels of temperature setting, being: control temperature, limit temperature and overheat cut-out temperature. At limit temperature set point of maximum 110 °C the system shall shut down, restoring normal operation when the temperature drops below the limit value. The system shall go in non-volatile lockout at overheat cut-out temperature set point, being the set point before the boiler is damaged and/or before a dangerous situation for the user occurs.

5.7.9 Remote control

5.7.9.1 General

Boilers with a remote control device or devices shall be so designed and constructed that failure of this device can not lead to an unsafe situation. The design of the remote control device shall be such as to prevent accidental operation or manipulation.

Appropriate measures shall be taken to prevent unauthorised controls from operating the boiler.

Connection of any remote controls recommended by the manufacturer shall be possible without disturbing the internal electrical connections except for purpose-designed removable links.

Operation of the controls at the boiler shall take priority over remote control.

In case of connection to Home and Building Electronic Systems (HBES) the relevant requirements of the EN 50090 series shall apply.

For more detailed requirements on data exchange, see EN 14459.

5.7.9.2 Remote control reset functions

5.7.9.2.1 General

Boilers that allow remote control reset functions shall be fitted with a switch or other means for switching off the boiler.

5.7.9.2.2 Functional requirements

A reset action of a boiler is intended to be a clear defined manual action.

An automatic reset (e.g. resets generated by automatic devices, like timers etc.) shall not be possible.

Whenever the remote reset function is performed by a mobile device at least 2 manual actions are required to activate a reset.

The remote reset function shall be at least a class B function according to EN 14459 (assessment according to EN 14459:2007, 6.3), with a fault tolerating time of 24 h.

Any fault of the remote reset shall not cause the boiler to operate outside the applicable requirements. It shall be detected before the next start-up or shall not prevent the boiler from going to shut-down or lock-out.

For reset functions where the manual action is initiated without line of sight of the boiler the following additional requirements apply:

- a) the actual status and relevant information of the process under control shall be visible to the user before, during and after the reset action;
- b) the maximum number of resets accepted by the control in the boiler shall be limited to 5 actions within a time span of 15 min. After this period, the boiler shall not reset by remote control.

5.7.9.2.3 Evaluation of the remote reset function on the boiler

The remote reset function shall be evaluated with the boiler.

If the reset is activated by manual switching of a thermostat or device with similar function this shall be declared by the manufacturer and be approved with the boiler.

5.7.10 Expansion vessel and pressure gauge

If the boiler incorporates a sealed system expansion vessel, this shall be located or protected in such a way that heat cannot damage the diaphragm and the boiler shall be fitted with a pressure gauge stating the maximum water-side operating pressure (PMS).

5.7.11 Protection against frost for boilers intended to be installed in a partially protected place

If the minimum ambient temperature declared by the manufacturer is less than 0 °C, a boiler intended to operate in a partially protected place, shall be protected from freezing by a frost protection system.

For combination boilers, the domestic hot water production circuit is also to be protected from damage caused by frost.

The condensate drain, if any, shall be protected from damage and shall not block the drain function in the case of frost.

5.7.12 Adjusting, control and safety devices for the domestic hot water circuit

If necessary, the domestic hot water circuit shall be fitted with control and safety devices necessary to comply with the requirements, of 5.7.8 of this standard.

The tank shall be fitted with a device for controlling the water temperature. This device shall allow a temperature to be attained which is sufficient to prevent the build-up of bacteria (see 8.11.3.1.3.3).

If the appliance is equipped with a temperature relief valve, any device controlling the temperature of the sanitary hot water shall act before this valve.

6 Electrical safety

The boiler shall comply with the relevant requirements of EN 60335-2-102.

If the boiler is fitted with electronic components or electronic systems providing a safety function, these shall comply with the relevant requirements in Clause 7.

If the manufacturer states, on the data plate, the nature of the electrical protection of the boiler, this statement shall comply with EN 60529.

For boilers intended to be installed in a partially protected place:

- a) the enclosure protection degree shall be at least IPX4D;
- b) the electrical and/or electronic equipment temperature range shall be relevant for the specified temperature range of the boiler.

7 Controls

7.1 General

In 7.2 controls requirements are specified by reference to existing controls standards. For some clauses, additional requirements and/or deletions are given in 7.2.

For boiler specific controls, approved for a specific boiler, some requirements can be waived, as these are covered by the boiler standard. See 7.2 for details on this.

7.2 Detailed specifications

7.2.1 Control and safety devices shall comply with the following standards:

EN 88-1, *Pressure governors for gas appliances*

EN 125, *Thermo-electric flame supervision devices for gas burning appliances*

EN 126, *Multifunctional controls for gas burning appliances*

EN 161:2011, *Automatic shutoff valves for gas burners and gas appliances*

EN 298, *Automatic gas burner control systems*

EN 12067-2, *Gas/air ratio controls for gas burners and gas burning appliances – Part 2: Electronic types*

EN 13611, *Safety and control devices for gas burners and gas burning appliances – General requirements*

EN 14459, *Control functions in electronic systems for gas burners and burning appliances – Method for classification and assessment*

7.2.2 In addition, for boilers the following applies:

- a) Valves using auxiliary fluids shall close automatically on reducing the actuating pressure to 15 % of the highest pressure declared by the manufacturer;
- b) A valve with pneumatic or hydraulic actuating mechanisms is energised at the maximum actuating pressure, and the actuating pressure is reduced slowly to 15 % of the maximum actuating pressure. At this point the valve shall have travelled to the closed position.

7.2.3 Boiler controls which have not been separately type tested shall be tested in combination with the boiler. In that case clauses of the above mentioned standards, which refer to the below mentioned aspects, can be waived:

- a) Connections: as mentioned in EN 13611:2007+A2:2011, 6.4, 6.4.1, 6.4.2, 6.4.3, 6.4.4, 6.4.5 and 6.4.6;
- b) Rated flow rate: as mentioned in EN 13611:2007+A2:2011, 7.6: (already covered in the nominal heat input/output tests);
- c) EMC/Electrical requirements: as mentioned in EN 13611:2007+A2:2011, 8.1 to 8.10;
- d) Marking: as mentioned in EN 13611:2007+A2:2011, Clause 9;
- e) Protection against environmental influences: as mentioned in EN 298:2012, 8.2 to 8.8;
- f) Marking, installation and operating instructions: as mentioned in EN 298:2012, Clause 11.

NOTE Alternative clause numbers may apply when the product standard (e.g. EN 88-1 / EN 161:2011) is used.

7.2.4 Boilers controls which have not been separately type tested shall be tested in combination with the boiler. In that case, the following additional aspects need to be considered:

- a) EN 13611:2007+A2:2011, 6.4.8, the strainer can also be in the boiler;
- b) EN 13611:2007+A2:2011, 7.1, the control shall work correctly taking into consideration the max. working pressure, as specified for the boiler, is used and for mounting position, the position of the control in the boiler is used;
- c) EN 13611:2007+A2:2011, 7.3, tests are limited to the pressures as defined for the boiler;
- d) EN 13611:2007+A2:2011, 7.4 and 7.5, tests are performed unless it's evident that the control will not have any bending and torque load, for example because of the way of construction or installation in the boiler;
- e) EN 88-1:2011, 7.101.5, correct functioning of the regulator is demonstrated on the boiler according to the requirements of the specific standards, comparable with a class C regulator, for the gases specified.

7.3 Thermostats and water temperature limiting devices

7.3.1 General

To protect a gas appliance against the basic risks of fire and explosion as a result of overheat, a Temperature Control Function (TCF) is required.

Scope of the TCF is to control the temperature (control thermostat and temperature limiter) and to prevent the risk of excessive temperature (overheat cut-out which could lead to the hazard of overheat for gas burning appliances. The TCF is a system which consists of temperature sensing, signal processing, switching actions (on/off or protective action) and reset.

Practical realisation of the TCF can be done with one control (electronic systems) or more controls, specifying control thermostats, temperature limiters and, overheat cut-out's). Also constructional measures, like an open expansion vessel system, can cover part of the risk.

Making use of existing classifications for safety related control functions (see EN 14459), the TCF is classified as class C. This is based on a comparison, made between the automatic burner controller and the TCF, the implication on safety of either function being considered equivalent.

Appliance standards can allow a lower safety class in combination with constructional measures, resulting in an overall TCF safety class C, e.g. open expansion vessel systems.

Traditional solutions as specified in 7.3.2 and 7.3.3, using a combination of electro-mechanical thermostats as specified in the specific appliance standards have been considered to fulfil the requirements for class C. This assumption is based on electro-mechanical solutions with specific constructional requirements, originating from practice over many years and relying on redundancy as the principle.

Electronic solutions for the overall Temperature Control Function are based on a fault assessment approach like EN 298 or EN 60730, with specific requirements described in EN 14459.

7.3.2 Construction requirements

7.3.2.1 Control thermostat

The control thermostat shall comply with the requirements of EN 60730-2-9 for type 1 devices.

If the control thermostat is adjustable, the manufacturer shall at least state the maximum temperature in the instructions. The positions of the temperature selector shall be easy to establish and it shall be possible to ascertain in which direction the water temperature rises or falls. If numbers are used for this purpose, the highest number shall correspond to the highest temperature.

At its maximum setting, it shall cause at least controlled shut-down.

7.3.2.2 Temperature limiter

The temperature limiter shall comply with the requirements of EN 60730-2-9 for type 1 devices.

The maximum set point temperature of this device shall not be able to be adjusted.

The temperature limiter contacts shall open before the temperature exceeds a preset limit and close again when the temperature falls below that preset limit.

7.3.2.3 Overheat cut-out device

The overheat cut-out device shall comply with the requirement of EN 60730-2-9 for type 2 devices.

This device shall not be adjustable and normal operation of the boiler shall not give rise to a change in its set point temperature.

The contacts of the overheat cut-out device shall open, resulting in non-volatile lockout, before the temperature exceeds a preset limit.

Interruption of the link between the temperature sensing element and the device responding to its signal shall cause at least safety shutdown.

7.3.2.4 Overheat cut-out device for appliances > 70 kW

For an overheat cut-out device in a appliance > 70 kW, the requirements of 7.3.2.3 are applicable with the following modifications:

- a) preset limit is 110 °C;
- b) the manufacturer may adjust the set-point temperature to achieve a maximum water flow temperature of less than 110 °C provided that once the adjustment has been made, re-adjustment above the new set-point is not possible without the use of a tool.

7.3.2.5 Sensors

Thermostats, temperature limiters and overheat cut-out devices shall have independent temperature sensing elements.

With an electronic system, thermostats and temperature limiters may have the same temperature sensing element provided that its failure cannot give rise to a dangerous situation for the user or damage to the boiler.

The temperature sensing elements shall withstand the thermal overload resulting from an overheat condition specified in this standard without the predetermined set point being affected.

EN 14459 shall be used for specific requirements on electronic temperature control systems and their sensors.

7.3.3 Performance

7.3.3.1 General

Requirements:

Under the test conditions as mentioned below, the opening and closing temperatures of the thermostats shall not differ from those stated by the manufacturer by more than 6 K. For adjustable thermostats, this requirement applies at the minimum and maximum temperatures of the control range.

Test conditions:

Where the devices are tested separately, they shall be mounted in a position identical to that which they occupy on the boiler. If the tests are carried out away from the boiler, the sensor and body of the thermostats are each placed in a thermostatically controlled enclosure.

The temperature of the body is that to which the device is subjected in the boiler, adjusted to the nominal heat input with the reference gas when thermal equilibrium is reached, with an adjustable thermostat adjusted to the position corresponding to the maximum water temperature.

Except where otherwise stated, the tests are carried out at ambient temperature and at the maximum temperature.

The sensor is subjected to the temperature stated in 7.3.3.2.

60 % of the cycles are carried out at 1,10 times the nominal voltage; the remaining tests at 0,85 times the nominal voltage.

At the end of these tests, it is checked that the requirements are met.