

Gas fired central heating boilers — Type B boilers of nominal heat input exceeding 300 kW, but not exceeding 1 000 kW

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National foreword

This British Standard was published by BSI. It is the UK implementation of EN 13836:2006.

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A list of organizations represented on GSE/29 can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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English Version

Gas fired central heating boilers - Type B boilers of nominal heat
input exceeding 300 kW, but not exceeding 1 000 kW

Chaudières de chauffage central utilisant les combustibles
gazeux - Chaudières de type B dont le débit calorifique
nominal est supérieur à 300 kW mais inférieur ou égal à 1
000 kW

Heizkessel für gasförmige Brennstoffe - Heizkessel des
Typs B mit einer Nennwärmebelastung größer als 300 kW
aber gleich oder kleiner als 1 000 kW

This European Standard was approved by CEN on 20 April 2006.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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Foreword

This European Standard (EN 13836:2006) 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of an identical text or by endorsement, at the latest by February 2007, and conflicting national standards shall be withdrawn at the latest by February 2007.

It was established to deal with aspects related to:

- safety;
- rational use of energy;
- fitness for purpose.

Other types of boilers are dealt with in separate standards.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directives 90/396/EEC “Approximation of the laws of Member States concerning gas appliances” and 92/42/EEC “Efficiency requirements for new hot water boilers fired with liquid or gaseous fuels” see informative Annex ZA, which is an integral part of this European Standard.

This standard covers only type testing.

Boilers within the scope of this European Standard are typically installed in a room separated from living rooms and provided with appropriate ventilation directly to the outside. They need not be fitted with a combustion products discharge safety device but appropriate warnings on the packaging and in the instructions should clearly indicate the limit on the use of this type of boiler.

It is impractical to use the full range of test gases to EN 437 for type testing since their availability, for inputs over 300 kW, may present problems for test houses and manufacturers. Informative Annex L gives guidance on the use of gases for tests in order to ensure conformity with EU Directive 90/396/EEC “Approximation of the laws of Member States concerning gas appliances.”

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

1 Scope

This European Standard specifies the requirements and test methods concerning, in particular, the construction, safety, fitness for purpose, and rational use of energy, as well as the classification and marking 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 applies to boilers of type B, as listed in 4.2:

- that use one or more combustible gases of the three gas families at the pressures stated in Tables 16 and 17;
- that have a nominal heat input (on the basis of net calorific value) exceeding 300 kW, but not exceeding 1 000 kW, including modular boilers;
- where the temperature of the heat transfer fluid does not exceed 105 °C during normal operation;
- where the maximum operating pressure in the water circuit does not exceed 6 bar;
- that can give rise to condensation under certain circumstances;
- of the standard and low-temperature types.

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

This European Standard does not contain all the requirements necessary for boilers:

- intended to be installed in the open or in living rooms;
- permanently fitted with more than one flue outlet;
- where the combustion circuit is sealed with respect to the room where the boiler is installed;
- of the condensing type;
- intended to be connected to a common flue having mechanical extraction;
- fitted with a forced draught burner in accordance with EN 676 (see EN 303-7);
- producing hot water for domestic purposes.

This standard only covers type testing.

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

2 Normative references

The following referenced documents are indispensable for the application of this European Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 88, *Pressure governors for gas appliances for inlet pressures up to 200 mbar*

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

EN 126, *Multifunctional controls for gas burning appliances*

EN 161, *Automatic shut-off valves for gas burners and gas appliances*

EN 257, *Mechanical thermostats for gas burning appliances*

EN 297, *Gas-fired central heating boilers — Type B₁₁ and B_{11BS} boilers fitted with atmospheric burners of nominal heat input not exceeding 70 kW*

EN 298, *Automatic burner control systems for gas burners and gas burning appliances with or without fans*

EN 437:2003, *Test gases — Test pressures — Appliance categories*

EN 656, *Gas-fired central heating boilers — Type B boilers of nominal heat input exceeding 70 kW but not exceeding 300 kW*

EN 1057, *Copper and copper alloys — Seamless, round copper tubes for water and gas in sanitary and heating applications*

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

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

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

EN 1561, *Founding — Grey cast irons*

EN 1643, *Valve proving systems for automatic shut-off valves for gas burners and gas burning appliances*

EN 1854, *Pressure sensing devices for gas burners and gas burning appliances*

EN 10029, *Hot rolled steel plates 3 mm thick or above — Tolerances on dimensions, shape and mass*

EN 12067-1, *Gas/air ratio controls for gas burners and gas burning appliances — Part 1: Pneumatic types*

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

EN 50165, *Electrical equipment of non-electric appliances for household and similar purposes — Safety requirements*

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

EN 60529, *Degrees of protection provided by enclosures (IP code) (IEC 60259:1989)*

EN 60730-2-9, *Automatic electrical controls for household and similar use — Part 2-9: Particular requirements for temperature sensing controls (IEC 60730-2-9:2000, modified)*

EN ISO 228-1, *Pipe threads where pressure tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation (ISO 228-1:2000)*

EN ISO 3166-1, *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes (ISO 3166-1:1997)*

ISO 7-1, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply.

3.1 Combustible gases

3.1.1

calorific value

quantity of heat produced by the complete combustion, at a constant pressure equal to 1 013,25 mbar, of unit volume or mass of gas, the constituents of the combustible mixture being taken at reference conditions and the products of combustion being brought back to the same conditions.

A distinction is made between:

— gross calorific value: the water produced by combustion is assumed to be condensed

Symbol: H_s

and

— net calorific value: the water produced by combustion is assumed to be in the vapour state

Symbol: H_i

NOTE The calorific value is expressed:

- either in megajoules per cubic metre (MJ/m^3) of dry gas under the reference conditions,
- or in megajoules per kilogram (MJ/kg) of dry gas.

3.1.2

gas pressure

static pressure of the moving gas, relative to the atmospheric pressure, measured at right angles to the direction of flow of the gas

Symbol: p

Unit: millibar (mbar)

3.1.3

limit gases

test gases representative of the extreme variations in the characteristics of the gases for which appliances have been designed

3.1.4

limit pressures

pressures representative of the extreme variations in the appliance supply conditions.

Symbols: maximum pressure: $p_{\max}$

minimum pressure: $p_{\min}$

3.1.5

normal pressure

pressure under which the appliances operate in nominal conditions when they are supplied with the corresponding reference gas.

Symbol: p_n

3.1.6

pressure couple

combination of two distinct gas distribution pressures applied by reason of the significant difference existing between the Wobbe indices within a single family or group in which:

- higher pressure corresponds only to gases of low Wobbe index;
- lower pressure corresponds to gases of high Wobbe index

3.1.7

reference gases

test gases with which appliances operate under nominal conditions, when they are supplied at the corresponding normal pressure

3.1.8

reference conditions

correspond to 15 °C, 1 013,25 mbar, unless otherwise specified

3.1.9

relative density

ratio of the masses of equal volumes of dry gas and dry air under the same conditions of temperature and pressure: 15 °C or 0 °C and 1 013,25 mbar.

Symbol: d

3.1.10

test gases

gases intended for the verification of the operational characteristics of appliances using combustible gases. They consist of the reference and the limit gases

3.1.11

test pressures

gas pressures used to verify the operational characteristics of appliances using combustible gases. They consist of normal and limit pressures

3.1.12

Wobbe index

ratio of the calorific value of a gas per unit volume and the square root of its relative density under the same reference conditions. The Wobbe index is said to be gross or net according to whether the calorific value used is the gross or net calorific value.

Symbol: gross Wobbe index: W_s

net Wobbe index: W_i

The Wobbe indices are expressed:

- either in megajoules per cubic metre (MJ/m³) of dry gas under the reference conditions;
- or in megajoules per kilogram (MJ/kg) of dry gas

3.2 Constituent parts of the boiler

3.2.1 Gas supply

3.2.1.1

gas circuit

assembly of parts of the boiler that carry or contain the combustible gas between the boiler gas inlet connection and the burner(s)

3.2.1.2

gas inlet connection

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

3.2.1.3

gas rate adjuster

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

The action of operating this component is called “adjustment of the gas rate”

3.2.1.4

injector

component that admits gas into the burner

3.2.1.5

primary aeration adjuster

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

3.2.1.6

putting an adjuster or a control out of service

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

3.2.1.7

range rating device

component on the boiler intended to be used by the installer to adjust the 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

3.2.1.8

restrictor

device with one or more orifices, 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 given rate

3.2.1.9

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).

A control or adjuster which is sealed is considered to be non-existent

3.2.1.10 Burners

3.2.1.10.1

alternating ignition burner

ignition burner which is extinguished as soon as ignition of the main burner is effected. It re-ignites at the main burner flame just before the latter goes out

3.2.1.10.2

automatic ignition device

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

3.2.1.10.3

ignition burner

burner intended to ignite a main burner

3.2.1.10.4

ignition device

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

3.2.1.10.5

intermittent ignition burner

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

3.2.1.10.6

interrupted ignition burner

ignition burner which operates only during the ignition sequence

3.2.1.10.7

main burner

burner that is intended to assure the thermal function of the boiler and is generally called "the burner"

3.2.1.10.8

manual ignition device

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

3.2.1.10.9

permanent ignition burner

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

3.2.1.10.10

premixed 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

3.2.2 Combustion circuit

3.2.2.1

combustion chamber

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

3.2.2.2

combustion products circuit

circuit including the combustion chamber, the heat exchanger and the circuit permitting evacuation of the combustion products to the flue, up to and including the flue outlet

3.2.2.3**damper**

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

3.2.2.4**draught diverter**

device, placed in the combustion products circuit of the 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

3.2.2.5**flue outlet**

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

3.2.2.6**flue stabilizer**

opening in the combustion products circuit which serves to stabilize the flow of combustion products.

It is fitted with a device which monitors the evacuation of combustion products in order to maintain the quality of combustion within certain limits and to keep the combustion stable under certain conditions of updraught and downdraught

3.2.3 Adjusting, control and safety devices**3.2.3.1****adjustable control thermostat**

control thermostat that permits the operator to adjust setting temperatures between a minimum and a maximum value

3.2.3.2**adjustable pressure regulator**

pressure regulator fitted with a means of adjusting the adjuster of the downstream pressure.

This means is considered as an “adjusting device”

3.2.3.3**automatic burner control system**

system that comprises a programming unit and all the elements of a flame detector. All the functions of an automatic burner control system may be assembled in one or more housings

3.2.3.4**automatic shut-off valve**

valve which opens when energized and closes automatically when de-energized

3.2.3.5**breather hole**

orifice that allows atmospheric pressure to be maintained in a compartment of variable volume

3.2.3.6**closure member**

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

3.2.3.7**control knob**

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

3.2.3.8

control thermostat

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

3.2.3.9

diaphragm

flexible component that operates a valve or a switch by means of forces resulting from a pressure difference

3.2.3.10

device monitoring the air supply or combustion products evacuation

device intended to cause safety shutdown in the event of abnormal conditions of air admission or of combustion products evacuation for boilers with a flue stabilizer

3.2.3.11

external soundness

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

3.2.3.12

flame detector

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

NOTE 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

3.2.3.13

flame signal

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

3.2.3.14

flame simulation

condition which occurs when a flame signal is given by the flame detector although in reality there is no flame

3.2.3.15

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

3.2.3.16

gas/air ratio control

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

3.2.3.17

high pressure cut-off device

device that shuts off the gas supply when the upstream pressure or the burner supply pressure rises above a predetermined value

3.2.3.18

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

3.2.3.19

low pressure cut-off device

device that shuts off the gas supply when the upstream pressure falls below a predetermined value

3.2.3.20**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

3.2.3.21**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

3.2.3.22**programme**

sequence of control operations determined by the programming unit involving switching on, supervising and switching off the burner

3.2.3.23**programming unit**

device that reacts to impulses from control and safety systems, gives control commands, controls the start-up programme, supervises the burner operation and causes controlled shutdown, safety shutdown and lockout if necessary.

NOTE The programming unit follows a predetermined sequence of actions and operates in conjunction with the flame detector

3.2.3.24**safety temperature limiter**

device that causes safety shutdown and non-volatile lockout so as to prevent the water temperature exceeding a preset limit

3.2.3.25**sealing force**

force acting on the valve seat when the closure member is in the closed position, independent of any force provided by gas pressure

3.2.3.26**start signal**

signal causing the boiler to leave its start position and the predetermined programme of the programming unit to commence

3.2.3.27**temperature sensing element; sensor**

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

3.2.3.28**volume regulator**

device which maintains a rate between fixed limits, independent of upstream and downstream pressures, within a range of given values

3.2.3.29**water rate monitoring device**

device that shuts off the gas supply to the main burner when the water rate through the boiler is less than a predetermined value and automatically reopens the gas supply when the water rate reaches this value

3.3 Operation of the boiler

3.3.1 Gas rates

3.3.1.1

heat input

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)

3.3.1.2

ignition rate

average heat input during the ignition safety time.

Symbol: Q_{ign}

Unit: kilowatt (kW)

3.3.1.3

mass flow rate

mass of gas consumed by the appliance in unit time during continuous operation.

Symbol: M (under test conditions);

M_r (under reference conditions)

Unit: kilograms per hour (kg/h) or grams per hour g/h

3.3.1.4

nominal heat input ¹⁾

value of the heat input declared by the manufacturer.

Symbol: Q_n

Unit: kilowatt (kW)

3.3.1.5

volumetric rate

volume of gas consumed by the appliance in unit time during continuous operation.

Symbol: V (under test conditions);

V_r (under reference conditions)

Unit: cubic metres per hour (m³/h)

¹⁾ Boilers fitted with a range-rating device operate at a nominal heat input between the maximum and minimum adjustable heat inputs. Modulating boilers operate between the nominal heat input and the minimum controlled heat input.

3.3.2 Outputs

3.3.2.1

nominal output

useful output stated by the manufacturer.

Symbol: P_n

Unit: kilowatt (kW)

3.3.2.2

useful output

quantity of heat transmitted to the heat carrier in unit time.

Symbol: P

Unit: kilowatt (kW)

3.3.3

useful efficiency

ratio of the useful output to the heat input.

Symbol: η_u

Unit: percent (%)

3.3.4 Gas combustion

3.3.4.1

combustion

combustion is said to be “complete” if there are no more than traces of combustible constituents (hydrogen, hydrocarbons, carbon monoxide, carbon etc.) in the combustion products.

Conversely, combustion is said to be “incomplete” if at least one combustible constituent is present in significant proportions in the combustion products.

The amount of carbon monoxide, CO, in the dry, air-free combustion products is used as the criterion to distinguish between “hygienic” and “non-hygienic” combustion.

This European Standard specifies maximum CO limits according to the circumstances of use or of test. In each case, the combustion is regarded as hygienic if the CO concentration is below or equal to the permitted limit but non-hygienic if it is above the limit

3.3.4.2

condensate

liquid formed from the combustion products during the condensation process

3.3.4.3

flame lift

phenomenon characterized by the total or partial lifting of the base of the flame away from the burner port or the flame holding zone

3.3.4.4

flame stability

characteristic of flames which remain on the burner ports or in the flame retention zone

3.3.4.5

light-back

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

3.3.4.6

light-back at the injector

phenomenon characterized by ignition of the gas at the injector, either as a result of light back into the burner or of the propagation of a flame outside the burner

3.3.4.7

sooting

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

3.3.4.8

yellow tipping

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

3.3.5 Times

3.3.5.1

extinction delay time (T_{IE})

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

3.3.5.2

extinction safety time (T_{SE})

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

3.3.5.3

ignition opening time (T_{IA})

for a 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

3.3.5.4

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 no flame being detected

3.3.5.5

maximum ignition safety time ($T_{SA,max}$)

ignition safety time measured under the least favourable conditions of ambient temperature and variation in supply voltage

3.3.6

spark restoration

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

3.3.7

automatic recycling

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

3.3.8**controlled shutdown**

process by which the control device (on the boiler or external to it) causes the gas supply to the burner to be stopped immediately the boiler returns to its start position

3.3.9**safety shutdown**

process which is initiated immediately in response to the signal from a limiting device or sensor and which causes the burner to shut down; the boiler returns to its start position

3.3.10 Locking out**3.3.10.1****lockout**

total interruption of the gas supply

3.3.10.2**non-volatile lockout**

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

3.3.10.3**volatile lockout**

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

3.3.11**de-energized to trip principle**

principle according to which neither auxiliary energy nor external action is required to activate a safety device

3.3.12**nominal voltage**

voltage or range of voltages stated by the manufacturer at which the boiler can operate normally

3.3.13**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:

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

4 Classification of boilers**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.

The applicable categories for each country are given in Annex A.

4.2 Classification according to the mode of evacuation of the combustion products

4.2.1 General

Boilers are classified into several types according to the mode of evacuation of the combustion products and admission of the combustion air, as described in CEN/TR 1749²⁾.

4.2.2 Type B

4.2.2.1 General

A boiler intended to be connected to a flue which evacuates the products of combustion to the outside of the room containing the boiler. The combustion air is drawn directly from the room.

4.2.2.2 Type B₁

Type B boiler incorporating a draught diverter.

4.2.2.3 Type B₁₁

Natural draught type B₁ boiler.

4.2.2.4 Type B₁₂

Type B₁ boiler designed for a natural draught flue incorporating a fan downstream of the combustion chamber/heat exchanger and upstream of the draught diverter.

4.2.2.5 Type B₁₃

Type B₁ boiler designed for a natural draught flue incorporating a fan upstream of the combustion chamber/heat exchanger.

4.2.2.6 Type B₁₄

Type B₁ boiler having an integral fan downstream of both the combustion chamber/heat exchanger and the draught diverter.

4.2.2.7 Type B₂

Type B boiler without a draught diverter.

4.2.2.8 Type B₂₂

Type B₂ boiler incorporating a fan downstream of the combustion chamber/heat exchanger.

4.2.2.9 Type B₂₃

Type B₂ boiler incorporating a fan upstream of the combustion chamber/heat exchanger.

²⁾ "European scheme for the classification of gas appliances according to the method of evacuation of the products of combustion (types)"

4.3 Classification according to operating conditions³⁾

4.3.1 Standard boiler

Boiler for which the average water temperature can be restricted by design.

4.3.2 Low-temperature boiler

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

NOTE This is the wording of the definition in the BED, except the last part which reads 'including condensing boilers using liquid fuel'.

4.3.3 Gas condensing boiler⁴⁾

Boiler designed to condense permanently a large part of the water vapour contained in the combustion products.

4.4 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.

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

5 Constructional requirements

5.1 General

Unless otherwise indicated, constructional requirements are checked by examination of the boiler and its technical documentation.

5.2 Conversion to different gases

The following operations are permitted when converting from a gas of one group or family to a gas of another group or family:

- adjustment of the gas rate to the main burner and the ignition burner;
- change of injectors or restrictor;
- change of ignition burner or its components;
- change of system which modulates the gas rate;
- putting out of service and sealing of an adjuster and/or a regulator.

³⁾ These definitions are in accordance with 92/42/EEC, however in this standard, definition 4.3.2 is limited to gas.

⁴⁾ Specific requirements and test methods for condensing boilers with heat inputs exceeding 300 kW subject of the draft standard EN 15417. To be discussed because EN 15417 covers boilers of 70 to 1000 Kw..

These operations shall be possible without having to interfere with the connections of the boiler to its pipe work (gas, water, flue system).

5.3 Materials and method of construction

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, materials shall be appropriate for their intended purpose and shall withstand the mechanical, chemical and thermal conditions to which they will foreseeably be subjected.

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

Materials containing asbestos are forbidden.

Hard solder containing cadmium in its formulation shall not be used.

If there is a risk of condensation in the combustion products circuit, 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.

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

5.3.2 Materials and thicknesses of walls or tubes under water pressure

5.3.2.1 General

The materials and the thicknesses of walls under pressure shall comply with 5.3.2.2, 5.3.2.3 and 5.3.2.4. If other materials and/or thicknesses are used, the manufacturer shall provide appropriate justification for their suitability of use.

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:

- steels that have the properties and composition detailed in Table 1;
- cast irons that have the mechanical properties detailed in Table 2;
- non-ferrous materials detailed in Table 3 and Table 4.

Table 1 — Mechanical properties and chemical compositions of carbon and stainless steels

Materials	Steel type	Mechanical properties				Chemical compositions									
		Tensile strength	Yield point	Breaking elongation	Breaking elongation	% by mass									
		R_m	$R_{oH}/R_p 0,2$	A_{long}	A_{transv}	C	P	S	Si	Mn	Cr	Mo	Ni	Ti	Nb/Ta
				at $L_o = 5 d_o$	at $L_o = 5 d_o$										
		N/mm ²	N/mm ²	%	%										
Pipes, sheets	carbon	≤ 520	≤ 0,7 ^a	≥ 20	-	≤ 0,25	≤ 0,05	≤ 0,05	--	--	--	--	--	--	--
	ferritic	≤ 600	≥ 250	≥ 20	≥ 15	≤ 0,08	≤ 0,045	≤ 0,030	≤ 1,0	≤ 1,0	15,5 to 18	≤ 1,5	--	≤ 7 × % C	≤ 12 × % C
	austenitic	≤ 800	≥ 180	≥ 30	≥ 30	≤ 0,08	≤ 0,045	≤ 0,030	≤ 1,0	≤ 2,0	16,5 to 20	2,0 to 3,0	9 to 15	≤ 5 × % C	≤ 8 × % C

^a Ratio yield point - tensile strength. An adequate high temperature yield point for the highest possible temperature of the components shall be guaranteed.

Table 2 — Minimum requirements for cast iron

Flake graphite cast iron (EN 1561)	
Tensile strength R_m	> 150 N/mm ²
Brinell hardness	160 HB to 220 HB 2,5/187,5
Spheroidal graphite cast iron (annealed ferritic):	
Tensile strength R_m	> 400 N/mm ²
Notch impact strength	> 23 J/cm ²

Table 3 — Aluminium and aluminium alloy parts

	Tensile strength	Temperature range
	R_m	°C
	N/mm ²	
Al 99,5	≥ 75	≤ 300
Al Mg2 Mn 0,8	≥ 275	≤ 250

Table 4 — Copper or copper alloy parts

	Tensile strength	Temperature range
	R_m	
	N/mm ²	°C
SF - Cu	≥ 200	≤ 250
Cu Ni 30 Fe	≥ 310	≤ 350

5.3.2.3 Thicknesses

The minimum wall thicknesses are given in Table 5 and Table 6. For rolled steel the tolerances shall be as given in EN 10029.

Table 5 — Minimum thicknesses for rolled parts

	Carbon steels, aluminium	Protected steels, stainless steels, copper
	mm	mm
Walls of the combustion chamber in contact with fire and water and flat walls of convection heating surfaces	6	4
Walls in contact only with water and rigidly formed (e.g. corrugated) convection heating surfaces outside the combustion chamber	5	2
Pipes used in the convection part of the heat exchanger	2,9	1

Table 6 — Nominal thicknesses of boiler sections of cast materials

Flake graphite cast iron, aluminium	Spheroidal graphite (annealed ferritic) cast iron, copper
5,5 mm	5,0 mm

The thicknesses of cast walls given in the production drawings shall not be less than the nominal minimum thicknesses given in Table 6 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 under 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 materials in accordance with Table 1 are suitable for welding and do not require additional heat treatment after welding.

Welded seams shall show no cracks or bonding faults and shall be defect free over the whole cross-section for butt welds.

One sided fillet welds and half Y-welds which have not been welded through shall be kept substantially free from bending stresses. Smoke tubes, inserted stays and similar components need not be counter-welded. Double fillet welds are only permissible when sufficiently cooled. Projections into the flue gas side in areas of high thermal stresses shall be avoided.

Corner welds, edge welds and similar welded connections which are subjected to high bending stresses during production and operation are to be avoided.

For welded in longitudinal stay bars or stay tubes the shearing cross-section of the fillet weld should be 1,25 times the required stay bar or stay tube cross-sectional area.

See Table 7 for details on the welding seams mentioned. Welding fillers shall be suitable for the material being used.

The terms given in Table 7 are in accordance with EN 22553; the reference numbers of welding processes are in accordance with ISO 857-1 and EN ISO 4063, as appropriate.

Table 7 — Weld joints and welding processes

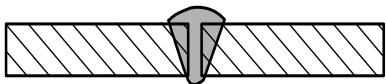
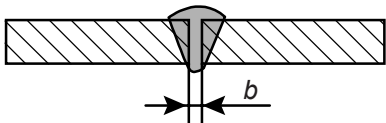
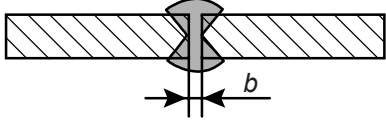
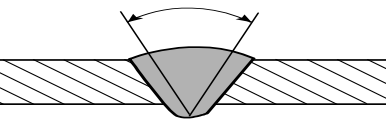
No	Weld joint type	Material thickness	Welding process ^a	Remarks
		t		
		mm		
1.1	Square butt weld  	≤ 6	135	Permissible up to $t = 8$ mm on use of deep penetration electrodes or welding on both sides
		(8)	12	
			131	
			(111)	
1.2	Square butt weld 	≥ 6 ≤ 12	12	Root gap $b = 2$ mm to 4 mm with stiffener, powder holder necessary
1.3	Square butt weld (double) 	> 8	135	Root gap $b = 2$ mm to 4 mm
		≤ 12	12	Deep penetration electrodes shall be used for manual electro welding
			(111)	
1.4	Single-V butt weld 	≤ 12	(111)	Seam preparation V-seam 60°

Table 7 — Weld joints and welding processes

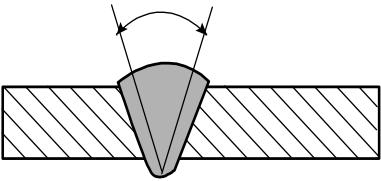
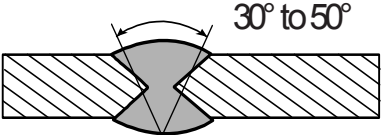
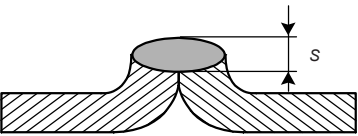
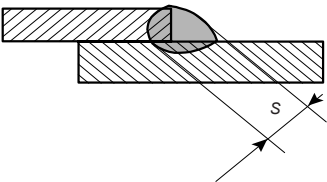
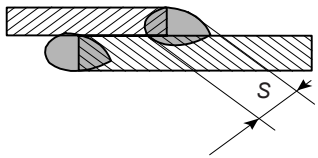
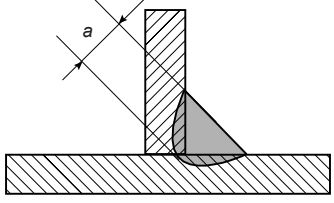
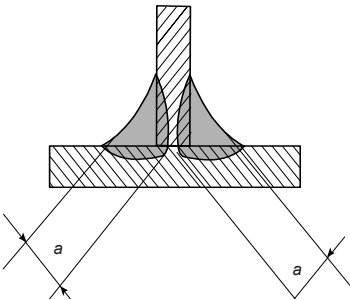
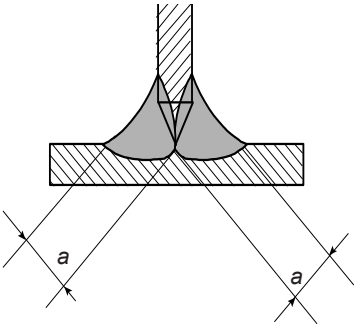
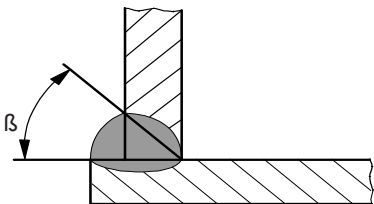
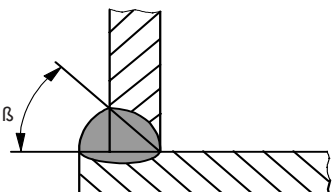
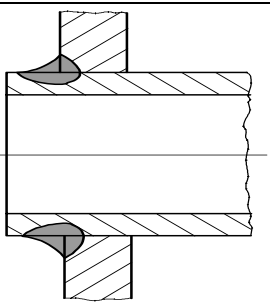
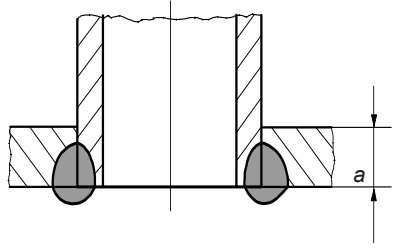
No	Weld joint type	Material thickness	Welding process ^a	Remarks
		t		
		mm		
1.5	Single-V butt weld 	≤ 12	135 12	Seam preparation V-seam 30° to 50° depending on thickness of material
1.6	Double-V butt weld 	> 12	135	Seam preparation double V-seam 30° to 50° depending on material thickness
			12	
1.7	Butt weld between plates with raised edges 	≤ 6	135	Only permissible in exceptional cases for parts welded in
			141	Moreover, the welds have to be kept largely free from bending stresses
			131	Not suitable for directly fired wall parts
			(111)	$s = 0,8 t$
1.8	Overlap welding 	≥ 6	135	Welds of this type are to be kept largely free from bending stresses
			12	Not suitable for directly fired wall parts
				$s = t$
1.9	Overlap welding (cont)	≤ 6	135	Not suitable for directly fired wall parts

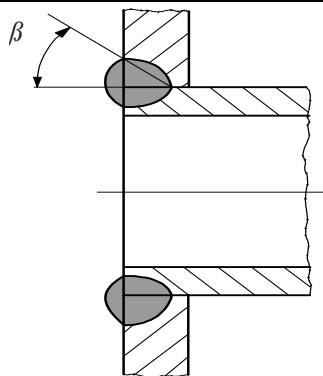
Table 7 — Weld joints and welding processes

No	Weld joint type	Material thickness	Welding process ^a	Remarks
		t		
		mm		
			12 (111)	$s = t$
2				
		≤ 6	135	Welds of this type are to be kept largely free from bending stresses
			12	$a = t$
			(111)	

2.1	Double fillet weld 	≤ 12	135	$a = t$
			12	
			(111)	
		> 12	135	$a = 2/3 t$
			12	
			(111)	

2.2	Double-bevel butt weld 	≤ 12	135	$a = t$
			12	
			(111)	
		> 12	135	$a = 2/3 t$
			12	
			(111)	

2.3	Single bevel butt weld 	≤12	135	for (111) $\beta = 60^\circ$
			12	for 135, 12 $\beta = 45^\circ$ to 50°
			(111)	
		> 12	135	
			12	
2.4	Single-bevel butt weld 	≤ 12	135	for (111) $\beta = 60^\circ$
			12	for 135, 12 $\beta = 45^\circ$ to 50°
			(111)	
2.5		≤ 12	135	Tube ends shall not project beyond fillet weld if it is subjected to heat radiation
			(111)	
2.6		≤ 6	135	Welding in of tube under high thermal stress $a \geq t$
			(111)	

2.7			135	Welding in of tube under high thermal stress
			(111)	For (111) $\beta = 60^\circ$ For 135 $\beta = 45^\circ$ to 50°
a Reference numbers of welding processes in accordance with ISO 857-1 or EN ISO 4063:				
Reference number	Process			
12	Submerged arc welding			
111	Metal-arc welding with covered electrode			
131	Metal-arc inert gas welding; MIG welding			
135	Metal-arc-active gas welding; MAG welding			
141	Tungsten inert gas arc welding TIG welding			

5.3.3 Thermal insulation

Any thermal insulation shall withstand a temperature of at least 120 °C without deformation and shall retain its insulating properties under the influences of heat and ageing.

The insulation shall withstand the normally expected thermal and mechanical stresses.

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

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

If flame 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 Design

5.4.1 General

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

For standard boilers that are designed not to give rise to condensation, there shall be no indication of condensation at the operating temperatures provided by the controls.

Low-temperature boilers are considered to be designed to give rise to condensation.

If condensation is produced at start-up, this shall not:

- affect the operational safety;
- drop outside the appliance.

Constructional parts accessible during use and maintenance shall be free from sharp edges and corners that might cause damage or personal injury during use and servicing.

5.4.2 Modular boilers

Each module shall be fitted with its own control system and automatic valves, including flame safeguard equipment, control thermostat and safety temperature limiter. The requirements in relation to control and safety devices depend on the nominal heat input (Q_n) of the module (e.g. when $Q_n \leq 70$ kW, the requirements shall be those of EN 297 and when $Q_n > 70$ kW but less than 300 kW, the requirements shall be those of EN 656, where relevant).

Where it is possible to close off the water flow to individual modules, it shall not be possible to operate the isolated module(s) unless provision is made for the modules to be installed in a manner similar to individual boilers.

5.5 Use and servicing

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:

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

All markings intended for 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.

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 by mechanical means or to remove them easily for cleaning: this shall not involve disconnection of the boiler from the gas or water pipes, or the use of other than commercially available tools. The gas circuit shall be designed so as to permit separate disconnection of the burner or of the whole burner and control assembly.

5.6 Connections to the gas and water pipes

5.6.1 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 be adequate to allow easy use of the tools required to make the connection. It shall be possible to make all the connections without special tools.

5.6.2 Connections to the gas pipe

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

If the boiler has a threaded connection, this thread shall comply with EN ISO 228-1 or ISO 7-1. 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 1092-1, EN 1092-2 or EN 1092-3, as appropriate, and the manufacturer shall provide the counter-flanges and sealing gaskets.

The conditions of connections prevailing in the various countries are given in A.5.

5.6.3 Connections to the central heating circuit

Threaded connections shall comply with EN ISO 228-1 or ISO 7-1.

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.

5.7 Soundness

5.7.1 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 adhesive.

5.7.2 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.

The soundness of parts likely to be removed during routine servicing shall be achieved by mechanical means, excluding pastes, liquids and tapes. The replacement of seals in accordance with the manufacturer's instructions is permitted.

5.8 Supply of combustion air and the evacuation of the combustion products

5.8.1 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:

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

5.8.2 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.

5.8.3 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:

- supervision of the combustion air pressure or the combustion products pressure;
- supervision of the combustion air rate or the combustion products rate;
- automatic gas/air ratio control;
- 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.

5.8.4 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 12067-1.

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

Control tubes may be made of metal with suitable mechanical connections or of other materials with at least equivalent properties. In this case, they are considered immune to breakage, accidental disconnection and leakage after initial soundness checks. As such, they are not subject to the tests in 7.5.5.4.1.

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.

5.8.5 Condensate discharge

For low-temperature boilers a means of condensate discharge shall be provided if the condensate:

- impairs safety or correct operation;
- results in spillage from the appliance;
- causes deterioration of materials.

A pipe or pipes shall be used to discharge condensate when this is necessary. The internal diameter of the outside connection of the condensate discharge system shall be at least 13 mm.

The disposal system, forming part of the boiler or supplied with the boiler, shall be such that:

- it can be easily inspected and cleaned in accordance with the manufacturer's instructions;
- it cannot transmit combustion products into the room where the boiler is installed; this requirement is satisfied if the disposal system incorporates a water trap;
- a water trap has a seal of at least 25 mm at the maximum pressure in the combustion chamber for the maximum pressure at the outlet as specified by the manufacturer according to the connecting conditions to the duct for the evacuation of the combustion products.

5.9 Checking the state of operation

The ignition and operation of the burner(s) and also the length of the flame(s) of the ignition burner, if any, shall be observable visually by the installer. The momentary opening of a door or the removal of a case shall not disturb the operation of the burners.

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.

5.10 Drainage

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

5.11 Electrical equipment

The electrical equipment shall comply with the requirements of EN 50165 except where reference is made to another electrical standard in 5.13.

If the boiler is fitted with electronic components or electronic systems providing a safety function, these shall comply with the relevant requirements of EN 298 with regard to electromagnetic compatibility immunity levels.

If the manufacturer specifies the nature of the electrical protection of the boiler on the data plate, this specification shall comply with EN 60529:

- to give the degree of personal protection against contact with dangerous electrical components inside the boiler case;
- to give the degree of electrical protection inside the boiler case, against harmful actions due to water penetration.

Where a three-phase supply is used, all control and safety devices shall be supplied by the same single-phase conductor which shall be identifiable without any possible ambiguity.

5.12 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 abnormal fluctuations or failure of the auxiliary energy, or following its restoration.

5.13 Adjusting, control and safety devices

5.13.1 General

Safety systems shall be designed in accordance with the de-energized to trip principle.

The operation of safety devices shall not be overruled by adjusting and control devices.

The design of the control and safety system shall be such that it is never possible to perform two or more actions which would be unacceptable in combination. The order of the actions shall be fixed in such a manner that it is not possible to change it.

All the following devices or the multifunctional control in which they might be fitted shall be removable or exchangeable if this is necessary for cleaning or replacement of the device. Adjusters for the devices shall not be interchangeable if this could result in confusion.

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

Control and safety devices shall comply with relevant CEN/TC 58 standards such as EN 88, EN 125, EN 126, EN 161, EN 257, EN 298, EN 12067-1, EN 12067-2 and EN 1643.

5.13.2 Adjusters and range rating devices

5.13.2.1 General

Adjusters shall be designed so that they are protected against accidental maladjustment by the operator once the appliance has been installed and put into service. It shall be possible to seal them (e.g. with paint) after adjustment; this sealing shall resist the heat to which it is subjected during normal operation of the boiler. Adjusting screws shall be located so 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.

5.13.2.2 Adjusters

Boilers shall be fitted with a gas rate adjuster and/or gas regulator.

An adjuster shall:

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

The adjusters shall be sealed by the manufacturer for boilers which are intended to operate on a gas of group 2E or 3 and include a pressure couple sign “+” (e.g. 2E+ or 3+).

5.13.2.3 Range rating devices

The boiler may have a range rating device.

If the gas rate adjuster and the range-rating device are one and the same, the manufacturer shall give suitable instructions for the use of the adjuster in his installation instructions.

5.13.3 Gas circuit

5.13.3.1 General

A device to protect against dust shall be positioned near the gas inlet. The maximum dimension of the mesh of the filter shall not exceed 1,5 mm; furthermore the mesh shall not allow passage of a 1 mm pin gauge.

5.13.3.2 Control devices

Every boiler shall be provided with at least one device that enables 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 signs shall be used:

- | | | | |
|---------------------------|---|----------------|---|
| — Off | : | Full disc | ● |
| — Ignition | : | Stylized star | ★ |
| — Full rate of the burner | : | Stylized 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 control to cut off the gas supply operates by turning, it shall turn off in a clockwise direction as seen by an observer facing the knob.

5.13.3.3 Composition of the gas circuit

The gas circuit shall be fitted with automatic shut-off valves in accordance with EN 161 and Table 8.

Valve proving systems shall comply with EN 1643.

Table 8 — Composition of the gas circuit

	Boiler without fan	Boiler with fan		
Heat input of the Individual gas line within the gas circuit		With pre-purge	Without pre-purge but with a valve proving system or permanent or alternating ignition flame	Without pre-purge
kW				
input ≤ 0,250	C ^a			C ^a
input ≤ 150	C ^{a b} + J			C ^{a b} + C or B + J
150 < input ≤ 300	B + C			B + B
300 < input ≤ 1 000	B + B			A + A
^a Or the valve of the flame supervision device.				
^b For heat inputs ≤ 1 000 W which meet the criteria of 6.5.3.3.1 second paragraph, only one Class C valve is needed.				

Safety devices which require non-volatile lockout to occur shall give rise to simultaneous signals 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 at least Class C (B for > 150 kW and A for > 300 kW).

In response to a control device, if the delay between the orders 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 G.

5.13.4 Gas pressure regulator

The gas regulator, if fitted, shall comply with EN 88.

Boilers using first and second family gases shall be fitted with a regulator. For boilers using third family gases this regulator is optional.

A regulator intended for operation with a pressure couple shall be adjusted or shall be capable of adjustment, so that it cannot operate between the two normal pressures.

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

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

5.13.5 Ignition devices

5.13.5.1 Ignition of the ignition burner

It shall be possible to light, in a simple manner, ignition burners that are directly ignited by hand.

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.

5.13.5.2 Ignition device for the main burner

Main burners shall be fitted with an ignition burner or a device for direct ignition.

Direct ignition shall not cause deterioration of the burner.

5.13.5.3 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 gas rate of the ignition burner is not governed, a gas rate adjuster is mandatory for boilers operating on first family gases, optional for second family gases and third family gases without a pressure couple. 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.

5.13.5.4 Direct ignition

Direct ignition devices shall ensure safe ignition even if the voltage is varied from 85 % to 110 % of the nominal voltage. The order to energize 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-energized no later than at the end of the ignition safety time.

5.13.6 Flame supervision systems

5.13.6.1 General

The presence of a flame shall be detected:

- either by a thermoelectric flame supervision device,
- or by the flame detector of an automatic burner control system.

At least one flame detector is required.

Where the main burner is ignited by an ignition burner, the presence of the ignition burner flame shall be detected before gas is admitted to the main burner.

5.13.6.2 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 shut-off valve.

The device shall include:

- either an ignition interlock,
- or a restart interlock.

It is permitted to use a burner ≤ 150 kW using a thermo-electric flame supervision device provided that the additional heat input is supervised by an automatic burner control system (see 6.5.3.3).

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

In the case of recycling a waiting time of at least 30 s shall be included for appliances without a fan.

5.13.7 Thermostats and water temperature limiting devices

5.13.7.1 General

Boilers shall be fitted with at least:

- an adjustable or fixed control thermostat (in accordance with 5.13.7.2), and
- a safety temperature limiter (in accordance with 5.13.7.3).

5.13.7.2 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 of the temperature range. 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 shutdown before the water flow temperature exceeds 105 °C.

5.13.7.3 Safety temperature limiter

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

This device shall cause non-volatile lockout before the water flow temperature exceeds 110 °C.

Normal operation of the boiler shall not give rise to a change in the set-point temperature of the device. However, 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.