

Gas-fired storage water heaters for the production of domestic hot water

The European Standard EN 89:1999, with the incorporation of amendments A1:1999, A2:2000, A3:2006 and A4:2006, has the status of a British Standard

ICS 91.140.65

National foreword

This British Standard was published by BSI. It is the UK implementation of EN 89:1999, incorporating amendments A1:1999, A2:2000, A3:2006 and A4:2006.

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

Note that amendment A1:1999 to EN 89:1999 was incorporated into this British Standard at the time of its initial publication. Amendment A2:2000 to EN 89:1999 has been incorporated into this British Standard as Amendment No. 1 to BS EN 89:2000.

BS EN 89:2000 supersedes BS 5258-7:1977 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GSE/34, Gas water heaters.

A list of organizations represented on GSE/34 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.

Compliance with a British Standard cannot confer immunity from legal obligations.

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English version

Gas-fired storage water heaters for the production of domestic hot water

Appareils de production d'eau chaude par accumulation
pour usages sanitaires utilisant les combustibles gazeux

Gasbeheizte Vorrats-Wasserheizer für den sanitären
Gebrauch

This European Standard was approved by CEN on 12 June 1997.

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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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 48 "Domestic gas-fired water heaters", the Secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2000, and conflicting national standards shall be withdrawn at the latest by April 2000.

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 Directive(s), see informative Annex ZA, which is an integral part of this standard.

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

It was prepared to deal with aspects relating to :

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

The "normative" annexes are an integral part of the standard. The "informative" annexes are given only for information. In this standard, Annexes B, C, E and J are normative and Annexes A, D, F, G, H, K, L and ZA are informative.

This standard covers type testing only.

In particular, matters which relate to quality assurance systems, production tests and certification of conformity of auxiliary devices are not dealt with by this standard.

If the manufacturer indicates that the appliance has been tested in accordance with EN 89, the appliance shall conform completely to the requirements of this standard.

Type B₁₁ appliances shall be fitted with a combustion products discharge safety device. In this standard, these appliances are identified as being of type B_{11BS}.

However, appliances intended to be installed :

- either in the open air ;
- or in a room separated from living rooms and provided with appropriate ventilation directly to the outside;

need not have this safety device, but in this case, appropriate warnings on the packaging and in the instructions shall clearly indicate the limit on the use of this type of appliance. In this standard, the appliance is designated as type B₁₁.

In respect of potential adverse effects on the quality of water intended for human consumption, caused by the product covered by this standard :

a) this standard provides no information as to whether the product may be used without restriction in any of the Member States of the EU or EFTA ;

b) it should be noted that, while awaiting the adoption of verifiable European criteria, existing national regulations concerning the use and/or the characteristics of this product remain in force.

The following amendments are being prepared and will subsequently supplement EN 89 :

- amendment EN 89 A1 for appliances with burners with a fan ;
- amendment EN 89 prA2 on requirements for combustion products discharge orifice closure devices.

Foreword to amendment A1

This amendment EN 89:1999/A1:1999 to EN 89:1999 has been prepared by Technical Committee CEN/TC 48 "Domestic gas-fired water heaters", the Secretariat of which is held by AFNOR.

This amendment to the European Standard EN 89:1999 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2000, and conflicting national standards shall be withdrawn at the latest by April 2000.

This amendment to the European Standard EN 89:1999 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).

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

This amendment gives the additions, alterations, deletions to cover type tests of appliances equipped with a fan incorporated in the combustion air intake circuit or combustion products evacuation circuit.

Foreword to amendment A2

This amendment EN 89:1999/A2:2000 to EN 89:1999 has been prepared by Technical Committee CEN/TC 48, Domestic gas-fired water heaters, the Secretariat of which is held by AFNOR.

This amendment to the European Standard EN 89:1999 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2001, and conflicting national standards shall be withdrawn at the latest by February 2001.

This amendment to the European Standard EN 89:1999 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).

According to the CEN/CENLEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

This amendment to the European Standard EN 89:1999 modifies the standard by providing for the type testing of water heaters fitted or intended to be fitted with an electrically operated flue damper.

Foreword to amendment A3

This document (EN 89:1999/A3:2006) has been prepared by Technical Committee CEN/TC 48 “Domestic gas-fired water heaters”, the secretariat of which is held by AFNOR.

This Amendment to the European Standard EN 89:1999 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2007, and conflicting national standards shall be withdrawn at the latest by April 2007.

The object of this amendment to EN 89 is to indicate additions, modifications and deletions to this standard relating to:

- measurement of NO_x emissions of on/off water heaters;
- alignment of some requirements and tests for type C water heaters with those defined in EN 483.

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.

Foreword to amendment A4

This document (EN 89:1999/A4:2006) has been prepared by Technical Committee CEN/TC 48 “Domestic gas-fired water heaters”, the secretariat of which is held by AFNOR.

This Amendment to the European Standard EN 89:1999 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2006, and conflicting national standards shall be withdrawn at the latest by May 2006.

This amendment includes requirements relative to the metallic, plastic and other non-metallic materials that are used in water heaters and which come into contact with water intended for human consumption. It is intended to ensure that products of this kind complying with these requirements meet current technological development and requirements which will result from the application of the EAS (European Approval Scheme) of the European Commission, with regard to the service life of the water heaters and their physiological suitability.

NOTE As long as no European regulations are enforced (EAS) national regulations in force.

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 defines the specifications and test methods for the construction, safety, rational use of energy and fitness for purpose, environment and classification and marking of gas-fired storage water heaters for domestic hot water uses, hereafter called "appliance". Requirements on NO_x emissions measurement for modulating water heaters are not included in this amendment.

This standard applies to appliances :

- of types B₁₁, B_{11BS}, C₁₁, C₂₁, C₃₁, C₅₁, C₇₂, C₈₁ connected to an individual flue duct, C₈₂ and C₈₃;
- fitted with atmospheric burners ;
- using one or more combustible gases corresponding to the three gas families and the pressures indicated in EN 437 ;
- of nominal heat input not exceeding 150 kW (net calorific value) ;
- using or not the water condensation heat in the combustion products ;
- appliances whether subject to the water mains pressure or open-circuit;
- fitted with electrically operated mechanical flue dampers that are positioned downstream of the heat exchanger and tested as an integral part of the water heater.

This standard does not contain all the requirements necessary for :

- appliances intended to be connected to a mechanical means of evacuating the combustion products ;
- appliances which fulfill a dual role of space heating and heating water for domestic hot water use ;
- appliances with a combustion products discharge safety device other than that for type B_{11BS} appliances.

Scope to amendment A1

This amendment completes EN 89 : Gas-fired storage water heaters for the production of domestic hot water used with sealed combustion circuit with a fan incorporated in the combustion air circuit or combustion products evacuation circuit, or total premix burner circuit.

This amendment does not contain all the necessary requirements to make it applicable to appliances with a variable combustion air flow rate.

It is applicable to Type C₁₂, C₁₃, C₃₂, C₃₃, C₄₂, C₄₃, C₅₂, C₅₃, C₆₂, C₆₃ appliances.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

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

EN 125, *Specification for flame supervision devices for gas burning appliances - Thermoelectric types.*

- EN 126, *Multifunctional controls for gas burning appliances.*
- EN 161, *Automatic shut-off valves for gas burners and gas appliances.*
- EN 298, *Automatic gas burner systems for gas burners and gas burning appliances with or without fans.*
- EN 437, *Test gases, test pressures, appliance categories.*
- EN 549, *Rubber materials for seals and diaphragms for gas appliances and equipment.*
- EN 60335-1:1988, *Safety of household and similar electrical appliances - Part 1 : General requirements.*
- EN 60730-2-9, *Automatic electrical controls for household and similar use - Part 2 : Particular requirements for temperature sensing controls.*
- EN 60529, *Degrees of protection provided by enclosures (IP code).*
- prEN 1487, *Building valves - Hydraulic Safety groups - Characteristics and tests.*
- prEN 1490, *Building valves - Combined temperature and pressure relief valves - Characteristics and tests.*
- prEN 50165, *Electrical equipment of non-electric heating appliances for household and similar appliances - Safety requirements.*
- ISO 7-1, *Pipe threads where pressure-tight joints are made on the threads - Part 1 : Designation, dimensions and tolerances.*
- ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads - Part 1 : Designation, dimensions and tolerances.*
- ISO 262, *ISO general purpose screw threads - Selected sizes for screws, bolts and nuts.*
- ISO 274, *Copper tubes of circular section – Dimensions.*
- ISO 301, *Zinc alloy ingots intended for casting.*
- ISO 3166, *Codes for the representation of names of countries.*
- ISO 7005, *Metallic flanges.*
- IEC 335-2-14, *Safety of household and similar electrical appliances - Part 2 : Particular requirements for electric kitchen machines.*
- IEC 479-1, *Effects of current on human beings and livestock - Part 1 : General aspects.*
- IEC 479-2, *Effects of current passing through the human body - Part 2 : Special aspects - Chapter 4: Effects of alternating current with frequencies above 100 Hz - Chapter 5: Effects of special wave forms of current - Chapter 6: Effects of unidirectional single currents of short duration.*
- Ⓐ CR 1404, *Determination of emissions from appliances burning gaseous fuels during type-testing.* Ⓐ

3 Terms and definitions

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

3.1 water heater

3.1.1 storage water heater

an appliance which heats and stores a quantity of water contained in a vessel at a pre-set temperature and which has the heating source located inside the vessel

3.1.2

fixed temperature storage water heater

an appliance fitted with a non-adjustable thermostat which controls the water temperature to a given setting

3.1.3

adjustable temperature storage water heater

an appliance fitted with a thermostat controlling the water temperature with the set point value of this device being adjustable between two values, one being the minimum and the other the maximum

3.1.4

open storage water heater

an appliance with a vent to the atmosphere

3.1.5

closed storage water heater

an appliance which has no vent to the atmosphere

3.1.6

condensing storage water heater

an appliance in which, under normal operating conditions and for certain operation temperatures, the water vapour of the combustion products is partially condensed in order to use the latent heat of this water vapour to produce heat

3.2

characteristics of the gas and electricity supplies

3.2.1

reference conditions

dry gas at a temperature of 15 °C, at an absolute pressure of 1 013,25 mbar

3.2.2

test gases

gases intended to check the operational characteristics of the appliances using combustible gases. They comprise reference and limit gases

3.2.2.1

reference gases

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

3.2.2.2

limit gases

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

3.2.3

calorific value

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

A distinction is made between two types of calorific value :

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

Symbol: H_g

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

Symbol: H_i

Units :

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

Only the net calorific value is used in this standard.

3.2.4

relative density

the ratio of the masses of equal volumes of gas and dry air under reference conditions

Symbol : d

3.2.5

Wobbe number

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

Symbols :

- gross Wobbe number : W_s
- net Wobbe number : W_i

Units :

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

3.2.6

gas pressures

Symbol : p

Unit: millibar (mbar)

NOTE 1 1 mbar = 10^2 Pa.

NOTE 2 A the pressures are static pressures of the moving gas, relative to the atmospheric pressure, measured at right angles to the direction of flow of the gas.

3.2.6.1

test pressures

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

3.2.6.2

normal pressure

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

Symbol : p_n

3.2.6.3

limit pressures

pressures representative of the extreme variations in the appliance supply conditions

Symbols :

- maximum pressure: p_{max}
- minimum pressure: p_{min}

3.2.6.4

pressure couple

a set of two distinct gas distribution pressures applied because of the big difference that exists between the Wobbe numbers within a single family or group :

- the higher pressure corresponds to the low Wobbe number gases ;
- the lower pressure corresponds to the high Wobbe number gases.

3.2.7

rated voltage

the voltage or range of voltages specified by the manufacturer at which the appliance will operate normally

3.3

composition of the gas circuit

3.3.1

gas circuit

all the parts of the appliance conveying or containing the combustible gas, included between the appliance gas supply connection and the burner(s)

3.3.2

restrictor

a device comprising one or more orifices that is placed in the gas circuit in such a way as to create a pressure drop and thus reduce the gas pressure at the burner to a predetermined value for a given supply pressure and given rate

3.3.3

injector

a component that admits gas into an atmospheric burner

3.3.4

gas pressure governor

a device that maintains the downstream pressure between fixed limits independent of variations, within a given range, of the upstream pressure and the gas rate

3.3.5

gas volume governor

a device that maintains a rate between fixed limits independent of variations, within a given range, of the upstream and downstream pressures

3.3.6

preset gas rate adjuster

a component allowing the gas rate of the burner to be set to a predetermined value according to the supply conditions. The action of operating this component is called "adjustment of the gas rate"

3.3.7

locking a preset adjuster

immobilization of the preset gas rate adjuster by some means (e.g. by a screw) in a position after adjustment

3.3.8

sealing a preset adjuster

arrangements made to make evident any change to the adjustment, for example: breakage of the device or sealing material

3.3.9

putting a preset adjuster or a control out of service

putting out of operation a preset adjuster or a control (of rate, pressure, etc.) and sealing it in this position. The appliance functions as if this device had been made inoperative

3.4

control and safety devices

3.4.1

control knob

a component intended to be moved by hand in order to operate an appliance control, for example: tap or temperature selector

3.4.2

manual shut-off valve

a component that permits manual interruption of the gas rate to the burner and ignition burner (if any)

3.4.3

automatic shut-off valve

a valve designed to open when energized by an electrical current and which closes automatically in the absence of the current

3.4.4

flame supervision device

a 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

3.4.5

multifunctional control

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

3.4.6

programming unit

a device that reacts to impulses from control and safety systems, gives control commands, controls the start-up program, supervises the burner operation and causes controlled shutdown, safety or lockout if necessary. The programming unit follows a predetermined sequence of actions, in conjunction with the flame detector

3.4.7

automatic burner control system

a system that comprises at least a programming unit and all the elements that make up a flame supervision device

3.4.8

combustion products discharge safety device

a device that causes at least safety shutdown of the main burner, when an unacceptable spillage of combustion products is detected at the draught diverter of the water heaters (type B_{11BS})

3.4.9

water overheat safety device

a device which causes a non-volatile lockout before the water heater can be damaged and the safety of/or the user endangered

3.4.10

combustion products temperature limiter

a device in the combustion circuit that causes shut-down with non-volatile lockout when the preset combustion products temperature is reached

3.4.11

vent

an orifice which permits atmospheric pressure to be maintained in a compartment of variable volume

3.4.12

device for monitoring air supply or evacuation of combustion products

device designed to switch the appliance to the shut-down position in the event of abnormal air intake or combustion products evacuation conditions

3.5

stages of operational and safety sequence

3.5.1

program

the sequence of the operations determined by the programming unit to assure the start-up, supervision and shutdown of the burner

3.5.2

spark restoration

the automatic process by which, following disappearance of the flame signal, the ignition device is switched on again without the gas supply having been interrupted

3.5.3

recycling

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

3.5.4

controlled shutdown

the process by which a control device (internal or external to the appliance) immediately cuts off the gas supply to the burner; the appliance returns to its start position

3.5.5

safety shutdown

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

3.5.6

locking out

interruption of the complete gas supply, with lockout

3.5.7

non-volatile lockout

a situation such that a restart can only be accomplished by a manual reset

3.5.8

volatile lockout

a situation such that a restart can only be accomplished either by manual intervention or by restoration of the electrical supply after its loss

3.5.9

ignition lockout (thermoelectric device only)

a device that prevents the ignition system from functioning for as long as the main gas circuit is open

3.5.10

restart lockout (thermoelectric device only)

a device that prevents restoration of the gas flow to the main burner or to the main burner and the ignition burner until the end of the extinction delay time

3.5.11

prepurging

operation consisting of introducing forced air into the combustion circuit in order to evacuate any air/gas mixtures remaining ; this takes place between the start-up command and the activation of the ignition device

3.6

burners and ignition devices

3.6.1

burner

a component that provides the air-gas mixture and ensures the combustion of the gas

3.6.2

main burner

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

3.6.3

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

3.6.3.1

manual ignition device

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

3.6.3.2

automatic ignition device

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

3.6.4

ignition burner

a burner intended to ignite a main burner. Those recognized are respectively:

- a) permanent ignition burner: An ignition burner that operates continuously throughout the whole period that the appliance is in use ;
- b) intermittent ignition burner: An ignition burner that is ignited before and extinguished at the same time as the main burner ;
- c) alternating ignition burner: An ignition burner that 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 ;
- d) interrupted ignition burner: An ignition burner that operates only during the ignition sequence.

3.6.5

total premix burner

burner in which the gas and a quantity of air, corresponding to the quantity which is at least equal to the theoretical value necessary for complete combustion, are mixed before pilot flame-formation orifices

3.7

combustion circuit

the circuit comprising the air supply circuit, combustion chamber, heat exchanger and combustion products circuit up to and including :

- the flue outlet for type B appliances ;
- the ducts without the terminal for type C appliances.

3.7.1

combustion chamber

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

3.7.2

flue outlet

the part of a type B appliance (see 4.3.1) that is intended to be connected to the flue evacuating the combustion products

3.7.3

draught diverter

the part of a type B₁ appliance (see 4.3.1), placed in the combustion products circuit to reduce the influence of updraught and to prevent that of downdraught on the stability of the burner flames and on combustion

3.7.4

terminal

 device fitted to the outside of the building, to which are connected:

- the air supply and combustion products evacuation ducts for type C₁ and C₃ water heaters (one or two devices);
- the air supply duct on the one hand and the combustion products evacuation duct on the other hand for type C₅ water heaters (two devices);
- the air supply duct for type C₈ water heaters (one device) 

3.7.5

duct adapter

a device for type C appliances which allows the air supply and combustion products evacuation ducts of the appliance to be fitted to an independent air supply and combustion products evacuation system

3.7.6

condensate

the liquid formed by the condensation of the combustion products water vapour

3.7.7

air intake and combustion products evacuation ducts

device used for transporting combustion air and combustion products from the appliance to the terminal or to the duct adapter

The following should be noted :

- ducts completely surrounded : the combustion products evacuation duct is surrounded by combustion air along its whole length ;
- separated ducts : the combustion products evacuation duct and the combustion air intake duct are neither concentric nor completely surrounded.

3.7.8

electrically operated mechanical flue damper

a device having a closure member which virtually blocks the flue gas passage when the main burner is off. The closure member is opened automatically, actuated by an electrical signal

3.7.9

total passage

the flue way's cross-sectional area that would be available to the flue gases if the closure member were removed 

3.7.10

terminal guard

device that protects the terminal from mechanical damage from outside influences

3.7.11

secondary flue

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

3.7.12

roof space (this is sometimes called loft)

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

3.8 water circuit

3.8.1 hydraulic safety group

the hydraulic safety group comprises all or some of the following items (in accordance with prEN 1487) in a single unit in the normal direction of the water flow :

- a check valve ;
- a pressure tapping for monitoring the check valve ;
- an isolating valve¹⁾ ;
- a safety valve ;
- a drain device ;
- an air break to drain ;
- a pressure tapping¹⁾.

3.8.2 combined temperature and pressure relief valve

a valve, in accordance with prEN 1490, activated both :

- by temperature, opening automatically to prevent the water in the appliance from exceeding 100 °C ;
- and by pressure, to discharge the water and prevent the pressure in the appliance from exceeding the maximum working pressure.

3.8.3 water temperature thermostat

a device allowing the water temperature to be maintained automatically at a pre-determined value

3.8.4 adjustable water temperature thermostat

a water temperature thermostat that permits the user to adjust the set point temperatures between the maximum and minimum values

3.8.5 water supply pressure

the gauge pressure measured at the water inlet connection of the appliance

Unit : bar (symbol: p)

NOTE 1 bar = 10⁵ Pa

3.9 soundness

3.9.1 external soundness

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

3.9.2 internal soundness

the 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

1) These are optional, in accordance with prEN 1487.

3.10 operation

3.10.1 gas rates

3.10.1.1 volumetric rate

the volume of gas consumed by the appliance over time during continuous operation

Symbols :

V expressed under the test conditions ;
 V_r expressed under the reference conditions

Unit : cubic meters per hour (m³/h)

3.10.1.2 mass rate

the mass of gas consumed by the appliance over time during continuous operation

Symbol : M

Unit : kilograms per hour (kg/h)

3.10.2 heat inputs

3.10.2.1 heat input

the product of the volumetric rate or the mass rate and the net calorific value of the gas referred to the same reference conditions

Symbol : Q

Unit: kilowatt (kW)

3.10.2.2 nominal heat input

the value of the heat input declared by the manufacturer

Symbol : Q_n

Unit: kilowatt (kW)

3.10.2.3 corrected heat input

the heat input that would be obtained if the appliance were supplied with dry reference gas at the normal supply pressure and a temperature of 15°C, with an atmospheric pressure of 1 013,25 mbar (see 7.3.1.2)

Symbol : Q_c

Unit: kilowatt (kW)

3.10.2.4 ignition heat input

the mean heat input during the ignition safety time

Symbol : Q_{IGN}

Unit: kilowatt (kW)

3.10.2.5 minimum heat input

if it exists, the heat input declared by the manufacturer corresponding to the minimum heat input of an appliance

Symbol : Q_m

Unit: kilowatt (kW)

3.10.3

efficiency

the ratio of the heat output to the heat input, expressed in percent (%)

Symbol: η_u

3.10.4

gas combustion

3.10.4.1

flame stability

the characteristic of flames that remain at the burner ports or in the flame retention zone provided by the design of the appliance

3.10.4.2

flame lift

the total or partial lifting of the base of the flames from the burner ports or the flame retention zone provided by the design of the appliance

3.10.4.3

lightback

the entry of a flame into the body of a burner

3.10.4.4

yellow tipping

yellowing of the top of the blue cone of an aerated flame

3.10.4.5

sooting

the appearance of deposits of soot on the parts of the appliance in contact with the combustion products or with the flame

3.10.5

response times

3.10.5.1

ignition opening time

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

Symbol : T_{IA}

Unit : second (s)

3.10.5.2

extinction delay time

for a thermoelectric flame supervision device, the time which elapses between extinction of the supervised flame and interruption of the gas supply concerned

Symbol : T_{IE}

Unit : second (s)

3.10.5.3

ignition safety time

the 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

Symbol : T_{SA}

Unit: second (s)

3.10.5.4

maximum ignition safety time

the ignition safety time measured under extreme operating conditions of temperature and supply voltage

Symbol : T_{SAmax}

Unit : second (s)

3.10.5.5

extinction safety time

the time that elapses between extinction of the supervised flame and the gas supply at least to the main burner being shut off

Symbol : T_{SE}

Unit : second (s)

3.11

appliance characteristics

3.11.1

nominal capacity

the volume of water in the appliance declared by the manufacturer

Unit : litre (l)

3.11.2

maintenance consumption

the heat input necessary to maintain a given difference between the water temperature and the ambient temperature

Symbol : q

Unit : watt (W)

3.11.3

heating up time

the time necessary to attain a given rise in the water temperature under the conditions specified by the test procedure

3.11.4

specific rate

the domestic hot water rate declared by the manufacturer, corresponding to a mean temperature rise of 30 K, that the appliance can supply in two successive delivery periods

Symbol : D

Unit : litres per minute (l/min.).

3.12

country of destination

3.12.1

direct country of destination

country for which the appliance has been certified and which is specified by the manufacturer as the intended country of destination. At the time of putting the appliance on the market and/or installation, the appliance shall be capable of operating, without adjustment or modification, with one of the gases distributed in the country concerned, at the appropriate supply pressure.

More than one country can be specified if the appliance, in its current state of adjustment, can be used in each of these countries.

3.12.2

indirect country of destination

country for which the appliance has been certified, but for which, in its present state of adjustment, it is not suitable. Subsequent modification or adjustment is essential in order that it can be used safely and correctly in this country

4 Classification of storage water heaters

Storage water heaters are classified :

- into categories, according to the gases capable of being used, as given in EN 437 ;
- into types, according to the modes of supply of the combustion air and evacuation of the combustion products.

4.1 Classification of gases

The gases are classified into three families, possibly divided into groups depending on the Wobbe number, according to the values given in EN 437.

4.2 Appliance categories

Appliances are classified into categories defined according to the gases and pressures for which they are designed.

The definition of the categories results from EN 437.

In each country, only some of the categories defined in EN 437 are marketed, in view of the local conditions of gas distribution (gas composition and supply pressures).

The situations concerning the marketing of these appliance categories in each country are given in Tables A.1 and A.2, and their corresponding supply pressures in Table A.3 (see A.3 for the particular categories marketed locally and nationally, corresponding to the gases and specific supply pressures specified in EN 437 ; A.5 gives conditions specific to certain countries).

4.3 Mode of supply of the combustion air and evacuation of the combustion products (appliance types)

According to CR 1749, appliances are classified into several types according to the mode of evacuation of the combustion products and admission of the combustion air :

4.3.1 Type B

An appliance intended to be connected to a flue evacuating the combustion products outside the room, with the combustion air being drawn directly from the room where the appliance is installed.

Type B₁ : A type B appliance fitted with a draught diverter in the combustion products circuit.

Type B₁₁ : A type B₁ appliance without a fan in the combustion products circuit or air inlet.

Type B_{11BS} : A type B₁₁ appliance factory fitted with a combustion products discharge safety device.

4.3.2 Type C

An appliance in which the combustion circuit is sealed with respect to the inhabitable area of the building where it is installed.

4.3.2.1 Type C₁

A type C appliance connected via its ducts to a horizontally installed terminal at the wall or on the roof. The orifices of the ducts are either concentric or close enough to come under similar wind conditions.

Type C₁₁ : A natural draught type C₁ appliance.

Type C₁₂ : Type C₁ appliance in which the fan is incorporated downstream of the combustion chamber/heat exchanger.

Type C₁₃ : Type C₁ appliance in which the fan is incorporated upstream of the combustion chamber/heat exchanger.

4.3.2.2 Type C₂

A type C appliance connected via its ducts to a shared duct system consisting of a single duct for both supply of the combustion air and discharge of the combustion products.

Type C₂₁ : A natural draught type C₂ appliance.

4.3.2.3 Type C₃

A type C appliance connected via ducts to a vertically installed terminal. The orifices of the ducts are either concentric or close enough to come under similar wind conditions.

Type C₃₁ : A natural draught type C₃ appliance.

Type C₃₂ : Type C₃ appliance in which the fan is incorporated downstream of the combustion chamber/heat exchanger.

Type C₃₃ : Type C₃ appliance in which the fan is incorporated upstream of the combustion chamber/heat exchanger.

4.3.2.4 Type C₄

A type C appliance connected via its ducts to a shared duct system consisting of a duct for the supply of the combustion air and a duct for the discharge of the combustion products. The orifices of this shared duct system are either concentric or close enough to come under similar wind conditions.

Type C₄₁ : A natural draught type C₄ appliance. This standard does not cover this type of appliance.

Type C₄₂ : Type C₄ appliance in which the fan is incorporated downstream of the combustion chamber/heat exchanger.

Type C₄₃ : Type C₄ appliance in which the fan is incorporated upstream of the combustion chamber/heat exchanger.

4.3.2.5 Type C₅

A type C appliance which is connected via its separate ducts to two terminals in zones of different pressure.

Type C₅₁ : A natural draught type C₅ appliance.  Text deleted 

Type C₅₂ : Type C₅ appliance in which the fan is incorporated downstream of the combustion chamber/heat exchanger.

Type C₅₃ : Type C₅ appliance in which the fan is incorporated upstream of the combustion chamber/heat exchanger.

4.3.2.6 Type C₆

A type C appliance which has to be connected to a separately approved and marketed system for the supply of combustion air and discharge of the combustion products.

Type C₆₁ : A natural draught type C₆ appliance. This standard does not cover this type of appliance.

Type C₆₂ : Type C₆ appliance in which the fan is incorporated downstream of the combustion chamber/heat exchanger.

Type C₆₃ : Type C₆ appliance in which the fan is incorporated upstream of the combustion chamber/heat exchanger.

4.3.2.7 Type C₇

A type C appliance which is connected via its vertical ducts and a draught diverter, located in the roof space, to a secondary flue. The combustion air is taken from the roof space.

Type C₇₂

A type C₇ appliance incorporating a fan downstream of the combustion chamber/heat exchanger.

Type C₇₃

A type C₇ appliance incorporating a fan upstream of the combustion chamber/heat exchanger.

4.3.2.8 Type C₈

A type C appliance connected via one of its ducts to a single or common duct system¹⁾. This duct system consists of a single natural draught duct (i.e. not incorporating a fan) that evacuates the products of combustion. The appliance is connected via a second of its ducts to a terminal, which supplies air to the appliance from outside the building.

Type C₈₁

A natural draught type C₈ ²⁾ appliance.

Type C₈₂

A type C₈ appliance incorporating a fan downstream of the combustion chamber/heat exchanger.

Type C₈₃

A type C₈ appliance incorporating a fan upstream of the combustion chamber/heat exchanger. 

5 Marking and instructions

5.1 Appliance marking

5.1.1 Data plate

Each appliance shall carry an indelible data plate which is visible on installation, possibly after removal of part of the case, which is solidly fixed and durable, carrying at least the following information :

- the name of the manufacturer ³⁾  and/or his identifying symbol ;
- the serial number or year of manufacture ;

 ¹⁾ This single or common duct system is part of the construction of the building and is not supplied with the appliance.

²⁾ A type C₈₁ appliance will not generally be included within the scope of European Standards for gas appliances. 

 ³⁾  "Manufacturer" means the person responsible for designing and manufacturing a product covered by the directive, with a view to placing it on the Community market on his own behalf.

- the trade name of the appliance ;
- if necessary, the CE mark with :
 - a) the appliance identification number ;
 - b) the last two digits of the year the CE mark was granted ;
- the countries of direct or indirect destination. In conformity with EN 23166, the names of the countries shall be represented by the following codes :

Austria	AT	Greece	GR
Belgium	BE	Ireland	IE
Switzerland	CH	Iceland	IS
Germany	DE	Italy	IT
Denmark	DK	Luxembourg	LU
Spain	ES	Netherlands	NL
Finland	FI	Norway	NO
France	FR	Portugal	PT
United Kingdom	GB	Sweden	SE

- the category/categories corresponding to the countries of destination. Any category shall be specified in accordance with 4.2 ;
- the gas supply pressures, in millibars, if several normal pressures may be used for the same gas group. They are indicated by the numerical value and the unit "mbar";
- the type(s) of appliance. The type of appliance shall be specified in accordance with 4.3 ;
- "condensing appliance", if that is the case ;
- the nominal heat input (in kW) ;
- the nominal capacity in litres ;
- the maximum water pressure ;
- the degree of protection, if necessary, in accordance with EN 60529 ;
- the type and voltage of the electrical supply used in volts (V), and the absorbed power in watts (W) as appropriate. The electrical magnitudes specified shall comply with the requirements of EN 60335-1 ;
- that the appliance is intended exclusively to be installed on a gas supply with a governed meter, where applicable.

The indelibility of markings shall be verified by a test carried out as described in 7.14 of EN 60335-1:1988.

5.1.2 Supplementary markings

The appliance shall carry visible and indelible information on a supplementary rating plate with regard to its state of adjustment :

- the country/countries of direct destination in accordance with symbols in 5.1.1 ;
- the gas group or range, the gas type symbol and the gas supply pressure and/or pressure couple in accordance with the "marking" column of Tables 1 and A.6 ;
- the gas supply pressure and/or the pressure couple (where applicable) for which the appliance has been adjusted by the manufacturer.

This information may, if appropriate, be given on the data plate.

A₃ The water heater may carry supplementary marking concerning the class of NO_x emissions of the water heater. **A₃**

The indelibility of the markings shall be verified by a test carried out as described in 7.14 of EN 60335-1:1988.

Table 1 — Symbols for indicating types of gas

Gas family	Category index	State of adjustment			Marking
		Gas group or range of gases	Symbol of gas	Gas pressure(s) (mbar)	
First	1ab, 1ab, 1ad	1a	G 110	8	1a - G 110 - 8 mbar
	1ab, 1abd	1b	G 120	8	1b - G 120 - 8 mbar
	1c, 1ace, 1ce	1c	G 130	8	1c - G 130 - 8 mbar
	1ad, 1abd	1d	G 140	8	1d - G 140 - 8 mbar
	1ace, 1ce	1e	G 150	8	1e - G 150 - 8 mbar
Second	2H	2H	G 20	20	2H - G 20 - 20 mbar
	2L	2L	G 25	25	2L - G 25 - 25 mbar
	2E, 2ELL	2E	G 20	20	2E - G 20 - 20 mbar
	2ELL	2LL	G 25	20	2LL - G 25 - 20 mbar
	2E+	2E+	G 20/G 25	20/25	2E+ - G 20/G 25 - 20/25 mbar
	2Esi	2Es	G 20	20	2Es - G 20 - 20 mbar
		2Ei	G 25	25	2Ei - G 25 - 25 mbar
	2Er	2Er	G 20/G 25	20/25	2Er - G 20/G 25 - 20/25 mbar
Third	3B/P	3B	G 30	30	3B - G 30 - 30 mbar
		3B	G 30	50	3B - G 30 - 50 mbar
		3P	G 31	30	3P - G 31 - 30 mbar
		3P	G 31	50	3P - G 31 - 50 mbar
	3P	3P	G 31	37	3P - G 31 - 37 mbar
		3P	G 31	50	3P - G 31 - 50 mbar
	3+	3+	G 30/G 31	28-30/37	3+ - G 30 /G 31 - 28-30/37 mbar
		3+	G 30/G 31	50/67	3+ - G 30/G 31 - 50/67 mbar
		3+	G 30/G 31	112/148	3+ - G 30/G 31 - 112/148 mbar

5.1.3 Packaging

The packaging shall carry the category/categories, the type of appliance and the information given on the supplementary data plate (see 5.1.2) and the warnings as specified in 5.1.4.

5.1.4 Warnings on the appliance and packaging

One or more labels shall give at least the following visible and legible warnings.

The warnings on the appliance shall be visible to the user.

5.1.4.1 For all appliances

- "Read the technical instructions before installing the appliance";
- "read the user's instructions before lighting the appliance".

5.1.4.2 For type B₁₁ appliances

- "This appliance shall only be installed outside or in a room separated from living rooms and provided with appropriate ventilation directly to the outside".

5.1.4.3 For type B_{11BS} appliances

- "This appliance shall only be installed in a room if the room meets the appropriate ventilation requirements".

5.1.5 Other information

No other information shall be carried on the appliance or packaging if it is likely to create confusion in relation to the actual state of adjustment of the appliance, the corresponding category or categories and the direct country or countries of destination.

** 5.1.6 Additional marking for appliances with flue dampers**

On the appliance data plate or on an alternative permanently fixed, readily visible plate, it shall be stated that the appliance:

- is fitted; or
- may be fitted at a later date; 

with a flue damper.

5.2 Instructions**5.2.1 Technical instructions**

Each appliance shall be accompanied by technical instructions intended for the installer giving instructions for installation, adjustment and maintenance of the appliance as a function of the requirements in force in the country where it is to be installed.

These instructions shall comprise at least the following information :

5.2.1.1 General

- The information on the data plate, except for the appliance number and the year of manufacture ;
- the meaning of the symbols used on the appliance and its packaging in accordance with 5.1.1 and 5.1.2;
- a reference to certain specific standards and/or regulations if this is necessary for correct installation and use of the appliance ;
- if appropriate the minimum distances to be maintained between easily flammable materials ;
- if necessary, indication that walls sensitive to heat, e.g. wood, shall be protected by suitable insulation, and the distance to be observed between the wall on which the appliance is fixed and the hot external parts of the appliance ;

- a general description of the appliance with an illustration of the main parts (subassemblies) to be removed to correct operating faults ;
- for electrical installation :
 - a) the need to earth appliances comprising mains-supplied electrical equipment ;
 - b) a circuit with connection terminals (including those for external adjustment) ;
- the method recommended for cleaning the appliance ;
- indication of the necessary maintenance.

5.2.1.2 For installation and adjustment of the gas circuit

- Information that the data in 5.1.2 on the state of adjustment mentioned on the data plate or supplementary plate shall be compatible with the local supply conditions ;
- adjustment instructions for appliances that can be adjusted by the installer, comprising an adjustment table giving the volumetric rates or mass rates in cubic metres per hour (m³/h) or kilogrammes per hour (kg/h) or the pressure at the burner as a function of the possible adjustment data according to the category or categories. The reference conditions for the volumetric rates are 15 °C, 1 013,25 mbar, dry ;
- if necessary, that the appliance is intended to be installed only on a gas supply with a governed meter ;
- for appliances capable of operating on several gases, indication of the operations required to convert from one gas to another and indication that the adjustments and modifications shall only be carried out by a qualified professional or competent person. When an adjustment is carried out by the installer, the adjuster shall be sealed after adjustment.

5.2.1.3 For installation of the domestic hot water

- Installation of a check valve at the cold water inlet ;
- incorporation of a hydraulic safety group and/or a combined temperature and pressure relief valve in accordance with the regulations in force ;
- the maximum water pressure for which the appliance is designed indicating that even when subjected to the effect of water expansion, the water pressure in the appliance shall not exceed this value.

5.2.1.4 For installation of the combustion products evacuation circuit

- a) For type B₁ appliances
 - the flue pipe diameter(s) as given in Table A.6 which may be used, if necessary with a duct adapter ;
 - the minimum length of the flue (1 m, or 0,5 m for certain wall-mounted appliances specified by the manufacturer) ;
 - for calculation of the flues, the combustion products mass rate in g/s and their mean temperature measured under the conditions of 8.2.2 ;
- b) for type B₁₁ appliances
 - indicate clearly that type B₁₁ appliances shall be installed outside or in a room separated from inhabited rooms with suitable ventilation directly to the outside ;
- c) for type B_{11BS} appliances
 - give a technical description of the combustion products discharge safety device ;

- specify that the combustion products discharge safety device shall not be put out of operation ;
- draw attention to the seriousness of untimely interference with the combustion products discharge safety device ;
- give instructions on the mounting of the combustion products discharge safety device and the replacement of defective parts. Specify that only the manufacturer's original parts shall be used, and describe the test for the correct operation of the device which shall be carried out after servicing ;
- draw attention to the fact that in the case of repeated shutdown of the appliance, it will be necessary to take appropriate action to remedy the discharge fault ;
- indicate the waiting time for appliances with an automatic reset.
- d) for type C appliances
 - indicate the type of air supply and combustion products evacuation system to which the appliances may be connected ;
 - give the special characteristics of the terminal protection device and indications of its fitting and position relative to the terminal ;
 - indicate the maximum number of bends to be used and the maximum length of the air supply and combustion products evacuation ducts ;
 - for type C₂₁ appliances, the minimum dimension of the common duct on which this can be installed.
-  — for type C₁ water heaters:
 - the information if and how the terminal shall be placed on the wall and/or on the roof space;
 - the instruction that the terminal outlets from separate ducts shall fit inside a square of 50 cm;
- for type C₂ water heaters:
 - the characteristics of the shared duct systems to which the water heater may be connected;
- for type C₃ water heaters:
 - the instruction that the terminal outlets from separate ducts shall fit inside a square of 50 cm;
- for type C₄ water heaters:
 - the minimum and maximum pressure loss permitted in the air supply and combustion products evacuation ducts, or the minimum and maximum length of these ducts;
 - the combustion products temperature and mass rate at the maximum and minimum heat input with the maximum length of ducts, if necessary;
 - the characteristics of the shared duct systems to which the water heater may be connected;
- for type C₅ water heaters:
 - the instruction that the terminals for the supply of combustion air and for the evacuation of combustion products shall not be installed on opposite walls of the building; 

Ⓐ₃ — for type C₆ water heaters:

- the minimum and maximum pressure loss permitted in the air supply and combustion products evacuation ducts, or the minimum and maximum length of these ducts;
- the combustion products temperature and mass rate at the maximum and minimum heat input;
- the instruction that the water heater shall only be installed with a terminal that complies with the requirements of EN 1856-1 (see Annex N);
- the method of calculating the pressure loss in the air supply and combustion products evacuation ducts, starting from the values of the temperature and mass rate of the combustion products in relation to the CO₂ concentration;

— for type C₇ water heaters:

- the instruction that the draught diverter and the air intake have to be installed in the roof space of the building;

— for type C₈ water heaters:

— the characteristics of the chimney to which the water heater may be connected. Ⓐ₃

5.2.1.5 For condensing appliances

- Specify in detail the methods adopted for the combustion products evacuation and for the removal of condensates ; in particular, attention should be drawn to the need to avoid horizontal passages ;
- if the appliance does not meet the combustion products temperature requirements in 7.8, specify that the appliance is not intended for connection to discharge ducts likely to be adversely affected by heat (e.g. plastics ducts or ducts lined with plastic) ;
- if the appliance meets the combustion products temperature requirements in 7.8, specify :
 - a) for these appliances, that only the materials supplied by the manufacturer may be used;
 - b) in other cases, a list of materials capable of being used.

Ⓐ₂ 5.2.1.6 Appliances with flue dampers

The installation instructions shall include all data needed for checking the appliance and the built-in flue damper for proper performance and for their maintenance.

The appliance may be delivered:

- a) without a flue damper;
- b) with a flue damper;
- c) with the possibility of installing a flue damper.

If there is a possibility of installing a flue damper after the installation of the appliance the instructions shall state that:

- 1) the only damper permitted is that tested/certificated with the appliance;
- 2) the damper is to be installed in accordance with the manufacturer's instructions. Ⓐ₂

5.2.2 Instructions for use

Each appliance shall be accompanied by instructions for use intended for the user. They shall comprise the necessary data on the use and maintenance of the appliance and shall include the following information at least:

5.2.2.1 General

- Point out that a qualified installer should be called on to install and adjust the appliance and that, in order to convert it to use other gases, a qualified installer, gas distributor, or other competent person should be called on according to the practice in the country where the appliance is installed ;
- specify the operations for starting up and putting the appliance out of service ;
- specify that the warnings should be observed ;
- explain the procedures for normal operation, cleaning and day-to-day maintenance of the appliance ;
- warn against incorrect use ;
- explain any necessary precautions to be taken against frost ;
- forbid any interference with a sealed component ;
- point out that appliances should be checked and maintained periodically by a competent person on according to the practice in the country where the appliance is installed ;
- indicate the normal capacity.

5.2.2.2 For type B_{11BS} appliances

- State that the device interrupts the admission of gas to the burner if the evacuation of the combustion products is disturbed ;
- describe the restart procedure ;
- recommended that a competent person is called if there are repeated interruptions, on according to the practice in the country where the appliance is installed.

5.2.2.3 For type C appliances

- For type C appliances with manual ignition, mention the precautions to be taken before carrying out new ignition attempts;

 — for type C₇ water heaters the roof space shall not be used as living area. 

5.2.2.4 For condensing appliances

- Specify that the condensate outlet(s) shall not be modified or plugged ;
- give the instructions for cleaning and maintaining the condensate neutralization device, if fitted.

** 5.2.2.5 Appliances with flue dampers**

In the instructions for the user, it shall be stated that during maintenance of the appliance the functioning of the flue damper shall be checked for proper performance by a competent person. 

5.2.3 Conversion instructions

Parts intended for conversion to another gas family, another group or gas range and/or another supply pressure shall be accompanied by conversion instructions intended for the competent person.

The instructions shall :

- specify the parts necessary to carry out the conversion and the method of identifying them ;
- specify clearly the operations required to change the parts, and where necessary, the correct adjustment ;
- specify that any broken seal shall be reconstituted and/or the preset adjusters shall be sealed ;
- indicate that for appliances operating with a pressure couple, any gas governor shall either be rendered inoperative over the normal range of pressures or be put out of operation and sealed in this position.

A self-adhesive label intended to be placed on the appliance shall be supplied with the parts and conversion instructions. The supplementary markings in 5.1.2 for which the appliance has been converted shall be indicated on this label.

5.3 Presentation

All the information in 5.1 and 5.2 shall be given in the official language(s) of the countries in which the appliance may be installed.

6 Construction requirement

Except where otherwise stated the constructional safety is verified by inspection of the appliance and its technical literature.

6.1 General

6.1.1 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 (see 4.2, 6.2.3, 6.2.4, 6.2.6.2.1 and 6.3) :

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

It shall be possible to carry out these operations without having to interfere with the connections of the appliance and its ducts (water, gas, combustion products evacuation).

6.1.2 Materials

6.1.2.1 General

When the appliances are installed according to the technical instructions, the quality and thickness of the materials used in their construction shall be such that, under normal conditions of use, maintenance and adjustment, these materials shall withstand the mechanical, chemical and thermal conditions to which they may be subjected during a reasonable life. Any anode is not subject to the requirement of this subclause.

Sheet metal parts, when they are not made of corrosion-resistant materials, shall be enameled or be coated with another effective protection against corrosion.

Zinc alloys may only be used in contact with gas if they are of quality ZnAl4, in accordance with ISO 301 and if the parts are not liable to be exposed to a temperature above 80 °C under the conditions of 7.4.2. Only external threads in accordance with ISO 228-1 are acceptable for principal inlet and outlet connections made of zinc alloy.

The use of asbestos-based materials is forbidden.

The use of cadmium containing solder is forbidden.

6.1.2.2 Metallic materials

6.1.2.2.1 Corrosion resistance

Provided that the water heater is used in accordance with the manufacturer's instructions:

- the functioning of components manufactured from corrosion-resistant metallic materials shall not be affected by corrosion within the expected service life of the water heater and
- no special maintenance shall be required to keep the components in good working order.

6.1.2.2.2 Requirements

Materials that come into contact with water intended for human consumption shall withstand the mechanical, chemical and thermal stresses to which they are exposed during the service life of the water heater and shall not contaminate the water supplied.

Metallic materials shall be corrosion-resistant. Metallic materials are considered to satisfy the requirements with respect to corrosion protection:

- if the material used is enamelled (one or more layers) and equipped with cathodic corrosion protection, or
- where types of stainless steel containing a minimum of 16 % chrome are used, or
- where they are assessed as acceptable to the national regulations in force.

Examples for the selection of metallic materials (steel, copper and copper alloys) are given in P.2 and P.3.

6.1.2.3 Enamelling - Physiological safety

The release of lead and cadmium ions or compounds into the water shall not exceed the following limit values:

Lead:

- cold water test: 0,3 mg/(m²·d);
- hot water test: 0,3 mg/(m²·h).

Cadmium:

- cold water test: 0,03 mg/(m²·d);
- hot water test: 0,03 mg/(m²·h).

A double parallel test with special specimen plates is carried out in cold and hot water. The cut edges of the specimen are covered with a coating of a material that does not contain lead or cadmium. 

^{A4} The cold water test shall be carried out using water at a temperature of $(18 \pm 5) ^\circ\text{C}$ and the hot water test using water at a temperature of $(90 \pm 5) ^\circ\text{C}$. Two parallel tests are carried out with special specimen plates. The cold water test is performed in 3 succeeding extractions of 72 h, the hot water test in 4 succeeding tests of 24 h. It is checked that the results obtained from the final extractions (cold and hot) satisfy the requirements of the given limits for lead and cadmium. The concentration is measured at each extraction. Concentrations of the successive extractions shall be not greater than that obtained at the preceding extractions.

6.1.2.4 Non-metallic materials

6.1.2.4.1 Plastic materials

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

6.1.2.4.2 Requirements of plastic materials

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

Examples for the selection of the plastic materials are given in P.4.

6.1.2.4.3 Other non-metallic operating and auxiliary materials

These materials include rubber, sealant, adhesives and also lubricants on moving parts that come into contact with the water intended for human consumption. These materials shall satisfy the physiological and hygiene requirements in force. Their use is to be limited to what is technically necessary. ^{A4}

For condensing appliances, all parts of the exchanger and other parts of the appliance likely to be in contact with the condensate shall be constructed of materials sufficiently resistant to corrosion or be coated so as to ensure the appliance has a reasonable life when installed, operated and maintained in accordance with the manufacturer's instructions.

6.1.3 Design - Assembly - Strength

All the constituent parts shall be constructed and assembled in such a way that the operating characteristics of the appliance are not altered significantly during a reasonable life and under normal conditions of installation and use.

The screws of preset adjusters shall be arranged so that they cannot fall inside the pipes. In addition, their threads shall not deteriorate even after several successive manipulations.

The construction of the appliance shall be such that condensate which may be produced during start up or in operation does not affect safety.

6.1.4 Accessibility - Ease of maintenance - Fitting and removal

It shall be possible to clean the combustion circuit by following the manufacturer's instructions.

It shall not be possible to replace parts that have to be removed for maintenance in such a way that the operational safety of the appliance is compromised. In particular, the soundness of the combustion circuit shall be maintained after refitting following cleaning or maintenance operations.

Removable components, for example the burner or the heating body, shall be able to be removed with commercially available tools and with the appliance remaining in position.

It shall be easy to replace the corrosion protection anode, if any.

6.1.5 Gas and water pipe connections

6.1.5.1 General

The appliance connections shall be easily accessible. They shall be clearly identified in the technical instructions and, where appropriate, on the appliance. The space left around the connection shall be adequate to allow free movement of tools necessary for assembly after removal of the enclosure, if necessary. All connections shall be capable of being made without special tools.

6.1.5.2 Gas pipe connection

The appliance gas inlet connection shall permit rigid connection.

If the appliance has a threaded inlet connection, this shall comply with ISO 228-1 or ISO 7-1. In the first case (ISO 228-1), the end of the appliance inlet connection shall be sufficiently flat to allow the use of a sealing washer.

If flanges are used, they shall comply with ISO 7005 and the manufacturer shall supply the counter-flanges and sealing gaskets.

If the inlet connection consists of a plain copper tube, it shall have a straight section at least 5 cm long and shall comply with ISO 274.

For the types of gas connection commonly used in the various countries, see Table A.6.

6.1.5.3 Water connections

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

If copper connections are used, the end of the prepared tube shall comply with ISO 274.

If materials other than metallic materials are used, the manufacturer shall supply suitable justification of suitability for the conditions of use.

For water connection conditions in common use in the various countries, see Table A.6.

6.1.6 Means of achieving soundness

6.1.6.1 Soundness of the gas circuit

Holes for screws, fixing studs, etc., intended for the assembly of parts shall not open into gasways. Furthermore, it shall not be possible for water to penetrate into the gas circuit.

The soundness of parts located in the gas circuit and likely to be dismantled for normal maintenance shall be assured by mechanical means, e.g. metal to metal joints or O-ring joints, i.e. excluding the use of all thread sealing materials (liquids, jointing pastes, tapes, etc.). This soundness shall be maintained even after dismantling and reassembly.

However, sealing materials may be used for permanent assemblies. The sealing materials shall remain effective under normal conditions of appliance use.

The soundness of unthreaded assemblies in the gas circuit shall not be achieved by means of soft soldering nor by means of adhesives.

Rubbers in contact with gas shall comply with the requirements of EN 549.

6.1.6.2 Soundness of the combustion circuit

6.1.6.2.1 Type B appliances

The soundness of the combustion circuit, up to the draught diverter, shall be achieved only by mechanical means, except for assemblies not intended to be dismantled during routine maintenance: these may be jointed using mastics or pastes in such a way that permanent soundness is assured in continuous service under normal conditions of use.

6.1.6.2.2 Type C appliances

 Parts which have to be removed during routine service and affect the soundness of the water heater 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 water heater case forms part of the combustion circuit and it can be removed without the use of tools, either the water heater shall not operate, or there shall be no leakage of combustion products into the room where the water heater is installed when the case is replaced incorrectly. 

However, parts of the assembly that are not intended to be dismantled for routine servicing 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 duct adapter of the combustion circuit 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 ensured after reassembly.

6.1.7 Supply of combustion air and evacuation of the combustion products

6.1.7.1 All appliances

It shall not be possible to adjust the cross-section of the air intake leading to the combustion chamber or the cross-section of the combustion products evacuation flue, in the case of appliances without fans.

Except where otherwise stated, the fan-assisted appliances may be fitted with an adjustment component in the combustion air intake or combustion products evacuation circuit, designed to adapt the appliance to installation conditions. This adjustment is carried out by calibrating orifices, or by predetermined positioning applying the detailed instructions of the manufacturer.

Any appliances shall be designed so that the combustion air supply is ensured under normal conditions of use and maintenance.

6.1.7.2 Type B₁ appliances

Type B₁ appliances shall be fitted with a draught diverter, fixed rigidly to the appliance by the manufacturer or installer in compliance with the instructions supplied by the manufacturer.

The outlet connection of the draught diverter shall be female. The manufacturer may supply an adaptor to permit connection between the draught diverter outlet and the flue to which the appliance is connected. The diameters of the flues in force in the various countries appear for information purposes in Table A.7.

It shall be possible to insert the flue to a depth of at least 15 mm vertically or 30 mm horizontally. When inserted as far as possible, the evacuation of the combustion products shall not be impaired.

6.1.7.3 Type C water heaters

6.1.7.3.1 General

All water heaters shall be designed so that there is an adequate supply of combustion air during ignition and over the whole range of possible heat inputs stated by the manufacturer. A gas/air ratio control is permitted.

Unless otherwise stated, fan-assisted water heaters may be fitted with a means of adjustment in the combustion circuit intended to adapt the water heater to the pressure losses in the installed ducts either by restrictors or by setting the means of adjustment to predetermined positions in accordance with detailed instructions from the manufacturer.

According to the water heater type, the manufacturer shall supply any terminal and/or fitting piece, with the water heater for test.

6.1.7.3.2 Air supply and combustion products evacuation ducts⁴⁾

The assembly of the various parts during installation shall be such that no work is necessary other than adjusting the length of the air supply and combustion products evacuation ducts (possibly by cutting them). Such adaptation shall not impair the correct operation of the water heater.

It shall be possible to connect the water heater, the air supply and combustion products evacuation ducts and the terminal or fitting piece using ordinary tools if necessary. All necessary accessories and the fitting instructions shall be supplied by the manufacturer.

The terminal outlets from separate ducts for the supply of combustion air and the evacuation of combustion products:

- shall fit inside a square of 50 cm for types C₁ and C₃ water heaters;
- may terminate in zones of different pressure for type C₅ water heaters, but not on opposite walls of the building.

6.1.7.3.3 Terminal

No opening in the external surfaces of the terminal shall permit the entry of a 16 mm diameter ball applied with a force of 5 N.

Any horizontal terminal shall be designed in such a way that any condensate is discharged away from the wall.

6.1.7.3.4 Terminal guard

If the manufacturer prescribes, in the installation instructions, a protective guard for the terminal for use when the outlets for evacuation of the combustion products open on to a walkway, this device shall be supplied to the laboratory for test.

The dimensions of the terminal guard, when installed in accordance with the manufacturer's instructions, shall be such that the distance between any part of the guard and the terminal, except the wall plate, exceeds 50 mm. The guard shall not have any sharp edges likely to cause injury.

6.1.7.3.5 Fitting piece

For water heaters of types C₂, C₄ and C₈, the fitting piece shall be designed so that it is possible to obtain the distances specified by the manufacturer for the projection of the ends of the combustion air supply and combustion products evacuation ducts into the common duct, whatever the total thickness (flue and cladding) of the common duct.

⁴⁾ In accordance with national regulations sampling points in the combustion circuit may be required. 

A3 6.1.7.3.6 Special requirements for certain components of water heaters with a fan

6.1.7.3.6.1 Fan

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

6.1.7.3.6.2 Air monitoring device

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

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

- supervision of the combustion air pressure or the combustion products pressure. This supervision of pressure is only allowed for water heaters fitted with a constant speed fan during the operation of the main burner and where the combustion products evacuation duct is surrounded by combustion air throughout its length, which shall not exceed 3 m. In addition the following requirements shall be fulfilled:
 - the ducts shall not have adjustable or removable restrictions and
 - the pressure loss of the heat exchanger shall not exceed 0,05 mbar;
- continuous supervision of the combustion air rate or the combustion products rate. In this system, the supervision device is activated directly by the flow of combustion air or combustion products. This is also valid for water heaters with more than one fan speed in which the flows associated with each fan speed are monitored by separate supervision devices;
- gas/air ratio control.

The following two indirect supervision methods are also allowed, but only for water heaters where the combustion products circuit is completely surrounded by the air supply circuit or for separate ducts when the leakage rate of the combustion products evacuation ducts meets the requirements of 7.2.2.2.1.2:

- indirect supervision (e.g. fan speed supervision) when there is an air monitoring device which monitors the supply of combustion air at least once at each start up;
- supervision of the minimum and maximum air or combustion products rates with two rate supervision devices.

6.1.7.3.6.3 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.

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 the tests in 7.16.2.4.2.

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. **A3**

A3 Text deleted **A3**

6.1.8 Confirming the state of operation

The installer shall be able to observe the correct ignition and operation of the burner(s) and also the length of the flame(s) of the ignition burner, if any. A door may be opened or a case removed provided that the soundness of the combustion circuit, as specified in 7.2.2, is maintained after closure or replacement.

This visibility shall continue to be assured and shall not deteriorate under the effect of heat, particularly where there is a viewing window. In addition, mirrors, sight glasses, etc., shall continue to retain their optical properties.

It shall be possible for the user, if necessary after opening a door, to check at any time that the appliance is operating, either by visual observation of the flame or by some other indirect means if the main burner is fitted with its own flame detector, (e.g. an indicator light). The means of indicating presence of a flame shall not be able to be confused with the indication of any other fault, except for a fault in the operation of the actual means of checking the flame which shall result in an indication that there is no flame.

6.1.9 Drainage

It shall be possible to drain the appliance easily without the aid of any tools other than a screwdriver or a spanner.

NOTE It is assumed that an appliance supplied with an hydraulic safety group defined in 3.8.1 fulfills this requirement.

6.1.10 Electrical equipment

The electrical equipment of the appliance shall comply with the relevant requirements of EN 50165, except where reference is made to another electrical standard in 6.2 of this standard.

Electric shock protection is not necessary in respect of the high voltages of ignition devices if the energy content of each pulse, the number of pulses and the delay between each pulse comply with the limits set (see Annex G).

If the appliance 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 and immunity levels.

If the manufacturer specifies the nature of the electrical protection of the appliance 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 appliance case;
- to give the degree of electrical protection, inside the appliance case, against harmful effects due to water penetration.

6.1.11 Operational safety in the event of failure or restoration of the auxiliary energy

If the appliance 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.

6.2 Adjusting, control and safety devices

6.2.1 General

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

There shall be no shaft or lever capable of being operated outside the body that could prevent correct closure of the gas shut-off valve.

Screwed fastenings that have to be removed for servicing of the device shall have a metric thread complying with ISO 262 unless a different thread is essential for the correct functioning and adjustment of the device.

Thread-forming screws that form a thread and do not produce filings may be used. It shall be possible to replace them by metric machine screws complying with the above-mentioned ISO standard.

Self-tapping screws that cut a thread and produce filings shall not be used for the assembly of gas-carrying parts or of parts that may be removed for servicing.

The operation of moving parts (e.g. diaphragms, etc.) shall not be impaired by other components. Packing glands that are adjusted and sealed at the factory may be used for sealing moving parts.

Manually adjustable packing glands shall not be used.

A device to protect against dust shall be positioned before the first control or shut-off device at the gas inlet. The maximum dimension of the mesh of the strainer shall not exceed 1,5 mm; furthermore the mesh shall not allow passage of a 1 mm pin gauge. However, for protection of a class D' automatic valve, the mesh shall not exceed 0,2 mm.

All the devices specified in 6.2 or the multifunctional control in which they may be fitted shall be removable or exchangeable if this is necessary for cleaning or replacement of the device.

The control knobs shall be designed and located so that they can neither be fitted in an incorrect position nor be capable of moving of their own accord.

When there are several control knobs, they shall not be interchangeable if this could prejudice safety.

All appliances shall be provided with a manual shut-off valve which allows the user to shut off the gas supply to the main burner and the ignition burner, if it exists. This device shall be designed and fixed in such a way that its operation is easy.

6.2.2 User controls

Every appliance shall be provided with at least one device enabling the user to control the admission of gas to the burner and to the ignition burner.

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	:	stylized spark	 ;
— full rate of the burner	:	large 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 gas rate control, 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.

6.2.3 Preset gas rate adjusters

Preset gas rate adjusters shall be designed so that they are protected against accidental incorrect adjustment by the user once the appliance has been put into service.

Any parts of the appliance that are not to be manipulated by the installer or user shall also be protected in an appropriate manner. Lacquer may be used for this purpose provided that it resists the heat to which it is subjected during normal operation of the appliance.

A preset gas rate adjuster is mandatory for appliances using more than one group of the first gas family, and optional for other appliances.

The preset adjusters shall :

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

The preset gas rate adjuster shall be locked and sealed when a gas of a family or group carrying a "+" suffix is used.

The adjustment may be continuous (adjusting screw) or discrete (change of restrictors).

The adjuster of an adjustable gas governor is regarded as a preset adjuster.

The action of adjusting these devices is called "adjusting the gas rate".

These devices shall be designed so that they can be moved easily with commercially available tools, even after prolonged use.

6.2.4 Gas governor

Gas governors shall meet the applicable requirements of EN 88.

Appliances intended to operate with first family gases shall have a gas governor. A gas governor is optional for other appliances.