

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 and A2:2000, has the status of a British Standard

ICS 91.140.65

National foreword

This British Standard is the official English language version of EN 89:1999, including amendments A1:1999 and A2:2000.

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BS EN 89:2000 supersedes BS 5258-7:1977 which is withdrawn.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, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

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Summary of pages

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English version

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

(includes amendments A1:1999 and A2:2000)

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

(inclut les amendements A1:1999 et A2:2000)

Gasbeheizte Vorrats-Wasserheizer für den sanitären
Gebrauch

(enthält Änderungen A1:1999 und A2:2000)

This European Standard was approved by CEN on 12 June 1997. Amendment A1:1999 was approved by CEN on 12 June 1997. Amendment A2:2000 was approved by CEN on 20 April 2000.

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.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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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.

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".

This standard applies to appliances :

- of types B₁₁, B_{11BS}, C₁₁, C₂₁ and C₃₁ ;
- 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 fitted with a fan on the combustion circuit ;
- 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.*

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_{1BS})

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

a special device, for type C₁ and C₃ appliances, to which the ducts are connected and which is intended to maintain the quality of combustion in the event of wind

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

3.8

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

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

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

Symbols :

V expressed under the test conditions ;

V_r expressed under the reference conditions

Unit : cubic meters per hour (m^3/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)

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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 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. This standard does not cover this type of appliance.

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.

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 manufacturer²⁾ and/or his identifying symbol ;
- the serial number or year of manufacture ;
- 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";

2) "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 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.

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_{1BS} 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.

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.

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.

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.

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

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.

Moreover, parts in contact with water shall be made of materials of quality so that the water for domestic hot water use cannot be polluted.

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

The soundness of the appliance and its ducts, with respect to the room in which the appliance is installed and with respect to the room through which the ducts pass, shall be achieved by mechanical means. The need for replacement of the seal, following a cleaning or servicing operation as stated by the manufacturer, is permitted.

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 C₁ and C₃ appliances

If, during installation adjusting the length of the air supply and combustion products evacuation ducts, perhaps by cutting them, is necessary to suit the thickness of the wall, these adaptations shall not impair the correct operation of the appliance.

It shall be possible, if necessary, to connect these ducts to the appliance using a commercially available tool; the accessories and 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 intended to lie in zones of equal pressure shall fit inside a square of side 50 cm.

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.

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 horizontal terminal shall be designed in such a way that any condensate is discharged outwards from the wall. If the manufacturer describes 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 terminal shall be supplied with the appliance for test.

6.1.7.4 Type C₂₁ appliances

These appliances 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 and combustion products discharge ducts into the common duct, whatever the total thickness (flue and cladding) of the common duct.

6.1.7.5 Requirements for fan-assisted appliances

6.1.7.5.1 Fan

Access to the rotating elements of any fan shall be prevented. Parts of any fan in contact with combustion products shall have adequate protection against corrosion if they are not made of corrosion-resistant material ; in addition, they shall be capable of withstanding the combustion products temperature.

6.1.7.5.2 Device for monitoring air supply

Before each start-up of the appliance, it shall be checked that there is no simulation of air flow. The supply of combustion air shall be checked continuously by :

- a) checking the pressure of combustion air or combustion products. This solution is only accepted for appliances equipped with a constant-speed fan and when the combustion circuit is completely surrounded by the air intake duct. In addition, the following requirements shall be respected :
 - the length of ducts shall not exceed 3 m ;
 - the ducts shall have no mobile and/or adjustable blocking devices ; and
 - the pressure loss of the heat exchanger shall not exceed 0.05 mbar ;
- b) checking the flow rate of combustion air or combustion products.

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.

A governor intended for operation with a pressure couple shall be adjusted or shall be capable of being adjusted in such a way that it cannot operate between the two normal pressures. However, when operating with a pressure couple, a non-adjustable gas governor is permitted for the ignition burner.

The design and accessibility of the gas governor shall be such that it can be easily adjusted or put out of service or, possibly, the governor or its components can be changed on conversion to another gas, but precautions shall be taken to make unauthorized interference with the preset adjuster difficult.

6.2.5 Pressure test points

All appliances shall be provided a gas pressure test point which allows the pressure at the appliance inlet to be measured.

For appliances which require the burner pressure to be measured, in accordance with the installation or conversion instructions, a second pressure test point shall be provided downstream of any preset adjuster.

For type C appliances, the measurement shall be able to be carried out at these points without opening the combustion circuit.

The pressure test points shall have an external diameter of $(9,0_{-0,5}^0)$ mm and a length of at least 10 mm to enable a rubber tube to be fitted.

The diameter of the bore of the pressure test point shall not exceed 1 mm at the narrowest place.

6.2.6 Ignition devices

6.2.6.1 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 normal tools.

Special ignition devices shall be provided (e.g. electric igniters) for type C appliances. Ignition of these appliances shall always be possible with the combustion chamber closed.

6.2.6.2 Ignition device for the main burner

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

6.2.6.2.1 Ignition burners

The cross section of the flame ports and the terminal area of the injectors shall not be adjustable.

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 the ignition burners differ according to the type of gas used, 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 ignition burner rate is not governed, a rate adjuster is mandatory for appliances operating on first family gases and optional for second and third family gases. It is however 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 can be changed easily.

Primary air inlet control devices are not permitted.

6.2.6.2.2 Direct ignition

Devices for direct ignition shall ensure safe ignition even if the voltage is varied from 85% to 110% of the nominal voltage. The order to energize devices for direct ignition shall be given no later than the order to open the automatic valve that releases the gas to be ignited. The ignition device shall be de-energized separately from flame detection and no later than the end of the ignition safety time.

6.2.7 Flame supervision device

6.2.7.1 General

The presence of a flame shall be detected :

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

At least one flame detector is required.

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

6.2.7.2 Thermoelectric flame supervision device

Separately marketed thermoelectric flame supervision devices shall meet the applicable requirements of EN 125 or EN 126 in the case of devices integrated in multifunctional valves.

The device shall cause a non-volatile lockout of the appliance in the case of flame failure and if the sensing element or the connection between this element and the actuator is destroyed.

If a safety device acts on the thermoelectric flame supervision device, closure shall be immediate.

In addition, for type C appliances, this device shall comprise either an ignition lockout, or a restart lockout.

6.2.7.3 Automatic burner control systems

Automatic burner control systems shall meet the applicable requirements of EN 298.

In case of flame failure, the system shall result in, 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 locking out with volatile lockout.

6.2.8 Combustion products discharge safety device

Appliances shall be so constructed that in abnormal draught conditions there is no release of combustion products in a dangerous quantity into the room concerned.

This can be achieved with a combustion products discharge safety device; in this case the appliance is designated as a type B_{11BS} appliance.

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;

may not be fitted with such a 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 case, the appliance is designated as a type B₁₁ appliance.

Any adjustable component forming part of the safety device shall be sealed by the manufacturer.

The safety device shall be designed so that it cannot be dismantled without a tool.

Incorrect refitting, after servicing, shall be made difficult.

The safety device shall be designed so that the electrical insulation withstands the thermal stresses resulting from spillage of the combustion products.

Interruption of the link between the sensor and the device responding to its signal or destruction of the sensor shall cause at least safety shutdown, if necessary after a waiting time.

6.2.9 Protection against accidental overheating

Closed appliances shall be fitted with overheating protection which cuts off the gas supply before the water temperature reaches 100 °C.

If the appliance is fitted with an electric overheating safety limiter, it shall meet the requirements of EN 60730-2-9 for type 2 K.

The action of the overheating safety device shall result in a non-volatile lock-out.

The sensor of the overheating safety device shall be independent of that of the control thermostat.

The valve which interrupts the gas supply shall be separate from the valve controlled by the control thermostat. The overheating safety device shall not be adjustable. The operation of the overheating safety device shall not be disrupted by the cold water supply or by deposits.

Any fault in the sensor or the connections between this element and the actuator or any interruption of the external power supply likely to impair the correct operation of the device shall result at least in a safety shutdown.

6.2.10 Control thermostat

All appliances shall be fitted with a thermostat which makes it possible to keep the water temperature in the storage vessel within specific temperature limits.

The water temperature thermostat shall meet the requirements of EN 60730-2-9 for type 1.

This thermostat may be :

- a) adjustable by the user. In this case, the position shall be clearly marked. It shall be easy to adjust, for example by means of a knob ;
- b) adjustable by the installer. In this case, there shall be a device which allows the installer to adjust the thermostat and then seal it ;
- c) non-adjustable.

6.2.11 Automatic shut-off valves

Automatic shut-off valves shall meet the relevant requirements of EN 161.

The gas circuit of the main burner and the gas circuit of the ignition burner, if heat input exceeds 0,250 kW, shall comprise at least two valves in series :

- a class C valve or a thermoelectric flame supervision device ;
- a second class D valve without an imposed closing time for appliances with a heat input not exceeding 70 kW, and with a closing time not exceeding 5 s for appliances with a heat input greater than 70 kW.

If the heat input of the ignition burner is less than or equal to 0,250 kW, the gas circuit of the ignition burner shall have at least one class C valve or a thermoelectric flame supervision device.

The safety devices which shall result in locking out with a non-volatile lockout shall give the order for the two valves to close simultaneously. However, in the case of a thermoelectric supervision device, the safety devices may act just on this device.

If the main burner is ignited directly and the order for control closure is not given simultaneously to the two valves, they may be class C valves.

If the period between the orders for control closure of the valves is less than or equal to 5 s, the orders are regarded as being simultaneous.

A class C valve may be replaced by a class B or class A valve; a class D valve may be replaced by a class C, class B, or class A valve.

Diagrams of the composition of the gas circuit are given in Annex D.

6.2.12 Combustion products temperature limiter

If the appliance is intended to be connected to a flue likely to be adversely affected by the heat of the combustion product (for example a plastics flue or a plastics-lined flue), the appliance shall have a device that prevents the combustion products temperature from exceeding the maximum permissible temperature for these materials declared by the manufacturer.

This device to limit the temperature of the combustion products shall not be adjustable and shall not be accessible without a tool. The action of this device shall result in a non-volatile lockout of the appliance.

6.2.13 Combined temperature and pressure relief valve

If the manufacturer's installation instructions specify the use of a combined temperature and pressure relief valve, the manufacturer shall fit the appliance with a combined temperature and pressure relief valve, complying with prEN 1490, or supply one with the appliance.

If a combined temperature and pressure relief valve is specified, the appliance shall be fitted with a connector at a specified location and of such a size that the combined temperature and pressure relief valve is fully open before the water temperature has reached 100 °C.

6.2.14 Flue damper

6.2.14.1 General

If the appliance and flue damper are to be marketed separately they shall be so designed that they cannot be assembled incorrectly. The installation instructions shall refer to this means of assembly.

If the auxiliary energy is interrupted or if some part that is important for the operation of the flue damper fails, it shall not be possible for the main burner to remain alight with the flue damper closed.

The gas supply to the main burner of the appliance shall not be released before the closure member has gone through 90 % of its total passage to the open position.

The connections between the damper and the shaft of the electric motor shall be rigid.

The connection of the closure member to the switch actuating the gas supply to the main burner shall be such that it cannot work loose. The switch controlling the gas supply to the main burner shall be actuated directly by the valve position. Otherwise it shall be safeguarded in some other, at least equivalent way.

Limit switches shall be so constructed and connected that a false "open position" signal cannot occur.

The position of the flue damper switch shall be proved prior to the operation of the burner.

6.2.14.2 Visual indication

An indication of the position of the flue damper shall be readily visible to the user.

6.2.14.3 Safety shut-off valve

The flue damper shall actuate an automatic shut-off valve of class A, B or C.

6.2.14.4 Minimum passage

For appliances with permanent or semi-permanent ignition burner, the minimum passage of the flue damper in a closed position shall be such that satisfactory pilot performance is ensured and there is no condensation from the combustion products.

6.3 Main burner

The cross section of the flame ports and the terminal area of the injectors of the burners and ignition burners shall not be adjustable.

All removable injectors and/or restrictors shall have an indelible identification mark to prevent any confusion. In the case of non-removable injectors and/or restrictors, the marking may be on the tank.

Any change of injectors or restrictors shall be capable of being carried out without a need to disconnect the appliance. If the injectors or restrictors are removable, their position shall be well defined and their fixing shall be such that it is difficult to put them in an incorrect position.

Burners shall be accessible without the need for any major disassembly of the appliance. If the burners or part of the burners are removable, their position shall be well defined and their fixing shall be such that it is difficult to place them in an incorrect position.

Primary air inlet control devices are not permitted.

NOTE Primary air adjusters are authorized for adjustments made and sealed at the factory. In this case they are regarded as being non-existent.

6.4 Discharge of condensate

In the case of appliances of the non-condensing type, any condensate shall be either evacuated or be re-evaporated avoiding any flow outside the appliance except, under certain conditions, via the combustion products flue of type C₁₁ appliances.

In the case of a condensing appliance, condensate produced during operation of the appliance, including condensate formed in the connecting or combustion products discharge pipes, shall be removed by means of a discharge pipe (or pipes).

The inside diameter of the condensate discharge pipe shall be at least 13 mm.

The discharge system, forming part of the appliance or supplied with the appliance, shall be such that :

- it can be easily inspected and cleaned in accordance with the manufacturer's instructions ;
- it cannot be easily obstructed ;
- it cannot transmit combustion products into the room where the appliance is installed; this requirement is satisfied if the discharge system incorporates a water trap ;
- the water trap has a seal of at least 25 mm at the maximum pressure in the combustion chamber at the maximum flue length specified by the manufacturer.

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

7 Operational requirements

7.1 Carrying out the tests

Except where otherwise stated, the requirements below are verified under the test conditions that follow.

7.1.1 Characteristics of the test gases

Storage water heaters are intended to use gases of various qualities. One of the aims of these specifications is to verify that the operation of the appliances is satisfactory for each of the gas families or gas groups for the pressures for which they are designed, after making use of the preset adjusters where appropriate.

The compositions and principal characteristics of the different test gases corresponding to the families or gas groups are given in EN 437.

7.1.2 Requirements for preparation of the test gases

The test gases are prepared in accordance with EN 437.

7.1.3 Choice of test gases

When an appliance can use gases of several groups or families, the tests are carried out using the reference gases and limit gases that correspond to the appliance categories as stated in EN 437.

For the efficiency tests (see 8.1.2.2), if several reference gases are specified, one of the 2nd family gases is used, preferably G 20.

7.1.4 Test pressures

Depending on the appliance categories, the test pressures have to be selected from EN 437, as appropriate, depending on the test gases and in compliance with the requirements of this standard.

The test pressures, i.e. the static pressures to be applied at the gas inlet connection with the appliance in operation, are given in EN 437.

These pressures and corresponding injectors shall be used in accordance with the requirements specified in Annex A depending on the country in which the appliance is to be installed.

7.1.5 General test conditions

The appliances are tested under the following conditions except where otherwise stated.

7.1.5.1 Test room

The appliance is installed in a well-ventilated, draught-free room (air speed less than 0,5 m/s), which has an ambient temperature of (20_{-3}^{+7}) °C, unless otherwise specified. The appliance is protected from direct solar radiation.

7.1.5.2 Installation requirements

For all tests, except where otherwise stated in the particular clauses, the appliance is installed, used and put into operation under the conditions specified in the manufacturer's instructions.

In particular, wall-mounted appliances are installed on a vertical test panel of plywood, or of a material with the same thermal characteristics, in accordance with the information in the technical instructions.

Except where otherwise stated, a type B₁ appliance is subjected to the draught created by a test flue of height 1 m, with an internal diameter equal to the smallest diameter stated by the manufacturer in the technical instructions and compatible with those given in Table A.7.

The thickness of the flue pipe is less than 1 mm.

If the diameter of the appliance flue socket does not correspond to the external diameter given in Table A.7, a linking piece of thickness 1 mm is used to adapt the flue socket diameter.

The height of the flue is measured :

- for appliances having a flue socket with a horizontal axis, from this axis ;
- for appliances having a flue socket with a vertical axis, from the plane of the flue socket outlet.

Type C appliances are tested with their ducts and terminal assembled in accordance with the manufacturer's instructions. When the manufacturer states in the installation instructions that a special terminal guard shall be fitted in certain cases, the tests are in general carried out without this guard except where specially stated in the relevant tests.

A type C₂ appliance is tested with the connecting ducts assembled in accordance with the manufacturer's instructions but not connected to a common test duct.

7.1.5.3 Water supply

The appliance is connected to a water supply capable of being controlled to give the required supply pressures to within ± 4 %. The stated water pressures are the pressure differences between the inlet and outlet of the appliance, including the valves supplied with the appliance.

The water inlet temperature shall in no case exceed 25 °C and, when the water outlet temperature is required to be measured, the water inlet temperature shall not vary by more than $\pm 0,5$ °C during the test.

The inlet temperatures are measured immediately upstream of the water inlet connection. Unless otherwise specified, the outlet temperatures immediately downstream of the outlet connection.

The hot water temperature is measured with a low inertia thermometer³⁾.

7.1.5.4 Measurement uncertainties

Unless otherwise specified in particular clauses, measurements shall be made with the maximum uncertainties stated below:

3) "Low inertia thermometer" means a measuring instrument with a response time such that 90% of the final temperature rise, in the range 15 °C to 100 °C, is obtained within 5 s when the sensor is plunged into still water.

These uncertainties correspond to two standard deviations. The laboratory evaluates these standard deviations taking account of the various sources of uncertainty: contribution from the instrument, repeatability, calibration, ambient conditions, etc..

- a) Atmospheric pressure 5 mbar ;
- b) combustion chamber and test flue pressure $\pm 5\%$ or 0,05 mbar ;
- c) gas pressure $\pm 2\%$;
- d) water-side pressure loss $\pm 5\%$;
- e) water rate $\pm 1\%$;
- f) gas rate $\pm 1\%$;
- g) time $\pm 0,2$ s up to 1 h ;
 $\pm 0,1\%$ beyond 1 h ;
- h) auxiliary electrical energy $\pm 2\%$;
- i) temperatures :
 - ambient ± 1 K ;
 - water ± 2 K ;
 - combustion products ± 5 K ;
 - gas $\pm 0,5$ K ;
 - surface ± 5 K ;
- j) CO, CO₂ and O₂ $\pm 6\%$;
- k) gas calorific value $\pm 1\%$;
- l) gas density $\pm 0,5\%$;
- m) mass $\pm 0,05\%$;
- n) couple $\pm 10\%$;
- o) force $\pm 10\%$.

For the determination of the leakage rate during the soundness tests, a volumetric method is used which gives a direct reading of the leakage rate and which is of such accuracy that the error in its determination does not exceed 0,01 dm³/h. The apparatus shown schematically in Figure 1 or another device giving equivalent results is used.

The stated measurement uncertainties relate to individual measurements.

For measurements that combine a number of individual measurements (for example: efficiency measurements), smaller uncertainties may be necessary on the individual measurements to ensure the required total uncertainty.

7.1.5.5 Adjustment of the appliance

The appliance shall be fitted successively with the appropriate components for each of the reference gases used, for the corresponding normal test pressure.

The gas governor and the preset gas rate adjusters are put out of service if they are not permitted for the gas concerned.

The appliance is adjusted, if necessary, in accordance with the technical instructions.

Except for tests having different conditions, the appliance is supplied with the reference gas(es) at normal pressure, in accordance with 7.1.4, and operated at its nominal heat input.

Before the required tests with a reference gas at the nominal heat input are carried out, an adjustment is made, where necessary, to ensure that the nominal heat input is obtained to within $\pm 2\%$ by changing the setting of the present gas rate adjuster or :

- if the appliance is provided with a gas governor kept in service for the gas to be used but has no preset gas rate adjuster, by putting the governor out of service and adjusting the appliance supply pressure ; or
- if the appliance has neither a preset gas rate adjuster nor a governor, or if these devices are put out of service for the gas to be used, by adjusting the appliance supply pressure.

The tests with the limit gases shall be carried out with the injector and adjustment corresponding to the reference gas of the group to which the limit gas belongs.

The test pressures shall be maintained constant to within $\pm 0,2$ mbar.

For all the tests at the minimum and maximum pressures, the pressures in 7.1.4 shall be used without the above correction.

7.1.5.6 Electrical supply

The appliance is supplied with nominal electric voltage or a voltage within the nominal voltage range, unless otherwise indicated in the specific clauses.

7.1.5.7 Steady state

Unless otherwise specified in the relevant subclauses, the tests are carried out in the steady state condition.

With the thermostat set at a mean value, the steady state is obtained by drawing off a quantity of water just sufficient to allow the burner to operate continuously at full rate or at reduced rate throughout the test, which, however, shall not commence until 10 min. after the burner has achieved its maximum rate.

7.1.5.8 Thermal equilibrium

The thermostat is set at the value indicated for the corresponding test. Temperature equilibrium mentioned in the specific clauses is obtained when, starting with the appliance cold, it has been heated up once and drained and then heated up a second time until the burner is extinguished.

7.2 Soundness

7.2.1 Soundness of the gas circuit

7.2.1.1 Requirements

The gas circuit shall be sound.

Soundness is assured if the leakage of air does not exceed :

- test no. 1: $0,06 \text{ dm}^3/\text{h}$;
- test no. 2: $0,06 \text{ dm}^3/\text{h}$, per shut-off device ;
- test no. 3: $0,14 \text{ dm}^3/\text{h}$.

7.2.1.2 Tests

The appliance gas inlet is connected to an air supply delivering an appropriate and constant pressure.

The appliance is at room temperature which shall remain constant throughout the tests.

The tests are carried out, firstly on delivery of the appliances, before any other test, and then on completion of the tests in this standard and after parts of the gas circuit comprising gas-tight joints which are specified as being removable in the manufacturer's instructions are removed and refitted five times.

An example of a device using the volumetric method is given in Annex E and Figure 1.

Test no. 1

The soundness of the first closure member is checked, with all other downstream closure members in the open position.

The pressure upstream of the appliance is 150 mbar.

Test no. 2

If the closure members have not been verified in accordance with the requirements of EN 161, the test is carried out with the appliance returned to its original state.

The test is carried out in the direction of the gas flow with the second closure member closed and the first one open. The ignition burner gas circuit is blocked.

The pressure upstream of the appliance is 50 mbar for appliances not using third family gases and 150 mbar for appliances using third family gases.

Any closure members in the ignition burner gas circuit are subjected to the same test.

This test is carried out at a test pressure of 6 mbar.

Test no. 3

The total leakage is checked with all the valves open as if the appliance were in operation, and the gas outlet blocked off by the careful use of solid injectors or suitable parts supplied by the manufacturer.

The pressure upstream of the appliance is 50 mbar for appliances not using third family gases, and 150 mbar for appliances using third family gases.

7.2.2 Soundness of the combustion circuit and evacuation of the combustion products

7.2.2.1 Type B₁ appliances

7.2.2.1.1 Requirements

Combustion products shall only escape from the outlet of the flue to which the appliance is connected.

7.2.2.1.2 Tests

The appliance, installed as described in 7.1.5, is connected to a 1 m test flue, except for wall-mounted appliances for which a 0,5 m test flue is used, unless the manufacturer specifies that the test shall be carried out on a 1 m flue. The test is carried out with one of the reference gases, or a gas actually distributed, for the category concerned at nominal heat input in still air, under normal draught conditions at steady state (see 7.1.5.7).

Spillages are looked for with a dewpoint plate (whose temperature is maintained at a value slightly above the dewpoint of the ambient air), which is moved close to all the places where a spillage is suspected.

In doubtful cases, however, look for spillages with a sampling probe connected to a rapid-response CO₂ analyser enabling contents of the order of 0,1% to be detected. Sampling shall not interfere with operation of the appliance and in particular shall not create any spillage of combustion products.

The requirement is satisfied if the amount of CO₂ does not exceed the amount in the test room by more than 0,20%.

7.2.2.2 Type C appliances

7.2.2.2.1 Requirements

The leakage rate is corrected to the reference conditions taking no account of the relative humidity of the air.

Soundness is ensured if the leakage rates do not exceed the values given in Table 2.

Table 2 — Soundness of combustion circuit

Parts concerned	Leakage rate in m ³ /h	
	Combustion products circuit completely surrounded by the combustion air circuit ^a	Combustion products circuit not completely surrounded by the combustion air circuit ^a
Appliance alone	3	0,6
Ducts alone	2	0,4 ^b
Appliance with its ducts	5	1
^a When, by choice of the manufacturer, the appliance and the ducts are tested separately, the requirements are taken from the applicable column. ^b Separate ducts are considered to be completely surrounded ducts if the leakage rates of the combustion products discharge duct do not exceed 0,03 dm ³ /h per mm diameter per joint.		

7.2.2.2.2 Tests

Tests are carried out in such a way that the assembly has the maximum number of seals indicated by the manufacturer, between :

- the appliance and its ducts ;
- the connection ducts ;
- the ducts and bends if applicable ; and
- the ducts, the duct adapter, if applicable, or the terminal.

If necessary, the wall mounting or the seal with the duct adapter may be sealed in compliance with manufacturer's instructions.

According to the choice of the manufacturer, the test is carried out either on the body of the appliance and on the ducts separately, or on the appliance connected to its ducts.

The test pressure shall be :

- for appliances without fans and appliances in which the fan is incorporated downstream of the combustion chamber :
 - 0,5 mbar ;
- for appliances in which the fan is incorporated upstream of the combustion chamber :

— 0,5 mbar + p_{br}

where

p_{br} is the pressure measured in the casing of the combustion chamber, the appliance being in thermal equilibrium at the nominal heat flow rate, equipped with longest ducts specified by the manufacturer.

The combustion circuit :

- of the body of the appliance and of the connection to the duct(s) ;
- of air intake ducts and combustion products evacuation flues ; or
- of the appliance connected to its ducts ;

shall be connected to a pressure source at one end and blocked at the other end.

7.2.3 Hydraulic test and soundness of the water circuit

7.2.3.1 Requirements

No water leakage shall appear during the test, nor any permanent visible deformation after the test.

7.2.3.2 Tests

The test pressure for the water circuit is 1,5 times the maximum service pressure declared by the manufacturer.

The water circuit is kept at the test pressure for at least 10 min, with the hydraulic safety group, if fitted, being put out of service.

7.3 Heat inputs

7.3.1 General

7.3.1.1 Heat input obtained

The heat input Q , expressed in kW, obtained during a test is given by one of the following expressions :

- if the volumetric rate is measured :

$$Q = 0,278 \times V_r \times H_i$$

or

- if the mass rate is measured :

$$Q = 0,278 \times M_r \times H_i$$

where

Q is the heat input obtained, in kilowatts (kW) ;

V_r is the measured volumetric rate expressed under reference conditions (15 °C, 1013,25 mbar) in cubic metres per hour of dry gas (m³/h) ;

M_r is the measured mass rate, in kilograms per hour of dry gas (kg/h) ;

H_i is the net calorific value of the gas used for the test, expressed as dry gas at 15 °C and 1013,25 mbar, in MJ/m³ on the volume basis, or in MJ/kg on the mass basis, as appropriate.

7.3.1.2 Corrected heat inputs for the verification of declared heat inputs

During the tests to verify a heat input, the corrected heat input Q_c , which would have been obtained if the test had been carried out under the reference test conditions (dry gas, 15 °C, 1013,25 mbar), is determined using the following formulae.

— If the volumetric gas rate V is measured :

$$Q_c = H_i \cdot \frac{10^3}{3600} \cdot V \sqrt{\frac{1013,25 + p_g}{1013,25} \cdot \frac{p_a + p_g}{1013,25} \cdot \frac{288,15}{273,15 + t_g} \cdot \frac{d}{d_r}}$$

whence

$$Q_c = \frac{H_i \cdot V}{214,9} \sqrt{\frac{(1013,25 + p_g) \cdot (p_a + p_g)}{273,15 + t_g} \cdot \frac{d}{d_r}}$$

— If the mass gas rate M is measured :

$$Q_c = H_i \cdot \frac{10^3}{3600} \cdot M \sqrt{\frac{1013,25 + p_g}{p_a + p_g} \cdot \frac{273,15 + t_g}{288,15} \cdot \frac{d_r}{d}}$$

whence

$$Q_c = \frac{H_i \cdot M}{61,1} \sqrt{\frac{(1013,25 + p_g) \cdot (273,15 + t_g)}{p_a + p_g} \cdot \frac{d_r}{d}}$$

In these formulae :

- Q_c is the corrected heat input, in kilowatts (kW) ;
- V is the measured volumetric gas rate expressed under the humidity, temperature and pressure conditions at the meter, in m³/h ;
- M is the measured mass gas rate, in kg/h ;
- H_i is, as appropriate, the net calorific value of the dry reference gas :
 - on the volume basis, in MJ/m³ ;
 - on the mass basis, in MJ/kg ;
- t_g is the gas temperature at the meter, in °C ;
- d is the density of the test gas⁴⁾ ;

4) If a wet meter is used to measure the volumetric rate, it may be necessary to make a correction to the density of the gas in order take account of its humidity. The value of d is then replaced by d_h given by the following formula :

$$d_h = \frac{d(p_a + p_g - p_s) + 0,622 p_s}{p_a + p_g}$$

- d_r is the density of the reference gas;
- p_g is the gas pressure at the meter, in mbar ;
- p_a is the atmospheric pressure at the time of the test, in mbar.

To carry out the tests :

- the water rate is adjusted as stated in 7.1.5.7 to ensure continuous operation of the burner ;
- the pressure at the meter shall be approximately the same as that at the appliance inlet.

7.3.2 Nominal heat input

7.3.2.1 Appliances without a preset adjuster

7.3.2.1.1 Requirements

For appliances without a preset gas rate adjuster, the corrected heat input shall not differ by more than 5% from the declared nominal heat input.

7.3.2.1.2 Tests

The tests are carried out at the normal test pressure with each of the appropriate reference gases.

7.3.2.2 Appliances with preset adjusters

7.3.2.2.1 Requirements

For appliances with preset gas rate adjusters, it is checked that the nominal heat input may be obtained.

7.3.2.2.2 Tests

The tests are carried out at the normal test pressure. It is checked that the gas rate, determined as stated in 7.3.1.2, may be obtained after operating the preset adjuster.

7.3.2.2.3 Instructions for adjustment of the heat input

7.3.2.2.3.1 Requirement

When the technical instructions specify the value of the downstream pressure that enables the nominal heat input to be obtained, the corrected heat input obtained in accordance with these instructions shall not differ by more than 5% from the declared nominal heat input.

7.3.2.2.3.2 Tests

The tests are carried out with each of the appropriate reference gases at normal test pressure.

The preset gas rate adjuster is set to the position giving the burner pressure stated in the technical instructions, measured at the downstream pressure test point.

where p_s is the saturated water vapour pressure at t_g , in mbar.

$$p_s = \text{EXP}\left(21,094 - \frac{5262}{(273,15 + t_g)}\right).$$

7.4 Temperature of the control knobs

7.4.1 Requirements

The surface temperatures of the knobs measured only in the areas where they are touched shall not exceed the ambient temperature by more than :

- a) 35 K for metals or equivalent materials ;
- b) 45 K for porcelains or equivalent materials ;
- c) 60 K for plastics or equivalent materials.

7.4.2 Test

The test is carried out with one of the reference gases or a distributed gas.

The temperatures are measured using temperature sensors. Verification is carried out when thermal equilibrium has been attained (see 7.1.5.8) at the maximum temperature given by the adjustment.

7.5 Temperature of the adjusting, control and safety devices

7.5.1 Requirement

The temperature rise of the device above the ambient temperature of the test room shall not exceed the maximum rise given by $(T_{\max} - 25)$ K, where T_{\max} is the maximum temperature in °C of the device stated by the manufacturer.

7.5.2 Test

The test is carried out under the conditions of 7.4.2.

However, when the device is itself likely to cause temperature rises (e.g. electromagnetic valves) the temperature measurement of the device may be replaced by measurement of the ambient temperature.

In this case, temperature sensors are arranged so as to measure the air temperature in the neighbourhood of the device. The result is considered satisfactory if the rise, above room temperature, of the air temperature in the region of the device does not exceed $(T_{\max} - 25)$ K.

7.6 Limit temperature of the walls and the test panels

7.6.1 Side walls, front and top

7.6.1.1 Requirements

The temperature of the side walls, front and top of the appliance, apart from the walls of the draught diverter and that of the duct that may exist between the appliance case and the draught diverter, shall not exceed the ambient temperature by more than 80 K.

However, parts of the case located less than 5 cm from the edge of the ignition port or viewing window and at least 15 cm from the flue are not concerned by this requirement.

7.6.1.2 Tests

The test is carried out under the conditions of 7.4.2.

The temperatures of the hottest points of the side walls, front and top are measured by means of temperature sensors by applying the sensing element to the outside of these parts of the appliance.

7.6.2 Test panels

7.6.2.1 Requirements

The temperature of the floor on which the appliance is possibly placed and that of the panels alongside and behind the appliance shall not exceed the ambient temperature by more than 80 K at any point.

When this temperature rise is between 60 K and 80 K, the manufacturer shall indicate in the technical instructions for the installer the nature of the protection to be provided between the appliance and the floor or the walls when they are made of inflammable materials.

This protection shall be supplied to the test laboratory which shall verify that, if the appliance is fitted with this protection, the measured temperature of the floor and panels will not exceed the ambient temperature by more than 60 K.

7.6.2.2 Tests

Depending on its design, the appliance is installed on a horizontal or vertical wooden test panel.

If the manufacturer indicates the possibility of installing appliances adjacent to one or several walls, the distances between the back and sides of the appliance and the wooden test panels are those indicated by the manufacturer or, in the case of appliances designed to be fixed to the wall, those given by the fixing device; however, this distance shall not exceed 200 mm in any case.

This distance is measured from the closest part of the appliance. The side panel is situated on the side of the appliance where the highest temperatures are.

If the manufacturer indicates the possibility of installing the appliance beneath a shelf, or a similar type of installation, a suitable panel is placed on top of the appliance at the minimum distance given in the technical instructions.

If the manufacturer specifies nothing regarding the possibility of installing the appliance close to one or several walls or beneath a shelf, the test is carried out with a suitable panel placed in contact with the appliance.

The wooden panels shall be 25 mm \pm 1 mm thick and finished in matt black paint. Their dimensions shall be such that they measure at least 5 cm more than the corresponding dimensions of the appliance.

The temperature sensors are incorporated in the panels in the centre of 10 cm squares and penetrate into the panels via the outer face so that the hot junctions are situated 3 mm from the surface facing the appliance.

The appliance is left in operation under the same conditions as 7.4.2 and the temperatures of the test panels measured when they have stabilized to within \pm 2 K.

If the manufacturer states in the technical instructions that it is necessary to use efficient protection, a further test is carried out with this protection in place.

The ambient temperature is measured at a height of 1,50 m above the floor and at a minimum distance from the appliance of 3 m by a temperature sensor protected against radiation from the test installation.

7.7 Ignition - Cross-lighting - Flame stability

7.7.1 Normal conditions

7.7.1.1 Requirements

In still air, it shall be capable of ensuring that ignition and cross-lighting are carried out correctly, quickly and quietly. The flames shall be stable. A slight tendency to lift at the moment of ignition is permitted but the flames shall be stable during operation.

There shall be a burner ignition for all values of the gas rate that can result from the adjustment and there shall be no prolonged lightback or lifting of the flame.

However, a brief lightback during ignition or extinction of the burner is tolerated if it does not affect its correct operation.

The permanent ignition burner, if fitted, shall not be extinguished during ignition or extinction of the burner; its flame shall not change either during operation of the appliance to the point of no longer being able to fulfill its role (burner ignition, operation of the flame supervision device).

When the ignition burner has been alight for a sufficient time to obtain normal and regular operation of the appliance, it shall always be ready to operate without failure even if the gas to the burner is interrupted and restored by operating the thermostatic control rapidly several times in succession.

For multi-rate or modulating appliances, these requirements are verified at nominal heat input and minimum heat input.

In addition in test 4, for appliances with an indirect means of signaling the presence of the flame, the carbon monoxide content of the neutral combustion products shall not exceed by more than 0,01% that obtained during the same conditions with the reference gas (see 7.12.2.1).

If spark restoration or recycling is planned, the above requirements shall also be met.

7.7.1.2 Tests

These tests are carried out twice with the appliance at ambient temperature and the appliance in the steady state condition.

The burner and ignition burner, if fitted, equipped with suitable injectors are adjusted beforehand as follows: they are supplied successively with each of the reference gases corresponding to the category so as to obtain the nominal heat input (see 7.1.5.5).

Then, the following four tests are carried out :

Test no. 1

The test is carried out without changing the adjustment either of the burner or the ignition burner.

For uncontrolled appliances, the appliance inlet pressure is reduced to a value equal to 70% of the normal pressure (see 7.1.4) for second family gases and to the minimum pressure indicated in 7.1.4 for the third family gases.

For controlled appliances, the pressure is also reduced to a value equal to 70% of the normal pressure, but the pressure downstream of the governor is reduced to a value corresponding to 90% of the nominal heat input for first family gases, 92,5% of the nominal heat input for second family gases and 95% of the nominal heat input for third family gases.

This test is repeated at the minimum heat input if ignition is possible under these conditions.

Test no. 2

For uncontrolled appliances, without altering the initial adjustment of the burner and ignition burner, the reference gases are replaced by the corresponding light-back limit gas and the pressure at the appliance inlet is reduced to the minimum pressure given in 7.1.4.

For controlled appliances, the pressure downstream of the governor is reduced, if necessary, to the value corresponding to 90% of the nominal heat input for first family gases, 92,5% of the nominal heat input for second family gases and 95% of the nominal heat input for third family gases, then the lightback limit gases are substituted for the reference gas.

This test is repeated at the minimum heat input if ignition is possible under these conditions.

Test no. 3

For uncontrolled appliances, without altering the initial adjustment of the burner and ignition burner, the appliance is supplied with the flame lift limit gas at the maximum pressure given in 7.1.4 and the absence of lift is checked.

For controlled appliances, the test is carried out with the burner input increased to 107,5% of the nominal heat input for first family gases or 105% of the nominal heat input for second and third family gases for the reference gases; then the corresponding flame lift limit gas is substituted for the reference gas.

This test is repeated at minimum heat input if ignition is possible under these conditions.

Test No. 4

For appliances with an indirect means of signaling the presence of the flame without changing the initial setting either of the burner or of the ignition burner, the appliance is supplied with the flame lift limit gas. The CO content is measured.

7.7.2 Special conditions

7.7.2.1 Type B₁ appliances

7.7.2.1.1 Resistance to draught

7.7.2.1.1.1 Requirements

The flames shall be stable.

7.7.2.1.1.2 Tests

The appliance is supplied with the reference gas or a distributed gas at nominal heat input and is subjected at burner level to a wind stream of 2 m/s. The wind stream covers at least the width of the burner and is made up of essentially parallel components (speed uniform to within $\pm 20\%$).

The axis of the wind stream is in a horizontal plane and is moved through one or more angles of incidence at the discretion of the laboratory within a semi-circle in front of the appliance, the centre of the semi-circle being at the intersection of the plane of symmetry of the appliance and the plane of the test.

The test is carried out on the ignition burner only (if fitted), then on the main burner at nominal heat input (and at minimum heat input, if appropriate). If there is a lighting door for the ignition burner, the test is carried out with the door closed.

7.7.2.1.2 Flue conditions

7.7.2.1.2.1 Requirements

The burner shall not be extinguished even if this is a result of the flame supervision device.

7.7.2.1.2.2 Tests

The appliance is supplied with a reference gas or a distributed gas at the nominal heat input.

For type B_{1BS} appliances, the combustion products discharge safety device is put out of operation.

A first test is carried out applying a continuous down-draught of 3 m/s to the top and within the flue.

A second test is carried out with the flue blocked.

7.7.2.2 Type C appliances

7.7.2.2.1 Requirements

Ignition of the ignition burner, ignition of the main burner by the ignition burner or direct ignition of the main burner, flame propagation over the whole of the main burner and stability of the ignition burner when it alone is alight or of the ignition burner and the main burner operating simultaneously shall be assured. Slight turbulence of the flames is accepted but extinction shall not occur.

7.7.2.2.2 Tests

These tests are carried out twice with the appliance at ambient temperature and with the appliance in thermal equilibrium.

7.7.2.2.2.1 Type C₁ and C₃ appliances

The appliance is installed in accordance with the information in the technical instructions, with accessories supplied by the manufacturer, on the test apparatus in Annex B.

The tests are carried out with the shortest and longest air supply and combustion products evacuation ducts.

The appliance is supplied with one of the reference gases for the category at the normal pressure.

First test series

With the appliances in thermal equilibrium, the terminal is subjected successively to winds of speeds :

- 1 m/s ;
- 12,5 m/s ;

and in the directions given in the figures, depending on the situation.

For each of the three incident planes, the three combinations of wind speed and incident angle that produce the lowest CO₂ content and, for the test described in 7.12.2.3.2, the highest CO content in the combustion products are noted.

Second test series

The appliance is at ambient temperature.

For each of the nine combinations giving the lowest CO₂ content in the first test series, it is checked that it is possible to light the ignition burner, if any, and then the main burner by means of either the ignition burner or the device for direct ignition.

Third test series

The boiler is at ambient temperature.

The tests of the first and second series are repeated at the minimum heat input if such operation is intended by the manufacturer.

Fourth test series

If the manufacturer makes provision for a terminal guard, this is fitted in accordance with the instructions, and the tests in the first series that gave the highest CO contents in the dry air-free combustion products are repeated.

The corresponding requirements of 7.7.2.2.1 are verified and the CO content of the dry, air-free combustion products is determined for use in evaluating compliance with the requirements of 7.12 (see 7.12.2.3.2).

7.7.2.2.2.2 Type C₂₁ appliances

The appliance is installed in accordance with the manufacturer's instructions on the test apparatus shown in Figure 3, the use of which is described in Annex C, using successively the minimum and maximum duct lengths specified by the manufacturer.

The appliance is supplied with the reference gas corresponding to the lift limit gas for its category at the nominal heat input.

The test apparatus is adjusted to give successively the following conditions :

- an upflow of average speed 2 m/s, a CO₂ concentration of 1,6% and a temperature within the range 60 °C to 80 °C;
- an upflow of average speed 4,5 m/s, a CO₂ concentration of 0,75% and a temperature within the range 40 °C to 60 °C.

All tests are repeated at minimum heat input if such operation is intended by the manufacturer.

The combustion products are also sampled under each of these test conditions, and the CO content of the dry, air-free combustion products is determined according to 7.12.2. These values of the CO content are used (see 7.12.2.3.3) in assessing compliance with the requirements of 7.12.

7.7.2.2.2.3 Type C₄ appliances

The appliance is installed with the shortest ducts specified by the manufacturer. A suction of 0,5 mbar is applied to the combustion products evacuation duct (see Figure 10).

7.7.2.2.2.4 Type C₅ appliances

The appliance is installed with the shortest ducts specified by the manufacturer. A suction of 2,0 mbar is applied to the combustion products evacuation duct (see Figure 10).

7.7.2.2.2.5 Type C₆ appliances

The appliance is installed with ducts supplied by the manufacturer. A pressure loss of 0,5 mbar is introduced to the opening of the combustion products evacuation flue (see Figure 10).

7.7.2.2.2.6 Fan-assisted appliances

The appliance is supplied at nominal electrical voltage or at extreme voltages from the nominal range. The test is repeated at a voltage varying from 85 % to 110 % of the nominal value.

7.7.3 Reduction of supply to ignition burner

7.7.3.1 Requirement

Ignition of the main burner shall be ensured without damaging the appliance.

7.7.3.2 Test

The appliance is supplied with each of the reference gases for its category. The gas supply to the ignition burner is reduced to the minimum necessary to keep the shut-off device of the flame supervision device open.

7.7.4 Additional requirements relating to operation of the permanent ignition burner when the fan is stopped

7.7.4.1 Requirements

The stability of the pilot flame of the ignition burner shall be correct.

7.7.4.2 Test

The ignition burner is adjusted with the reference gas at normal pressure as specified in the manufacturers' instructions.

The test is carried out with the fan stopped, in still air, at maximum pressure with incomplete combustion gas and coal gas. When the appliance is cold, the ignition burner is ignited and maintained in operation for 1 h.

7.8 Temperature of combustion products in condensing appliances

7.8.1 Requirements

If the appliance incorporates a device to limit the temperature of the combustion products, the temperature of the combustion products shall not exceed the maximum temperature for the materials of the combustion circuit and the flue materials specified by the appliance manufacturer.

Actuation of this device shall result in non-volatile lockout of the appliance.

7.8.2 Tests

The appliance is supplied with one of the corresponding reference gases for the appliance category at the nominal heat input.

Type B appliances are connected to a 0,5 m test flue and type C appliances are fitted with the shortest ducts specified by the manufacturer.

The appliance thermostat is overridden.

Where fitted, the control to limit the temperature of combustion products remains in operation.

The temperature of the combustion products is progressively raised, either by increasing the gas rate or by another means which increases the temperature (e.g. removal of baffles), in accordance with the manufacturer's instructions.

7.9 Adjusting, control and safety devices

7.9.1 General

The devices shall operate correctly in the case of normal or abnormal variation of the voltage between 85% and 110% of the rated voltage or extreme values of the range of rated voltages, as indicated in the various tests below.

For voltages less than 85% of the rated value, the devices shall continue to ensure safety, or cause a safety shutdown.

7.9.2 Ignition devices

7.9.2.1 Ignition burner ignition devices

7.9.2.1.1 Requirements

At least half the manual ignition attempts shall result in correct ignition of the ignition burner.

The efficiency of the ignition device shall be independent of the speed and sequence of operation. If manually-operated electric ignition devices are involved, their operation shall remain satisfactory when the voltage is varied between 85% and 110% or of the range of the rated voltage.

The signal to open the gas supply to the main burner shall only be given after detection of the ignition burner flame.

7.9.2.1.2 Tests

The tests are carried out at nominal heat input, with the appliance at ambient temperature, with each of the reference gases corresponding to the appliance category.

Ignition burners fitted with the suitable injectors, adjusted beforehand to the nominal heat input, are operated 40 times at intervals of at least 1,5 s after a first positive attempt.

7.9.2.2 Automatic ignition system of the ignition burner or main burner

7.9.2.2.1 Ignition

7.9.2.2.1.1 Requirements

The direct ignition devices shall ensure reliable ignition.

Ignition may be obtained after a maximum of 5 automatic attempts.

After each ignition attempt, the valve(s) shall open and close.

The ignition system shall be actuated at the latest at the same time as the command is given to open the valve(s).

If no ignition is produced, the spark shall persist until the end of the ignition safety time T_{SA} (a delay of - 0,5 s is permitted). Then, at least locking out with volatile lockout shall occur.

7.9.2.2.1.2 Tests

The burners and ignition burners fitted with suitable injectors are adjusted, if necessary, as indicated by the manufacturer. The tests are carried out with each of the reference gases corresponding to the appliance category at normal pressure and at a voltage equal to 0,85 times the rated voltage.

After a first positive ignition attempt, 20 ignition attempts with an interval of 30 s between two consecutive attempts are carried out when the appliance is at ambient temperature.

After first positive ignition attempt, 20 ignition attempts with interval of 30 s between two consecutive attempts are carried out immediately after deliberate extinction of the burner with the appliance at the thermal equilibrium.

Under these conditions, it is verified that each attempt results in ignition.

If several automatic ignition attempts are specified, the above test conditions are applied to the last automatic ignition attempt.

7.9.2.2.2 Endurance

7.9.2.2.2.1 Requirements

The spark generators shall withstand an endurance test of 100 000 cycles. After the tests, the operation of the device shall remain satisfactory and meet the requirements of 7.9.2.2.1.1.

7.9.2.2.2.2 Tests

The tests are carried out with the appliance at ambient temperature. The devices are supplied at a voltage of 1,10 times the rated voltage. The duration of the ignition sequence and waiting time between two attempts is given by the automatic control device.

7.9.3 Opening and safety times

7.9.3.1 Thermoelectric device

7.9.3.1.1 Ignition opening time (T_{IA})

7.9.3.1.1.1 Requirements

The ignition opening time of a permanent ignition burner with thermoelectric flame control shall not exceed 30 s.

This time may be increased to 60 s if, during this period, no manual intervention is required.

7.9.3.1.1.2 Tests

The appliance is supplied successively with each of the reference gases of the family concerned.

With the appliance at ambient temperature, the gas supply is opened and the ignition burner is lit. After a period equal to the limit fixed above, the manual assistance is withdrawn and it is verified that the ignition burner remains alight.

7.9.3.1.2 Extinction delay time (T_{IE})

7.9.3.1.2.1 Requirements

The extinction delay time of a thermoelectric flame control device shall not exceed :

- a) 6s if $Q_n \leq 35$ kW ;
- b) 45 s if 35 kW $< Q_n \leq 70$ kW ;
- c) 30 s if 70 kW $< Q_n \leq$ kW.

7.9.3.1.2.2 Tests

The appliance is supplied successively with each of the reference gases of the family concerned.

With the appliance at ambient temperature, the flame supervision device is actuated and the ignition burner lit.

The appliance is left to operate at its nominal heat input for 10 min.

The extinction delay time (T_{IE}) is measured between the moment the ignition burner and the burner are deliberately extinguished by interrupting the gas supply and the moment when, this supply having been re-established, it stops through the operation of the flame supervision device.

7.9.3.2 Automatic control and safety system

7.9.3.2.1 Ignition safety time (T_{SA})

7.9.3.2.1.1 Requirements

The T_{SAmax} is indicated by the manufacturer.

NOTE Where several automatic ignition attempts are carried out, the sum of the T_{SAS} and waiting times meet the above requirement for the T_{SAmax} .

If the nominal heat input of the ignition burner does not exceed 0,250 kW, there is no requirement for T_{SAmax} .

If the nominal input of the ignition burner is greater than 0,250 kW, or for direct ignition of the main burner, the T_{SAmax} is selected by the manufacturer so as to avoid any dangerous situation for the user or damage to the appliance.

This requirement is considered to be met when, for appliances with an heat input not exceeding 70 kW, the T_{SAmax} meets the following requirement :

$$T_{SAmax} \leq 5 \frac{Q_n}{Q_{IGN}}$$

without exceeding 10 s however,

where

Q_{IGN} is the ignition heat input (see 3.10.2.4).

For the following appliances :

- type B with a heat input exceeding 70 kW ;
- type B with a heat input not exceeding 70 kW whose T_{SAmax} does not meet the above requirement;
- type C ;

a limit ignition test is carried out as described in 7.9.3.2.5.

7.9.3.2.1.2 Tests

The appliance is supplied successively with each of the reference gases of the family concerned.

The ignition safety time (T_{SAmax}) is verified with the reference gas at the normal pressure, and the appliance adjusted to its nominal heat input is subjected to the limit supply voltages (85% to 110%) and temperatures (cold and at thermal equilibrium).

7.9.3.2.2 Extinction safety time (T_{SE})

7.9.3.2.2.1 Requirements

The extinction safety time of the ignition burner and of the main burner shall not exceed 5 s.

7.9.3.2.2.2 Tests

The appliance is supplied successively with each of the reference gases of the family concerned.

With the appliance operating at its nominal heat input, the extinction safety time is measured between the moment when the ignition burner and main burner are deliberately extinguished by interrupting the gas supply and the moment when, the supply having been re-established, it is stopped by the action of the safety device. The gas meter or any other suitable device may be used to detect closure of the flame supervision device.

With the burner alight, flame failure is simulated by disconnecting the flame detector and the time elapsing between this moment and the moment when the flame supervision device effectively shuts off the gas supply is measured.

7.9.3.2.3 Spark restoration

7.9.3.2.3.1 Requirements

If there is spark restoration, the ignition device shall be put back into service within a maximum period of 1 s after disappearance of the flame signal.

In this case, the T_{SA} is the same as for ignition and starts at the putting into service of the ignition device.

7.9.3.2.3.2 Tests

The appliance is supplied successively with each of the reference gases of the family concerned at the rated heat input.

7.9.3.2.4 Recycling

7.9.3.2.4.1 Requirements

If there is recycling, this shall be preceded by interruption of the gas supply. The ignition sequence shall start at its original point.

In this case, the T_{SA} is the same as for ignition and starts at the putting into service of the ignition device.

7.9.3.2.4.2 Tests

The appliance is supplied successively with each of the reference gases of the family concerned at the nominal heat input.

7.9.3.2.5 Limit ignition

7.9.3.2.5.1 Requirements

For type C appliances, type B appliances with a heat input exceeding 70 kW and type B appliances with a heat input not exceeding 70 kW with a T_{SAmax} not meeting the requirement of 7.9.3.2.1, it is checked that there is no deterioration of the appliance or ignition of the test fabric (type B appliances only).

7.9.3.2.5.2 Tests

The appliance is supplied successively with one of the reference gases of the family concerned at the nominal heat input.

A limit ignition test is carried out on the appliance under the following conditions :

- with the appliance at ambient temperature, an ignition spark is produced successively from 0 s to T_{SAmax} in steps ;
- for type B appliances only, the test fabric (cheesecloth) is placed at the minimum distances indicated in the technical instructions for flammable materials; if no indication is given, 0 cm is used.

The strip of material used for the test shall meet the following requirements :

- composition cotton ;
- mass per unit area 135 to 152 g/m² ;
- other materials 3% maximum ;
- number of threads per m warp 2,32 to 2,44, weft 2,28 to 2,40 ;
- weave plain or twilled 2/2 ;
- finish bleached (no fluff).

It is checked that there is no ignition of the test material and that the appliance has not undergone any deterioration.

7.9.4 Endurance of thermostats and temperature limiters

7.9.4.1 General

7.9.4.1.1 Requirements

The interlocking and release temperatures shall not deviate by more than 6 K from those indicated by the manufacturer.

7.9.4.1.2 Tests

If the tests are carried out away from the appliance, the sensor and body of the thermostats and of the temperature limiters are placed in an enclosure where the temperature is controlled and regulated.

The sensor is subjected to the temperature indicated in the relevant subclause.

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

For adjustable thermostats, this requirement is checked at the minimum and maximum temperatures of the control range.

7.9.4.2 Control thermostats

7.9.4.2.1 Requirements

At the end of the endurance tests, the thermostats shall remain satisfactory.

7.9.4.2.2 Tests

Bulb thermostats are placed in an enclosure in which the temperature varies by no more than 2 K/min. between the interlocking and release temperatures of the thermostat.

In the case of adjustable thermostats, these are adjusted to 0,7 times the maximum design temperature. Non-adjustable thermostats are tested at their maximum temperature selected by the manufacturer.

Contact thermostats are tested under the same conditions except that they are subjected to a contact temperature instead of being subjected to ambient temperature.

The thermostats are subjected to a 100 000 cycle endurance test.

7.9.4.3 Overheat and combustion products evacuation safety limiters

7.9.4.3.1 Requirements

At the end of the endurance tests, the operation of these limiters shall remain satisfactory.

Interruption of the connection between the detection element and actuator shall result at least in a safety shutdown.

7.9.4.3.2 Tests

The limiters, except for combined temperature and pressure discharge valves, shall withstand an endurance test of 4 500 thermal cycles without release and 500 interlocking and resetting cycles.

During the first test series, these limiters are subjected to the same test conditions as the non-adjustable thermostats except that the temperature of the enclosure or the surface temperature varies between 0,70 and 0,95 times the maximum declared temperature.

The second test series is carried out alternately at the temperature that results in release and that which permits interlocking.

Finally, with the appliance in the steady state condition, the connection between the detecting element and the actuator is broken⁵⁾ .

7.9.5 Operation of water temperature safety devices

7.9.5.1 Control thermostat

7.9.5.1.1 Requirements

The minimum control temperature shall be between 40 °C and 50 °C (test no. 1).

In the case of an adjustable thermostat, the maximum control temperature measured shall be between 60 °C and 85 °C (test no. 2).

In the case of a non-adjustable thermostat, the water temperature measured under the same conditions, shall be between 55 °C and 70 °C (test no. 3).

7.9.5.1.2 Tests

Test no. 1:

The appliance thermostat is adjusted to its minimum position and the appliance is started up at its nominal heat input with one of the reference gases corresponding to its category.

After the first shutdown of the burner by the thermostat, the burner gas supply is interrupted and a quantity of water equal to 10% of the nominal capacity at a rate equal to 1% of the nominal capacity, expressed in l/min (litre per minute) is drawn off via the hot water outlet.

At the end of this drawing off, the hot water temperature is measured as close as possible to the outlet.

Test no. 2:

The thermostat is then adjusted to its maximum position, the burner is re-ignited and the procedure of test no. 1 is repeated.

Test no. 3:

For non-adjustable thermostats, a single test is necessary.

7.9.5.2 Water overheat safety device

7.9.5.2.1 Requirements

The overheat safety device shall result in non-volatile lockout before the water temperature can exceed 100 °C.

The overheat safety device shall not be actuated by prolonged operation of the ignition burner or of the reduced rate of the modulating thermostat or the high/low thermostat.

7.9.5.2.2 Tests

The appliance is started up at its nominal heat input with one of the reference gases corresponding to its category.

The control thermostat is put out of operation.

5) If this test causes destruction of the safety device, a suitable test on a device supplied separately by the manufacturer may be agreed between the test laboratory and the manufacturer.

The water temperature in the tank is measured by drawing off immediately at the moment of shutdown by the overheat safety device.

In addition, for appliances with a permanent or alternating ignition burner, and/or with a modulating or multi-rate ignition burner the following test is carried out :

- the control thermostat is adjusted to its maximum position ;
- the ignition burner preset device, if fitted, is adjusted to its maximum position.

The main burner rate is reduced or stopped by the control thermostat and the ignition burner supplied at the maximum gas pressure given in 7.1.3.

After 16 h, it is verified that, solely under the action of the ignition burner or reduced rate, the water temperature in the tank has not risen to the above value.

7.9.6 Combustion products evacuation safety device for type B_{11BS} appliances

7.9.6.1 General

The general test conditions are specified in 7.1 except for the following specific points :

- the appliance is connected to a test flue as described in 7.2.2.1.2 ;
- the tests are carried out with a reference gas corresponding to the appliance category ;
- the shutdown times at nominal heat input are verified at the beginning of the heating-up time.

7.9.6.2 Nuisance shutdown

7.9.6.2.1 Requirements

When the combustion products are being evacuated normally the safety device shall not cause shutdown and the temperature rise that ensues with repeated drawing-off (see 7.10) shall not cause shutdown.

7.9.6.2.2 Tests

The appliance is installed as indicated in 7.9.6.1.

The appliance is kept operating at its maximum temperature for 30 min. It is verified that the device does not cause a shutdown. The main burner is then shut down.

The temperature rise after the burner shutdown shall not cause the device to order a shutdown.

7.9.6.3 Shutdown time

7.9.6.3.1 Requirements

The control device results at least in a safety shutdown within the maximum time limit fixed in Table 3:

Table 3 — Shutdown time as a function of the blockage

Degree of blockage	Diameter of the opening in the blocking plate d	Maximum shutdown time (minutes)	
		At nominal heat input Q_n	Minimum heat input Q_m
Total	0	2	$2 \frac{Q_n}{Q_m}$
Partial	$0,6 \times D$ or $0,6 \times D'$	8	—

D : internal diameter of the test flue at its top.
 D' : diameter of plate allowing limit of spillage to be obtained.

When there is a safety shutdown, automatic return to service will only be possible after a minimum waiting time of 10 min. The manufacturer shall indicate in the instructions for use the actual waiting time of the appliance.

7.9.6.3.2 Tests

7.9.6.3.2.1 Tests with complete blockage

The appliance is operated at nominal heat input. The gas evacuation duct is completely blocked (see Figure 8). The reaction time between blocking the duct and shutdown is measured. For appliances without lockout, the time between shutdown and ignition of the main burner is then measured with the blockage being maintained.

A second test is carried out at reduced heat input (if applicable).

7.9.6.3.2.2 Tests with partial blockage

The appliance is operated at nominal heat input.

The length of the telescopic duct is progressively reduced to the limit of spillage before the blocking plate is put into position.

If the device operates before this length has been reached, the requirement of 7.9.6.3.1 is regarded as satisfied.

If not, the telescopic test flue is covered with a blocking plate having a concentric circular orifice with a diameter d of 0,6 times the diameter D of the test flue at its upper extremity (see Figure 8).

If spillage is not achieved with the telescopic test flue, it is covered with a plate incorporating a circular hole of diameter D' which allows the limit of spillage to be obtained.

This plate is then replaced by another blocking plate incorporating a circular hole of diameter d which is equal to 0,6 times D' .

The time between the blocking plate being put into position and shutdown is measured.

However, if the manufacturer states a minimum flue height for this test, mandatorily not exceeding 0,50 m the test is carried out with a test flue of that height.

7.9.6.4 Endurance

7.9.6.4.1 Requirements

After the endurance test, the device shall operate as indicated in 7.9.6.3.

7.9.6.4.2 Tests

The device is made non-operational without any change to the component parts.

Under the test conditions of 7.9.6.1, the flue is totally blocked and the appliance is operated without interruption for 4 h. For this test, it is possible to use a distributed gas instead of the reference gas.

7.9.7 Pressure governors

7.9.7.1 Requirements

The gas rate of appliances fitted with a pressure governor shall not differ from the gas rate obtained at normal pressure by more than :

- a) - 10%, + 7,5% for first family gases, between p_n and p_{max} ;
- b) - 7,5%, + 5% for second family gases (without a pressure couple), between p_{min} and p_{max} ;
- c) \pm 5% for third family gases (without a pressure couple), between p_{min} and p_{max} ;
- d) \pm 5% for second and third family gases (with a pressure couple) between p_n and p_{max} corresponding to the higher pressure of the couple.

7.9.7.2 Tests

If the appliance is fitted with a pressure governor, the gas rate is measured with the reference gas at the normal pressure. Keeping the initial adjustment, the supply pressure is varied between :

- p_n and p_{max} for first family gases for requirement a) ;
- p_{min} and p_{max} for first and second family gases without a pressure couple for requirements b) and c) ;
- p_n and p_{max} for the higher pressure of the couple for second and third family gases with a pressure couple for requirement d).

7.9.8 Flue dampers

7.9.8.1 Resistance to high temperatures

7.9.8.1.1 Requirement

At the end of the resistance to high temperatures test, the operation of the flue damper shall remain unchanged.

7.9.8.1.2 Test

The appliance is supplied with the incomplete combustion gas at maximum pressure. After the main burner has been ignited the appliance is kept operating continuously for four hours. The water flow rate is so adjusted that the supply water temperature is about 60 °C.

7.9.8.2 Long-term performance

7.9.8.2.1 Requirement

At the end of the long-term performance test, the operation the flue damper shall remain unchanged.

7.9.8.2.2 Tests

This test is carried out at nominal input with one of the reference gases at normal supply pressure

At operating temperature, 5 000 switching operations of the flue damper, from closed to open and back to the closed position, are carried out by on/off regulation of the main burner.

At ambient temperature, i.e. with the appliance turned off, 40 000 switching actions of the flue damper, from closed to open and back to the closed position, are carried out. This test is carried out at the nominal input with one of the reference gases at nominal supply pressure.

At operating temperature another 5 000 switching actions are carried out. After each switching action it is checked that the opening and closing times do not deviate by more than 50 % from the times measured at the beginning of this long-term performance test.

7.10 Repeated draw-off

7.10.1 Requirements

During the repeated draw-off test, the water temperature shall never exceed 95 °C with the thermostat adjusted to its maximum position. The gas supply shall not be interrupted by the overheat safety device before a whole number of draw-offs corresponding to at least 50% of the nominal capacity.

7.10.2 Tests

The appliance is installed as indicated in 7.1.5.

The thermostat, if adjustable, is adjusted to its maximum position.

The test commences one hour after the end of the heating-up period.

The test is carried out at nominal rate with one of the reference gases corresponding to the appliance category.

Water is drawn off several times at a rate, expressed in l/min., of :

- 5% of the nominal capacity, but not less than 1 l/min. nor greater than 15 l/min for appliances with a heat input less than 12 W ;
- 10% of the nominal capacity, but not less than 2 l/min. or greater than 30 l/min for appliances with a heat input not less than 12 W.

In each draw-off period, the water is drawn off until the burner operates at a rate of at least 95% of its nominal heat input and then the drawing-off is immediately ended.

The following drawing off period commences immediately after extinction of the burner or when the gas rate drops to a value of less than 1,5 times the minimum rate in the case of a modulating or high/low thermostat.

The temperature of the water being drawn off is measured as close as possible to the outlet port at the beginning of each drawing-off period.

The test is continued :

- until a constant value is obtained for this temperature ; or
- for 5 ; or
- for 10 draw-offs.

7.11 Nominal capacity

7.11.1 Requirements

The volume of water measured shall not deviate by more than $\pm 5\%$ from the nominal capacity indicated by the manufacturer.

7.11.2 Tests

The appliance is filled with cold water, with the hot water outlet open to the atmosphere. It is then emptied as completely as possible either by gravity or siphoning. The water collected during drainage and weighed gives the capacity of the appliance.

7.12 Combustion

7.12.1 Requirements

The CO content of the dry, air-free combustion products shall not exceed :

- a) 0,10% under the normal conditions of 7.12.2.2 when the appliance is supplied with the reference gas(es) and under the special conditions of 7.12.2.3.1 ;
- b) 0,20% under the limit conditions of 7.12.2.2 when the appliance is supplied with the incomplete combustion limit gas and under the conditions of 7.12.2.3.2 and 7.12.2.3.3.

7.12.2 Tests

7.12.2.1 General

The appliance is supplied with gas and, if necessary, adjusted according to the instructions given in 7.12.2.2 and 7.12.2.3.

When the appliance is in the steady state condition, in accordance with 7.1.5.7, the combustion products are sampled using, for type B₁₁ and type B_{11BS} appliances, a probe placed as near as possible to the outlet of the heat exchanger as used for the blocked flue and downdraught tests.

For the other combustion tests, the combustion products are sampled by means of a probe of the type illustrated in Figure 4 or 5 which is placed in the test flue, 150 mm from the top of the flue.

For type C appliances, the combustion products are sampled by means of a probe of the type illustrated, by way of example, in Figure 6 installed as shown in Figure 7.

The CO content of the dry, air-free combustion products (neutral combustion) is given by the formula :

$$CO = (CO)_M \times \frac{(CO_2)_N}{(CO_2)_M}$$

where

CO	is the carbon monoxide content of the dry air-free combustion products, in percent ;
$(CO_2)_N$	is the maximum carbon dioxide content of the dry, air-free combustion products of the relevant gas, in percent ;
$(CO)_M$ and $(CO_2)_M$	are the measured concentrations in the samples taken during the combustion test, both expressed in percent.

The contents, in percent, of $(CO_2)_N$ for the test gases are given in Table 4 :

Table 4 — Percentage of CO₂

Designation of the gas	G110	G 20 G 27	G 21	G 23	G 25 G231	G 26	G 30	G 31 G 130	G 120	G 150	G 271
(CO ₂) _N	7,6	11,7	12,2	11,6	11,5	11,9	14,0	13,7	8,35	11,8	11,2

The CO content, in percent, of the dry, air-free combustion products may also be calculated by the formula :

$$CO = \frac{21}{21 - (O_2)_M} \times (CO)_M$$

where

(O₂)_M and (CO)_M are measured concentrations of oxygen and carbon monoxide in the samples taken during the combustion test, both expressed in percent.

The use of this formula is recommended when the CO₂ content is less than 2%.

7.12.2.2 Tests in still air

Type B₁ appliances are placed in the test room of 7.1.5.1, with the back as near as possible to a wall while following the manufacturer's instructions.

The appliances are installed under the conditions of 7.1.5.2.

Test no. 1

The test is carried out with each of the reference gases. The water rate and water temperature are adjusted in accordance with 7.1.5.7.

- For appliances with neither a gas governor in the main burner circuit, nor a preset gas rate adjuster, the test is carried out by supplying the appliance at the maximum pressure stated in 7.1.4 ;
- for appliances fitted with preset gas rate adjusters and without a gas governor in the main burner circuit, the test is carried out by adjusting the burner so as to obtain a heat input of 1,10 times the nominal heat input ;
- for appliances fitted with a gas governor in the main burner circuit, the test is carried out by altering the burner heat input to 1,07 times the nominal heat input if it is supplied with gas G 110 or to 1,05 times the nominal heat input if it is supplied with gas G 20 or G 25.

For appliances having a preset gas rate adjuster or a gas governor in the main burner circuits but which is put out of service for one or more gas families, the tests are carried out successively according to the various supply situations specified.

Test no. 2

The appliance is tested with the incomplete combustion limit gas for its category.

The appliance is first supplied with the reference gas and the heat input is adjusted to 1,075 times the nominal heat input, if the appliance has no governor, or 1,05 times the nominal heat input if the appliance has a governor.

If the appliance is intended to be installed exclusively on an installation with a meter governor, the factor of 1,05 may be applied. Then, without changing the adjustment of the appliance or the supply pressure, the reference gas is replaced by the corresponding incomplete combustion gas.

In addition, a test is carried out with each of the reference gases at the minimum heat input if it exists.

7.12.2.3 Supplementary tests

7.12.2.3.1 Type B₁ appliances

The tests are carried out at the nominal heat input with the reference gas with the highest Wobbe number for the category.

The appliance is fitted with a flue of the maximum diameter stated by the manufacturer.

- A first test is carried out with the flue blocked ;
- a second test is carried out by applying successively from the top of the flue a continuous down-draught of speeds 1 m/s and 3 m/s (see Figure 2).

For type B_{1BS} appliances, the combustion products discharge safety device is put out of action.

7.12.2.3.2 Type C₁ and C₃ appliances

The tests being carried out under the conditions of the first test series of 7.7.2.2.1 with the reference gas with the highest Wobbe number for the category, the arithmetic mean of the nine CO contents noted is calculated.

In addition, when the manufacturer makes provision for a terminal guard, tests are carried out under the conditions of the first or, if necessary, the fourth test series of 7.7.2.2.1, with the terminal guard fitted in accordance with the manufacturer's instructions, and the arithmetic mean of the nine CO contents thus determined is calculated.

7.12.2.3.3 Type C₂₁ appliances

The appliance is installed and tested as stated in 7.7.2.2.2 with the reference gas with the highest Wobbe number for the category.

7.12.2.3.4 Appliances of types C₄, C₅ and C₆

In the test conditions of 7.7.2.2.2, it is checked that requirements of 7.12.1 are met.

7.13 Non-condensation in the flue (type B appliances)

7.13.1 Requirements

Under the normal operating conditions, the appliance shall not give rise to condensation in a traditional flue. This requirement is met if :

- a) the combustion products temperature (t_{pdc}) exceeds the dew point temperature (t_{ms}) by at least 20 °C ($t_{\text{pdc}} > t_{\text{ros}} + 20 \text{ °C}$) ;
- b) or the flue losses are at least 8% ;
- c) or the useful efficiency does not exceed 90% ;
- d) or the combustion products temperature is not less than 80 °C.

These requirements do not apply to condensing appliances.

7.13.2 Tests

7.13.2.1 Exceeding the dew point temperature

The appliance is installed as indicated in 7.1.5. However, it is connected to the 5 m test flue as shown in Figure 9.

The test is carried out at nominal heat input and minimum heat input if appropriate, in accordance with 7.1.5.7.

The combustion products temperature and their CO₂ content are measured.

7.13.2.2 Determination of flue losses

The combustion products temperature and their CO₂ content are measured at the nominal heat input.

The flue losses are determined, for example, using the following formula :

$$q_c = \left(a + \frac{b}{\text{CO}_2} \right) \times \frac{(t_c - t_a)}{100}$$

where

q_c are the flue losses of the heat input in percent ;

CO₂ is the carbon dioxide content in the dry products of combustion, in per cent ;

t_c is the temperature of the products of combustion in °C ;

t_a is the ambient temperature, in °C .

a and b are the coefficients given in Table 5 below :

Table 5 — Coefficients for determination of flue losses

Coefficient	Reference gas			
	G 110	G 20	G 25	G 30
A	1,05	0,86	0,85	0,65
B	23,2	36,6	36	42,5

7.13.2.3 Maximum useful efficiency

The useful efficiency is determined at nominal heat input.

7.13.2.4 Minimum combustion products temperature

The combustion products temperature is measured in the 1 m test flue 150 mm from the top of the flue.

The test is carried out at the minimum heat input (or nominal heat input if there is only one rate).

7.14 Formation of condensate (in the case of condensing appliances)

7.14.1 Requirements

When the appliance is installed in accordance with 7.1.5, the condensate produced during operation of the appliance shall only form at the points intended for this purpose and shall be readily drained.

The condensate shall not find its way to parts of the appliance which are not intended for formation, collection or discharge of condensate nor shall it adversely affect the operation of the system, nor cause any nuisance to the appliance or its environment.

7.14.2 Tests

This test is carried out under the same conditions as 9.4.2 with a temperature rise of 30 K and with the appliance operating continuously for 4 h.

7.15 Prepurging

7.15.1 Requirements

For fan-assisted appliances, prepurging is compulsory before each ignition of the main burner (one attempt or several sequential automatic ignition attempts), except if one of the following conditions is satisfied :

- a) the appliance is equipped with a permanent or non-permanent ignition burner ;
- b) if the heat flow rate is greater than 0,250 kW, the gas circuit features two taps which close simultaneously ;
 - 1) of class C (or B, or A) ; or
 - 2) one of class B (or A) and the other of class D (or C, or B, or A).

Under test conditions, the volume or duration of prepurging shall be at least the following :

- for appliances in which the prepurging air is drafted over the whole of the intake cross-section of the combustion chamber : at least the volume of the combustion chamber or at least 5 s at air flow rate corresponding to the nominal heat flow rate ;
- for other appliances, at least three times the volume of the combustion chamber or at least 15 s.

7.15.2 Test

Depending on the option chosen by the manufacturer, the volume or time for prepurging are determined as follows :

- a) prepurging volume
 - the air flow rate is measured at the combustion products flue output at ambient temperature ;
 - the appliance is stopped at ambient temperature. The fan is powered at the electrical voltage specified for prepurging ;
 - the flow rate measured precisely in a range of ± 5 % is returned to reference conditions (15 °C, 1 013,25 mbar) ;
 - the volume of the combustion circuit is indicated by the manufacturer ;
- b) prepurging time
 - the duration between the fan start-up command and power up of the ignition device is determined.

7.16 Air monitoring device

7.16.1 Requirements

The gas flow rate shall cease before the CO content exceeds 0,2 %.

7.16.2 Tests

The appliance is supplied with one of the reference gases from its category at nominal heat input. Measurements are carried out at normal operating temperature (according to 7.1.5.7).

The appliance is connected to air intake ducts and the longest combustion products evacuation flues specified by the manufacturer. Tests are carried out without the terminal or the duct adapter.

The CO content is determined as indicated in 7.12. The CO and CO₂ contents are measured continuously.

In the case of a pressure or combustion products monitoring device, the voltage at the fan terminations is progressively reduced.

In the case of a combustion air or combustion products monitoring device, the air intake duct or the combustion products evacuation flue is progressively blocked. The method used for blocking shall not allow combustion products to be reintroduced.

8 Rational use of energy

8.1 Efficiency

8.1.1 Requirements

The efficiency based on the net calorific value shall not be less than :

- e) 84% for all appliances, except condensing appliances ;
- f) 98% for condensing appliances.

8.1.2 Tests

8.1.2.1 General

The appliance is supplied with the reference gas corresponding to its category and adjusted to supply the nominal heat input.

The measuring uncertainties are selected so as to ensure an overall uncertainty in the measurement of the efficiency of $\pm 2\%$.

The test is carried out under the following normal combustion products evacuation conditions:

- type B₁ appliances connected in accordance with 7.1.5 to the test flue of the largest diameter specified by the manufacturer in his technical instructions ;
- type C appliances installed as described in 7.7.2.2.2.1 in still air and 7.7.2.2.2.2 in a non-polluted atmosphere (all dampers open and test bench fan stopped as in Figure 3)

8.1.2.2 Determination of efficiency

The efficiency η_u (in %) is calculated using one of the formulae :

$$\eta_u = 100 \cdot \frac{m \cdot C_p \cdot \Delta}{V_\eta \cdot H_i} \quad (\text{1st, 2nd, 3rd family gases})$$

or

$$\eta_u = 100 \cdot \frac{m \cdot C_p \cdot \Delta}{m_\eta \cdot H_i} \quad (\text{3rd family gases})$$

where

m is the mass of water collected during the test, in kg ;

- C_p is the specific heat of water, $4,186 \times 10^{-3}$ in megajoules per kilogramme and per kelvin ($\text{MJ kg}^{-1} \text{K}^{-1}$);
- ΔT is the temperature rise of this water, in K, obtained by subtracting the mean temperature of the cold water in degrees Celsius from the mean of 10 measurements of the temperature of the hot water in degrees Celsius;
- V_{η} is the volume of dry gas (first, second and third family gases) used by the appliance during the test, corrected to reference conditions in m^3 ;
- M_{η} is the mass of gas (third family gases) used by the appliance during the test and expressed in kg;
- H_i is the net calorific value of the dry gas used expressed, as appropriate :
- on the volume basis, in MJ/m^3 ;
 - on the mass basis, in MJ/kg .

The temperatures are measured immediately before the inlet connection and immediately after the water outlet connection of the appliance, every precaution being taken that the measuring device does not give rise to any thermal losses.

With the thermostat set at its maximum value, the cold water inlet is closed. The gas supply is interrupted and the hot water is drawn through the drainage port. The drainage rate is adjusted if possible to a value of approximately 1/10 of the capacity per minute.

At the end of drainage, the appliance is refilled with cold water and its temperature t_f is measured. The burner is relit and the temperature rises again until the gas is shut off by the action of the thermostat (or the gas rate drops to the minimum gas rate in the case of a modulating or high/low thermostat). During this new temperature rise, the cold water supply is shut off, the quantity of gas consumed is measured and the water evacuated by expansion is collected (at the valve and hot water outlet).

The gas supply is shut off and the appliance is drained as previously.

During the second drainage period, the temperature of the water leaving the appliance is measured 10 times: the first when the quantity of water equal to approximately one twentieth of the normal capacity has drained, then each time that a quantity of water equal to approximately one tenth of the capacity has drained.

The total mass of water drained is measured by weighing.

8.2 Maintenance consumption

8.2.1 Requirements

The maintenance consumption shall not exceed the value given by the following formulae :

- for appliances of any nominal capacity with a heating-up time (see 9.1) not less than 45 min, and for appliances with a nominal capacity up to 200 l with a heating-up time less than 45 min :

$$q = 11C^{2/3} + 0,015 Q_n \text{ (or 250 W if the value given by the formula is lower);}$$

- for appliances with a nominal capacity exceeding 200 l with a heating-up time less than 45 min :

$$q = 9C^{2/3} + 0,017 Q_n \text{ (or 250 W if the value given by the formula is lower) ;}$$

where

- q is the maintenance consumption in W ;
- C is the nominal capacity in litres ;
- Q_n is the nominal heat input in W.

8.2.2 Tests

The appliance connected to the 1 m flue if it is of type B₁ or to the special evacuation device of minimum length if it is of type C is supplied with one of the reference gases; the thermostat is adjusted to a position corresponding to a hot water temperature of approximately 45 K above the ambient temperature t_a in the case of a variable temperature appliance and the value specified in the case of a fixed temperature appliance.

The appliance is started up to attain this temperature rise and with the gas having been shut off twice by the thermostat in the case of the on/off type thermostats or operating at the minimum rate given by the high/low or modulating thermostats, the mean water temperature t_{ch1} is determined (using a circulator for example).

The appliance is then kept at the maintenance consumption for a number of complete cycles and for a period T_e of at least 24 h. Then the water is drawn off and temperature t_{ch2} is measured.

The quantity of gas consumed is measured.

The volumetric consumption of gas G obtained is corrected as follows:

$$G' = G \cdot \frac{t_{ch} - 20}{t_{ch} - t_a} \cdot \frac{45}{t_{ch} - t_a} \cdot \frac{24}{T_e}$$

with

$$t_{ch} = \frac{t_{ch1} + t_{ch2}}{2}$$

where

- G is the maintenance consumption obtained during the test, in m³/h ;
- t_{ch1} is the mean water temperature at the beginning of the test ;
- t_{ch2} is the mean water temperature at the end of the test ;
- t_a is the mean ambient temperature ;
- T_e is the test duration, in h.

The maintenance consumption q (in W) is obtained by the following formula

$$q = \frac{1000}{3,6} \cdot \frac{(G' \cdot H_i)}{24}$$

9 Fitness for purpose

9.1 Heating-up time

9.1.1 Requirements

For all types of appliances, the time necessary to raise the water temperature by 45 K shall not exceed the value given by the manufacturer.

9.1.2 Tests

Starting with the appliance cold, it is heated up once then drained then immediately filled with cold water. The thermostat is adjusted to obtain a temperature rise of the water of approximately 45 K or the value specified in the case of a fixed temperature appliance.

The burner is relit and the time T_C is measured between ignition of the burner and :

- either shutdown of the burner by the action of the thermostat if this is of the on/off type ;
- or when the gas rate falls to the minimum rate if the thermostat is of the high/low or modulating type.

1/10th of the nominal capacity is drawn off and the water temperature t_{ch} is measured.

The nominal heating-up time T is derived from the formula :

$$T = T_C \frac{45}{t_{ch} - t_f}$$

where

t_{ch} is the hot water temperature after drawing off 1/10th of the nominal capacity ;

t_f is the cold water temperature.

9.2 Mixing factor of the water temperature in the appliance

9.2.1 Requirements

The water temperature measured at the outlet at the end of drawing off shall exceed :

$t_f + 0,9 (t_c - t_f)$ after drawing off 70% of the nominal capacity ;

and

$t_f + 0,6 (t_c - t_f)$ after drawing off 85% of the nominal capacity;

where

t_c is the hot water temperature in degrees Celsius ($^{\circ}\text{C}$) ;

t_f is the cold water temperature in degrees Celsius ($^{\circ}\text{C}$).

During this test, it shall only be possible for the burner to be brought back into service by the action of the control thermostat.

9.2.2 Tests

The appliance is installed in accordance with 7.1.5, then brought into the thermal equilibrium conditions of 7.1.5.8.

The test is carried out at the nominal input with one of the reference gases corresponding to the appliance category.

The thermostat is adjusted to obtain a cold water temperature rise of approximately 45 K.

The test begins after the first shut-off by the thermostat.

The cold water temperature t_f is measured.

Water is drawn off via the hot water outlet port at a rate, expressed in l/min., of $(10 \pm 0,5\%)$ of the nominal capacity but not less than 2 l/min. nor greater than 30 l/min.

The temperature of the hot water drawn off t_c is measured as close as possible to the hot water outlet port of the appliance.

The temperature t_c is measured at the moment when a quantity of water approximately 5% of the nominal capacity has been drawn off.

During the test, the main burner shall only be capable of being restored by the action of the control thermostat.

9.3 Draw-off limits causing operation of the burner

9.3.1 Requirements

The appliance shall be relit for a draw-off value between the following limits :

- lower limit 0,05 C ;
- upper limit $(0,17 + \frac{10}{T}) C ;$

where

T is the heating-up time expressed in minutes (min) ;

C is the capacity expressed in litres (l).

9.3.2 Tests

With the appliance installed in accordance with 7.1.5 and brought to thermal equilibrium as specified in 7.1.5.8. Water is drawn from the hot water outlet port at a rate, expressed in litres per minute of $(5 \pm 0,5\%)$ of the nominal capacity without however being less than 1 l/min.

During the test, the main burner shall only be capable of being brought back into operation by the action of the control thermostat.

9.4 Continuous draw-off

9.4.1 Requirements

If the manufacturer declares a continuous draw-off for a temperature rise of 30 K, it is checked that the continuous draw-off rate is at least equal to that declared by the manufacturer.

9.4.2 Tests

The draw-off rate is adjusted to that indicated by the manufacturer. Measurement begins after having drawn off a quantity of water equal to 1,5 times the appliance capacity.

Under these conditions, the burner shall never be extinguished and the temperature of the water drawn off shall not vary by more than ± 2 °C relative to the variation of the cold water temperature.

9.5 Specific rate

9.5.1 Requirements

If the manufacturer declares a specific rate D , the value measured afterwards shall not be more than 5% below the value indicated by the manufacturer on the data plate.

9.5.2 Test

The appliance is supplied with one of the reference gases and is operated at the nominal heat input.

The domestic hot water temperature is adjusted to 65 °C by acting on the thermostat. If, as a result of the design, the temperature of 65 °C cannot be attained, the test is carried out at the closest possible temperature to 65 °C. The first drawing off is carried out after the second controlled shut down of the burner and lasts 10 min. The temperature and the water rate are recorded.

After a waiting time of 20 min after the end of the first drawing off, a further water drawing off is carried out for 10 min and the temperature and water rate are recorded.

For each drawing off the following is calculated :

$$D_i = \frac{m_{i(10)}}{10} \times \frac{\Delta t}{30}$$

where

D_i is the specific rate D_1 and D_2 , determined respectively during the first and second drawing off, expressed in litres per minute (l/min) ;

$m_{i(10)}$ is the quantity of water collected during the first or second drawing off, expressed in litres (l) ;

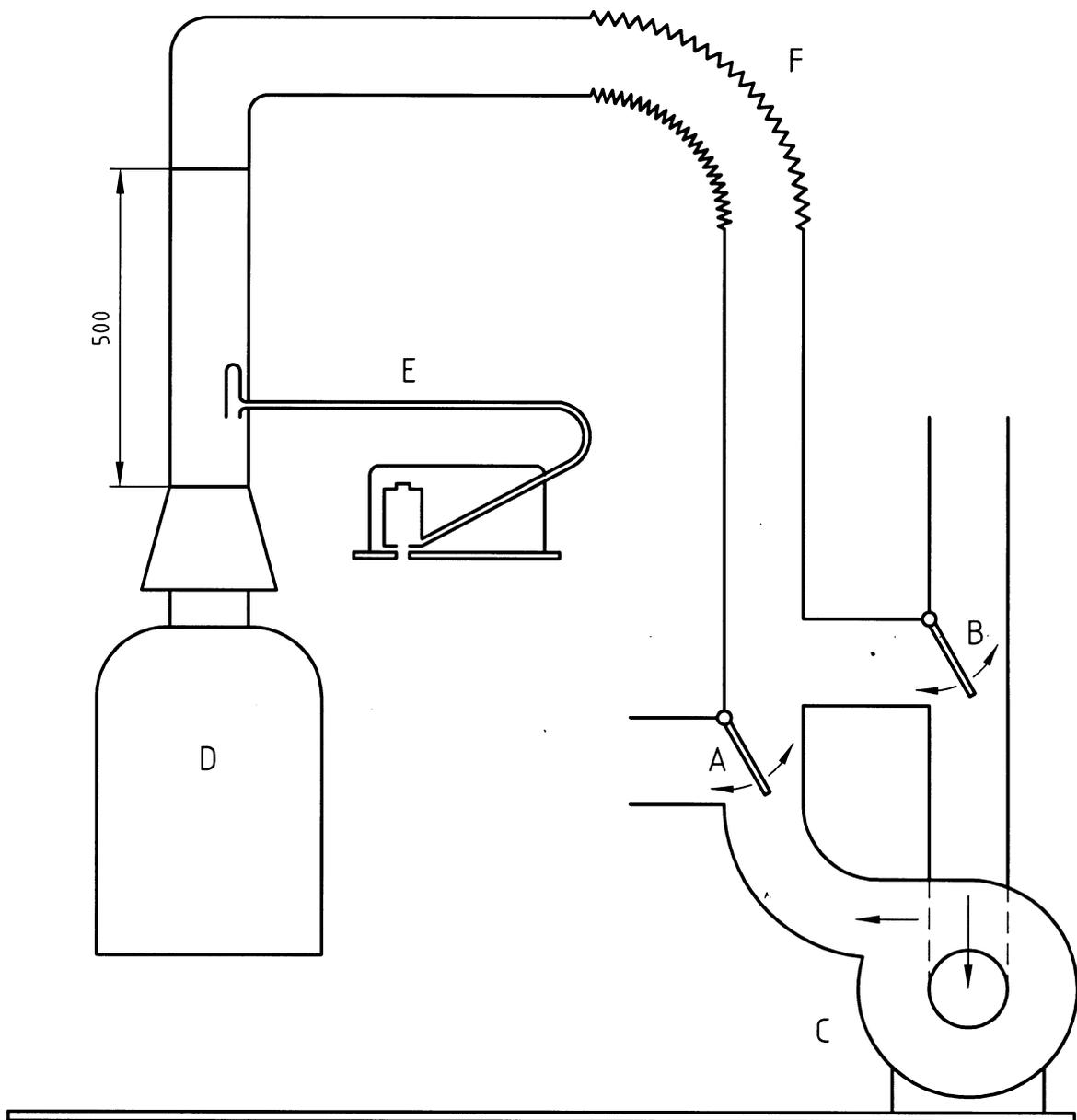
Δt is the mean effective temperature rise of the collected water, expressed in kelvins (K).

If the difference between D_1 and D_2 does not exceed 10% of their average value, the requirement applies to :

$$\frac{D_1 + D_2}{2}$$

If the difference between D_1 and D_2 exceeds their average value, the requirement applies to the lower value of the two.

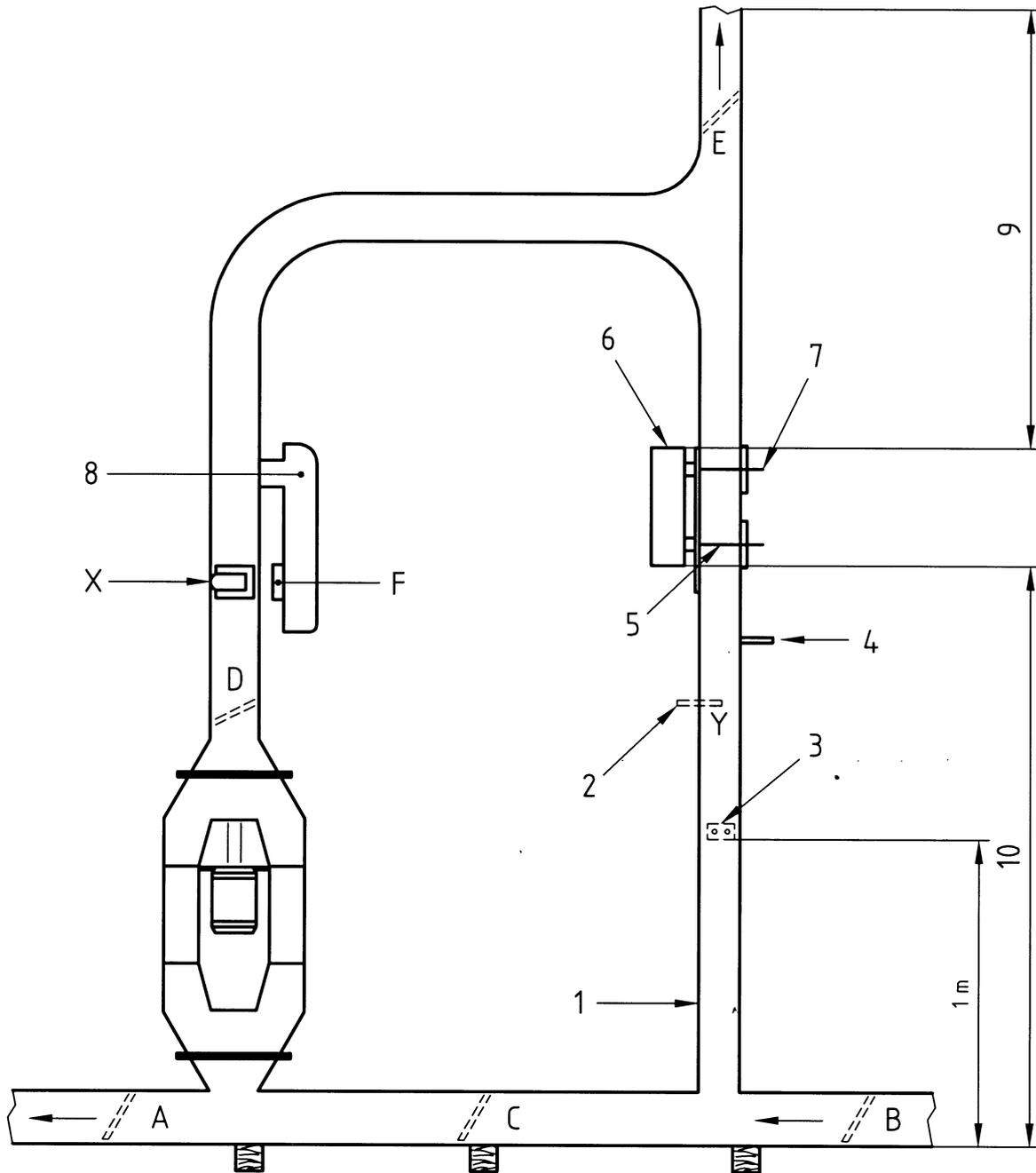
Dimensions in millimetres



Key

- A and B: By-pass valves to obtain either a downdraught or suction
- C: Fan
- D: Hot water generator
- E: Measurement of speed by means of pilot tube
- F: Hose

Figure 2 — Test of an appliance of types B₁ under abnormal draught conditions (see 7.12.2.3.1)



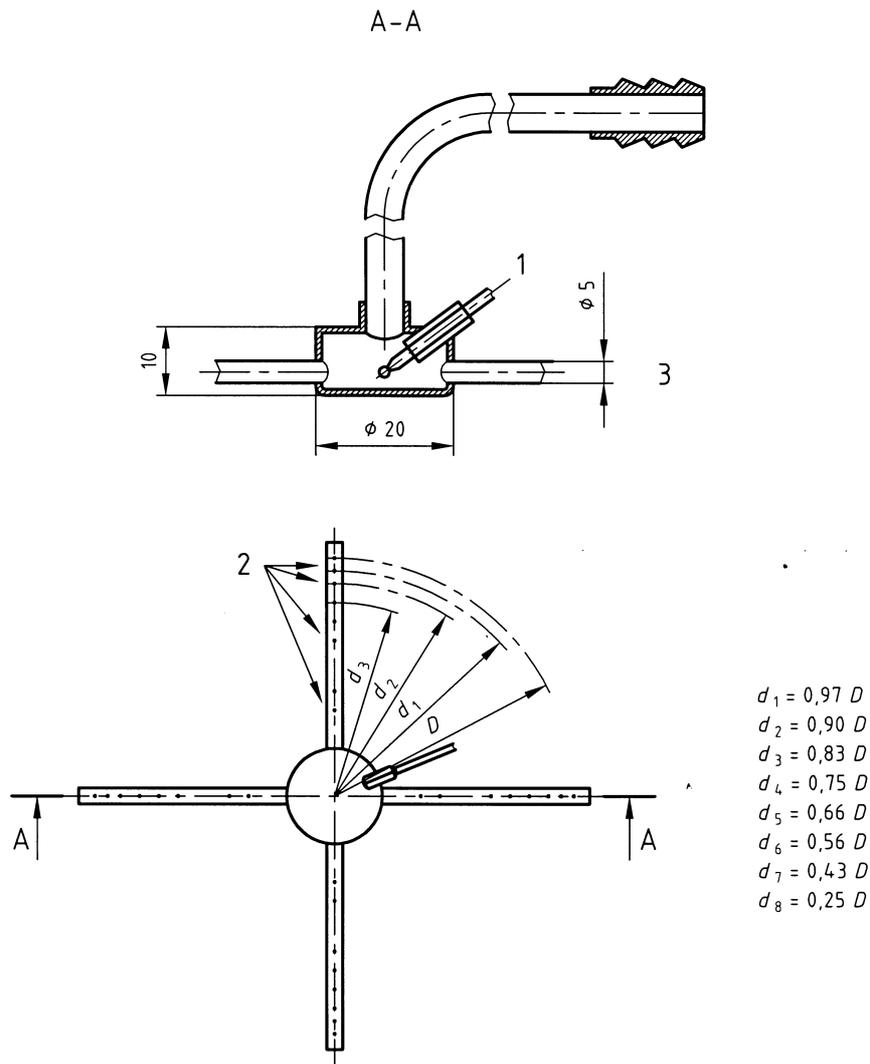
Key

- 1 Rectangular section duct 225 mm × 400 mm
- 2 Temperature reading point
- 3 2 recordings anemometers (interchangeable)
- 4 Pressure tapping point
- 5 Connection to CO and CO₂ analysers for pollution test in the updraught
- 6 Appliance under test
- 7 Thermocouple and sampling tube to be connected to CO and CO₂ analysers
- 8 Hot water generator
- 9 1 m at least
- 10 2 m at least

X: Heat exchanger

Figure 3 — Test of a type C₂₁ appliance mounted on the common duct
(see 7.7.2.2.2.2 and Annex C)

Dimensions in millimetres

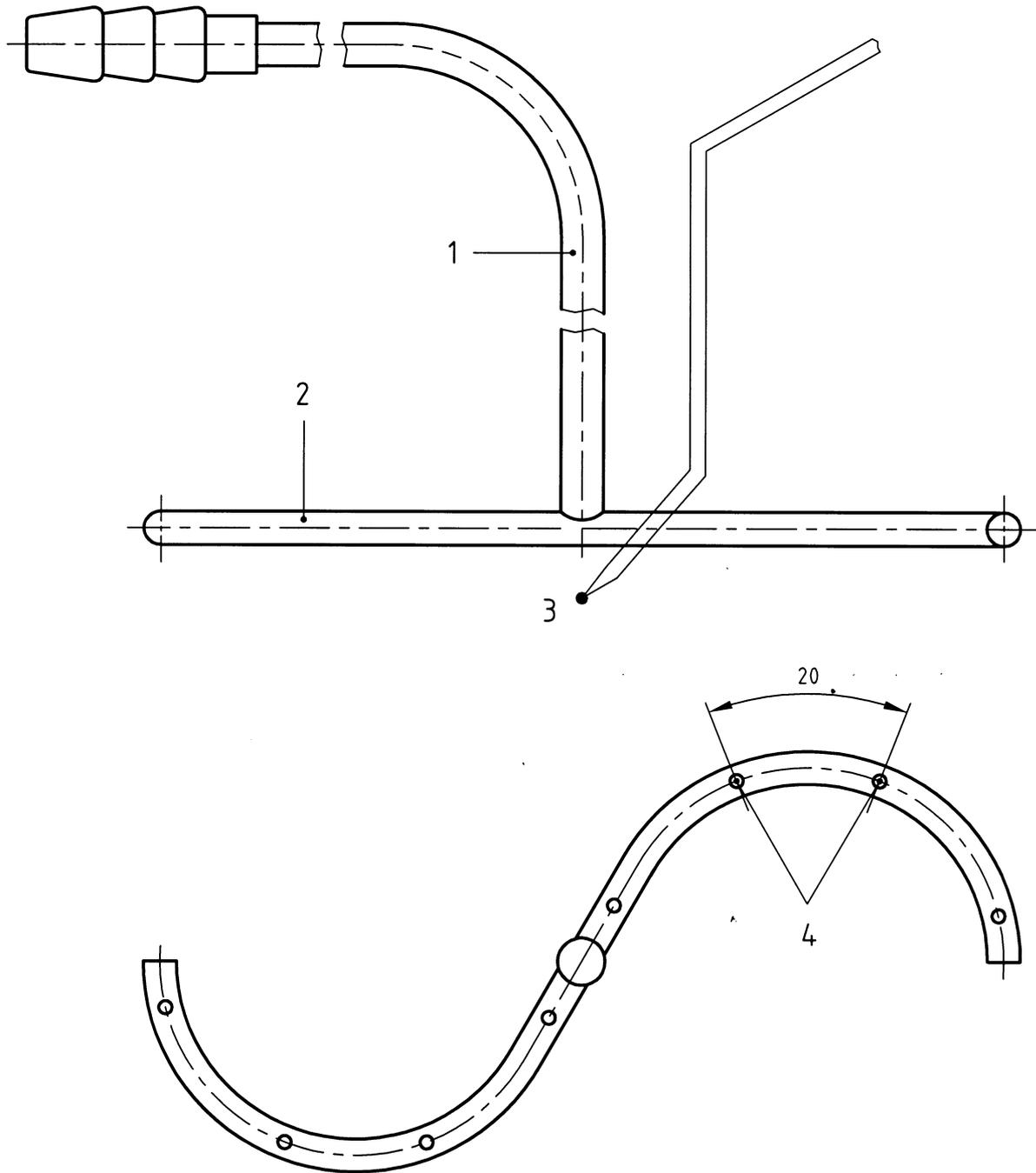


Key

- 1 Thermocouple
- 2 Openings in each branch : $8 \times \varnothing 1$
- 3 Sampling probe

Figure 4 — Sampling probe for test flues of diameter greater than 100 mm (see 7.12.2.1)

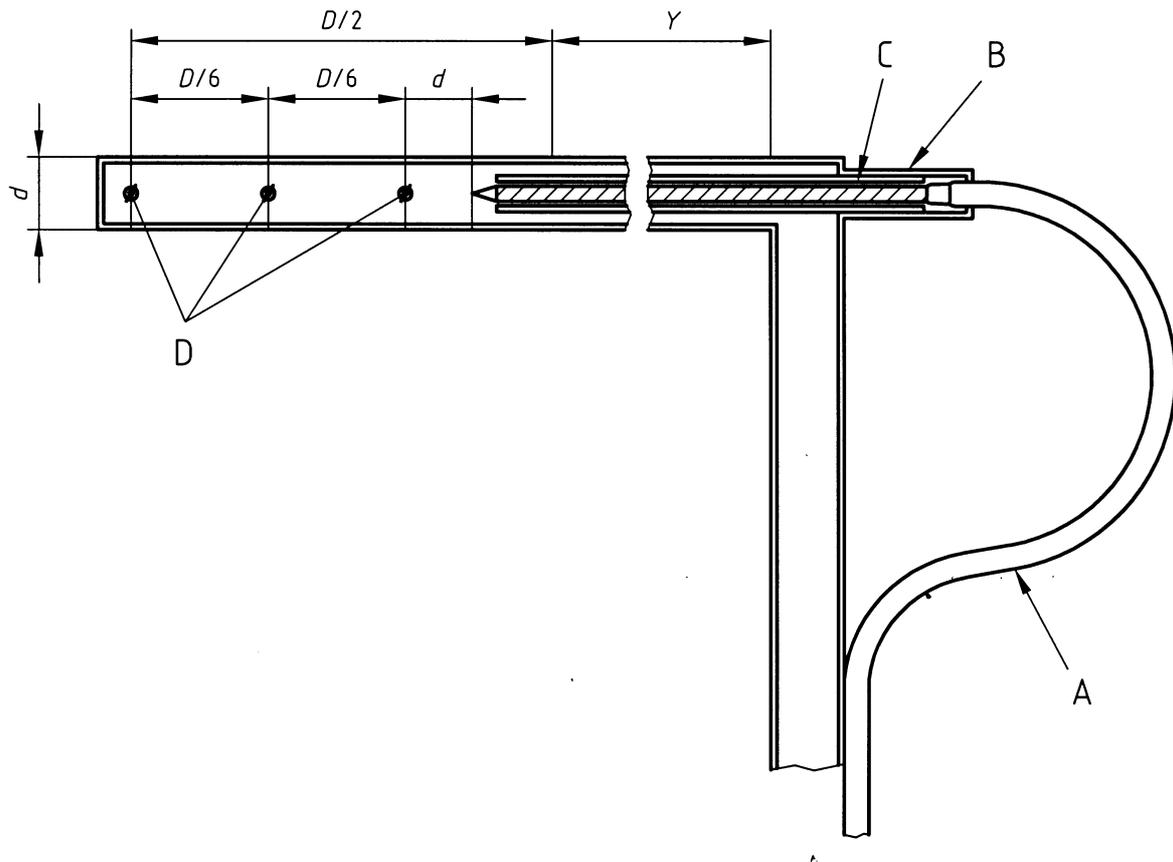
Dimensions in millimetres



9.5.3 Key

- 1 Tube $\varnothing 6$
- 2 Tube $\varnothing 4/3$
- 3 Thermocouple
- 4 Openings : $8 \times \varnothing 1$

Figure 5 — Sampling probe for test flue diameters less than 100 mm (see 7.12.2.1)



NOTE 1 The dimensions of a 6 mm diameter probe (suitable for a flue of diameter D greater than 75 mm) are as follows :

- external diameter of the probe (d) 6 mm ;
- wall thickness 0,6 mm ;
- diameter of the three sample holes (x) 1,0 mm ;
- two channel ceramic tube 3 mm diameter with channels of 0,5 mm diameter ;
- thermocouple wires 0,2 mm diameter.

The dimensions (d) and (x) of a probe suitable for a flue of diameter less than 75 mm shall be such that :

- c the cross section of the probe shall be less than 5% of the cross section of the flue ,
- d the total surface area of the three sampling holes is less than three quarters of the cross section of the probe.

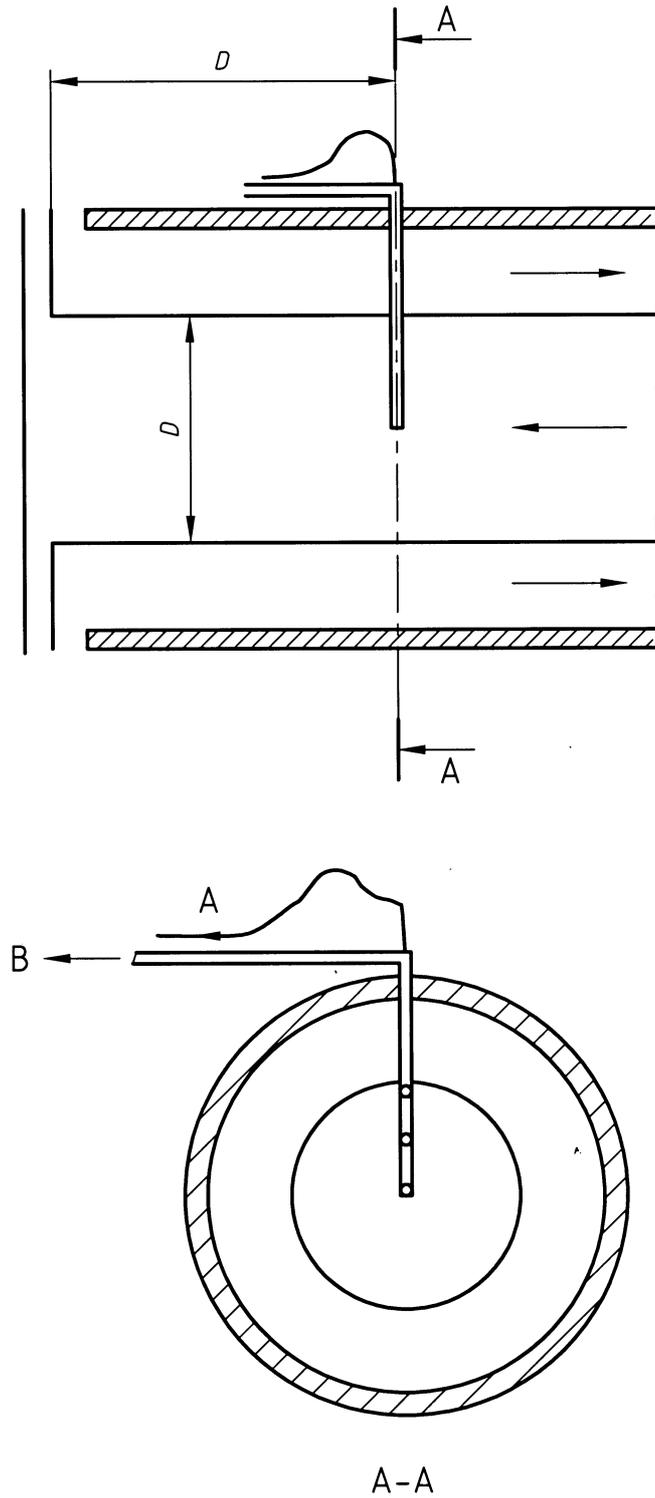
NOTE 2 The dimension Y is chosen depending on the diameter of the air inlet duct and its insulation.

Material : stainless steel.

Key

- (A) : Thermocouples wires
- (B) : Insulating cement
- (C) : Two channel ceramic tube
- (D) : 3 sampling probes $\varnothing x$ mm

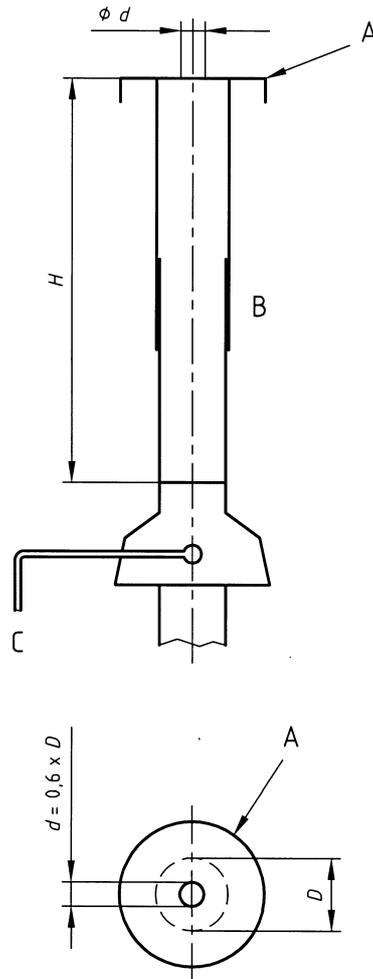
**Figure 6 — Probe for sampling and measuring the temperature of the combustion products
(see 7.12.2.1)**



Key

- (A) : To temperature reader
- (B) : To sampling pump

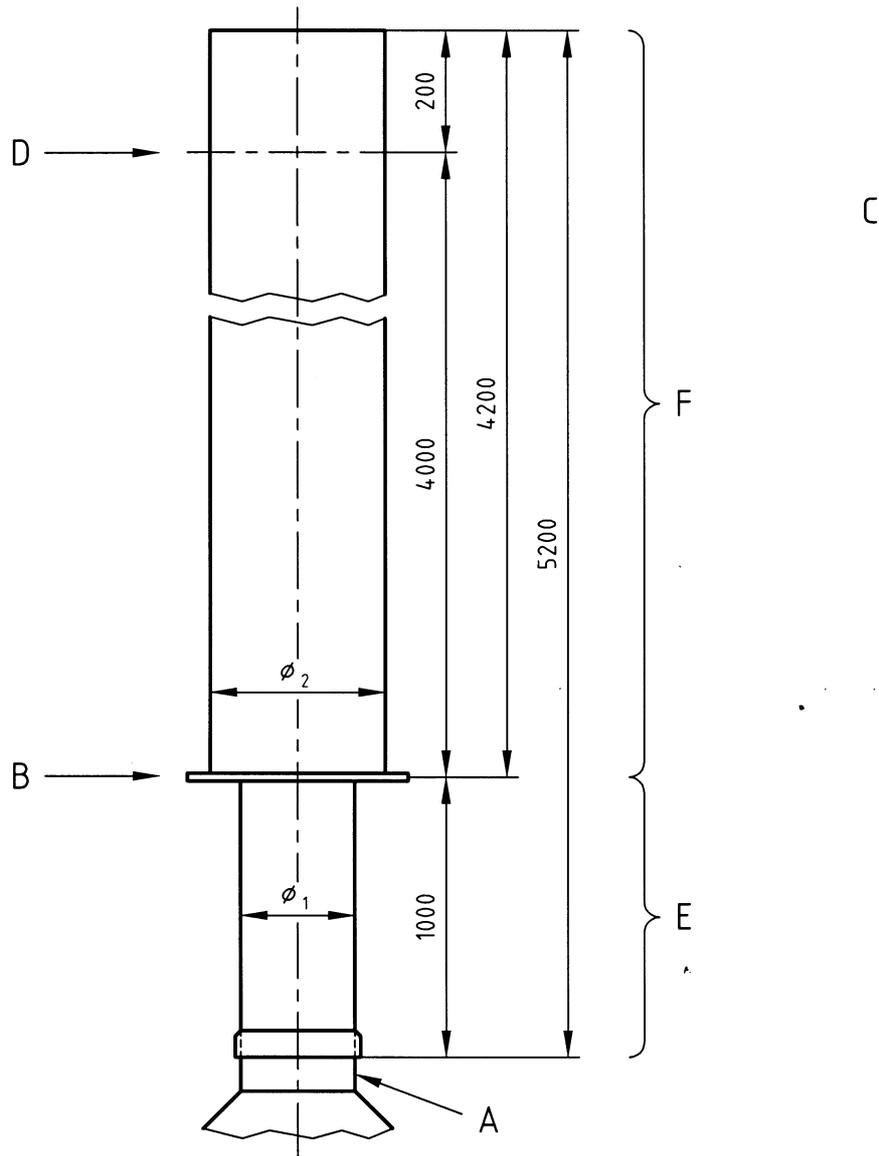
Figure 7 — Location of the probe for type C appliances (see 7.12.2.1)



Key

- (A) : plate
- (B) : Telescopic test flue
- (C) : Detector

**Figure 8 — Combustion products discharge safety device for Type B_{11BS} appliances
(see 7.9.6.3.2.1 and 7.9.6.3.2.2)**



Key

ϕ_1 diameter of flue outlet

$\phi_2 = 190$ for appliances with heat input ≤ 35 kW

225 for appliances with heat input > 35 kW

(A) : Appliance flue outlet

(B) : Diaphragm permitting adjustment of ϕ_2 of the 5 m flue to ϕ_1 of the 1 m flue

(C) : Material: non-insulated plate. Coefficient of linear thermal loss: 8,4 kJ/ (m K h)

(D) : Sampling probe from Figure 4

(E) : 1 m flue

(F) : 5 m flue

Figure 9 — 5 m test flue (see 7.13.2.1)

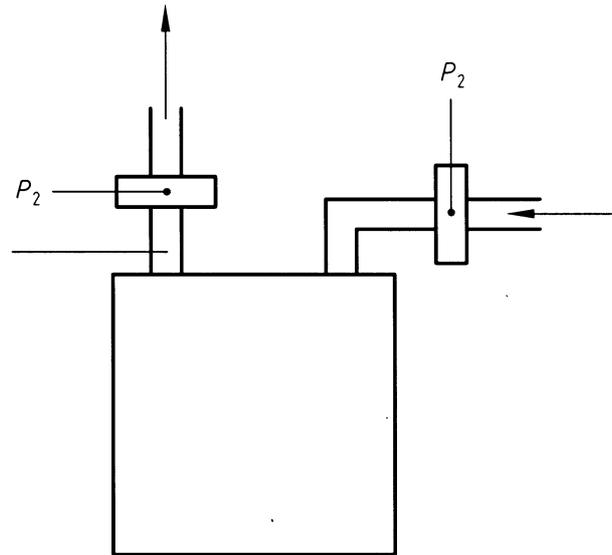


Figure 10 — Test device under pressure loss

Annex A (informative)

National situations

In each of the countries that this standard concerns, appliances may only be marketed that comply with the particular supply conditions specific to these countries.

In order to permit, both at the time of testing the appliances and at the time of their delivery, the appropriate choice to be made from all the anticipated possibilities, the various national situations are summarized in Tables A.1, A.2, A.3, A.4 and A.5.

The conditions for connection are given in A.6 and A.7.

A.1 Marketing of the categories listed in the body of this standard in the different countries

Tables A.1 and A.2 give the national situations concerning the marketing in the various countries of the appliance categories listed in the body of the standard.

The information given in the body of the tables indicates only that these categories may be sold throughout the whole of the country concerned and A.3 shall be consulted for confirmation.

In all cases of doubt the local gas supplier should be consulted in order to identify the precise category applicable.

Table A.1 — Simple categories marketed

Country	I _{2H}	I _{2L}	I _{2E}	I _{2E+}	I _{3B/P}	I ₃₊	I _{3P}
AT	x				x		
BE				x		x	
CH	x				x	x	x
DE			x		x		x
DK	x				x		
ES	x					x	x
FI	x				x		x
FR				x		x	x
GB	x					x	x
GR (?)							
IE	x					x	x
IS (?)							
IT	x					x	
LU (?)							
NO					x		
NL		x			x		x
PT	x					x	x
SE	x				x		

The (?) sign next to the country code means that the countries concerned have not indicated their choice.

Table A.2 — Double categories marketed

Country	II _{1a2H}	II _{2H3B/P}	II _{2H3+}	II _{2H3P}	II _{2L3B/P}	II _{2L3P}	II _{2E3B/P}	II _{2E+3+}	II _{2E+3P}
AT		X							
BE									
CH	X	X	X	X					
DE							X		
DK	X	X							
ES	X		X	X					
FI		X							
FR								X	X
GB			X	X					
GR (?)									
IE			X	X					
IS (?)									
IT	X		X						
LU (?)									
NL					X	X			
NO									
PT			X	X					
SE	X								

The (?) sign next to the country code means that the countries concerned have not indicated their choice.

A.2 Appliance supply pressures corresponding to the categories given in A.1.

Table A.3 states the national situations concerning the normal supply pressures of appliances in the categories given in A.1.

Table A.3 — Normal supply pressures

Country	Gas										
	G 110	G 20	G 25		G 20 and G 25	G 30		G 31		G 30 and G 31	
	Pressure (mbar)										
	8	20	20	25	couple 20-25	30 28-30	50	30	37	50	couple 28-30/37
AT		x					x			x	
BE					x						x
CH	x	x	x				x		x ^b	x	x
DE		x	x				x			x	
DK	x	x				x		x			
ES	x	x							x	x	x
FI		x				x		x			
FR		x ^a		x ^a	x				x		x
GB		x							x		x
GR (?)											
IE		x							x		x
IS (?)											
IT	x	x									x
LU											
NL				x		x		x		x	
NO						x		x			
PT		x				x			x		x
SE	x	x				x			x		

^a These pressures are used for group Esi.
^b This pressure is used for category I3P.
The (?) sign next to the country code means that the countries concerned have not indicated their choice.

A.3 Particular categories marketed nationally or locally

A.3.1 List of particular categories

The national or local conditions of gas distribution (gas composition and supply pressures) lead to the definition of special categories which are marketed nationally or locally in certain countries according to Table A.4.

Table A.4 — Categories marketed nationally or locally

Category	Reference gas	Incomplete combustion limit gas	Lightback limit gas	Flame lift limit gas	Sooting limit gas	Country concerned
I _{2Esi} ^a	G 20, G 25	G 21	G 222	G 231	G 21	France
I _{2ELL}	G 20 G 25	G 21	G 222	G 231 G 271	G 21	Germany
II _{1c2E+}	G 130 G 20	G 21	G 132 G 222	G 231	G 21	France
II _{1c2Esi} ^a	G 130, G 20 G 25	G 21	G 132 G 222	G 231	G 21	France
II _{1ab2E}	G 110 G 120 G 20	G 21	G 112 G 222	G 231	G 21	Germany
II _{1ab2ELL}	G 110 G 120 G 20, G 25	G 21	G 112 G 222	G 231 G 271	G 21	Germany
II _{2Esi3+} ^a	G 20 G 25 G 30	G 21	G 222 G 32	G 231 G 31	G 30	France
II _{2Esi3P} ^a	G 20 G 25 G 30	G 21	G 222 G 32	G 231 G 31	G 31 G 32	France
II _{2ELL3B/P}	G 20 G 25 G 30	G 21 G 30	G 222 G 32	G 231 G 271	G 30	Germany
III _{1a2H3B/P}	G 110 G 20 G 30	G 21	G 112 G 222 G 32	G 23 G 31	G 30	Denmark
III _{1c2E+3+}	G 130 G 20 G 31	G 21	G 132 G 222 G 32	G 231 G 31	G 30	France
III _{1c2E+3P}	G 130 G 20 G 30	G 21	G 132 G 222 G 32	G 231 G 31	G 32	France

« to be continued »

Table A.4 (end)

Category	Reference gas	Incomplete combustion limit gas	Lightback limit gas	Flame lift limit gas	Sooting limit gas	Country concerned
III _{1c2Esi3+} ^a	G 130 G 20 G 25 G 30	G 21	G 132 G 222 G 32	G 231 G 31	G 30	France
III _{1c2Esi3P} ^a	G 130 G 20 G 25 G 31	G 21	G 132 G 222 G 32	G 231 G 31	G 32	France
III _{1ab2H3B/P}	G 110 G 120 G 20 G 30	G 21	G 112 G 222 G 32	G 23 G 31	G 30	Sweden
III _{1ce2H3+}	G 130 G 150 G 20 G 30	G 21	G 132 G 222 G 32	G 23 G 31	G 30	Spain
III _{1ace2H3+}	G 110 G 130 G 150 G 20, G 30	G 21	G 112 G 222 G 32	G 23 G 31	G 30	Spain

^a The categories with the Esi index is only permitted for appliances with a fan.

A.3.2 Definitions of the particular categories

The definitions of the categories in Table A.4 are explained in EN 437.

A.4 Test gases corresponding to the particular categories given in A.3

The characteristics of the gases distributed nationally or locally and the corresponding test gases are given in EN 437.

A.5 Particular conditions (Belgium)

Appliances of category I_{2E+} marketed in Belgium shall successfully undergo a test for ignition, cross-lighting and flame stability with the limit gas G 231 at the minimum pressure of 15 mbar.

A.6 Gas connection conditions in common use in the various countries

The different national positions in respect of all the connection possibilities in 6.1.5.2 are defined in Table A.5.

Table A.5 — Gas inlet connections

Country	Category I ₃₊ , I _{3P} , I _{3B/P}						Other categories				
	Threaded connections		Plain connections	Compression joints	Other connections in 6.1.5.2	Flanges	Threaded connections		Plain connections	Compression joints	Flanges
	ISO 7-1 ^a	ISO 228-1	ISO 274			ISO 7005	ISO 7-1 ^a	ISO 228-1	ISO 274		ISO 7005
AT	yes			yes	yes		yes				
BE	yes	yes			yes			yes			
CH					yes		yes				
DE					yes		yes				
DK					yes		yes				
ES		yes	yes		yes			yes	yes		
FI	yes	yes			yes		yes	yes			
FR		yes			yes			yes			
GB	yes		yes	yes			yes		yes	yes	
GR (?)											
IE (?)											
IS (?)											
IT	yes	yes			yes		yes	yes			
LU (?)											
NL	yes					yes	yes				yes
NO	yes	yes			yes						
PT	yes	yes	yes	yes	yes		yes	yes	yes	yes	
SE (?)											

^a Tapered male threads and parallel female threads.

The (?) sign next to the country code means that the countries concerned have not indicated their choice.

A.7 Water connection conditions in common use in the various countries

The different national positions in respect of all the water connection possibilities in 6.1.5.3 are defined in Table A.6.

Table A.6 — Water inlet and outlet connections

Country	Types of connection		
	Threaded connections ISO 228	Plain connections ISO 274	Compression joints
AT	yes		
BE	yes		
CH	yes		
DE	yes		
DK	yes		
ES	yes		
FI	yes		
FR	yes		
GB		yes	yes
GR (?)			
IE (?)			
IS (?)			
IT	yes		
LU	yes		
NL	yes		
NO	yes		
PT	yes	yes	yes
SE (?)			

The (?) sign next to the country code means that the countries concerned have not indicated their choice.

A.8 Flue pipe diameters in force in the various countries (see 6.1.7)

Table A.7 shows the national situations concerning standard flue pipe diameters.

Table A.7 — Diameters of marketed flues

Diameters in mm

Country	Diameter	Diameter of flues
AT	nominal	60 - 70 - 80 - 90 - 100 - 110 - 120 - 130 - 140 - 150 - 180 - 200
BE		no standardization
CH		60 - 70 - 80 - 90 - 100 - 110 - 120 - 130 - 140 - 150 - 160 - 170 - 180 - 200
DE	internal	60 - 70 - 80 - 90 - 110 - 120 - 130 - 150 - 200
DK	nominal	50 - 60 - 70 - 80 - 90 - 104 - 118 - 120 - 130 - 150 - 180 - 200 - 250
ES		80 - 100 - 110 - 120 - 150 - 175 - 200
FI		90 - 100 - 110 - 130 - 150 - 180 - 200
FR	external	66 - 83 - 97 - 111 - 125 - 139 - 153 - 167 - 180
GB	internal	75 - 101 - 126 - 152 metal pipes 92 - 117 - 146 - 171 fibre-cement pipes
GR (?)		
IE	internal	75 - 101 - 126 - 152 metal pipes 84 - 109 - 136 - 162 fibre-cement pipes
IS (?)		
IT	internal	60 - 80 - 100 - 110 - 120 - 130 - 140 - 150
LU		
NL	internal	50 - 60 - 70 - 80 - 90 - 100 - 110 - 130 - 150 - 180 - 200
NO		no standardization
PT	external	60 - 85 - 90 - 95 - 105 - 110 - 115 - 120 - 125 - 130 - 135 - 145 - 155 - 205 - 255 - 305 - 355
SE (?)		

The (?) sign next to the country code means that the countries concerned have not indicated their choice.

Annex B (normative)

Test apparatus for type C₁₁ appliances (see 7.7.2.2.1)

The characteristics of the wind generator and the distance from the test wall at which it is placed must be chosen such that the following criteria are met at the level of the test wall, after the central panel has been removed :

- the wind front must be either approximately 90 cm square or circular with a diameter of 60 cm ;
- wind speeds of 1 m/s and 12,5 m/s with an accuracy of 10% shall be obtained ;
- the wind stream must be essentially parallel and has no residual rotational movement.

If the central removable panel is not large enough to allow checking of these criteria, they shall be checked without the wall and measured at a distance corresponding to the distance existing in practice between the test wall and the wind generator discharge nozzle.

$\alpha = 0^\circ$ (horizontal winds)

+ 30° and - 30°

$\beta = 0^\circ$ (glancing winds),

15°, 30°, 45°, 60°, 75°, 90°,

(perpendicular to the test wall)

For appliances fitted with a non-symmetrical terminal, the examination is continued for the following values: 105°, 120°, 130°, 150°, 165°, 180°.

Angle β may be varied either by modification of the position of the wind generator (fixed wall) or by rotation of the test wall about a central vertical axis.

The test wall consists of a strong vertical wall at least 1.8 × 1.8 m, with a removable panel at its centre. The device for supplying combustion air and discharging combustion products is mounted so that its geometric centre is at the centre 0 of the test wall, and its projection from the wall is as recommended by the manufacturer.

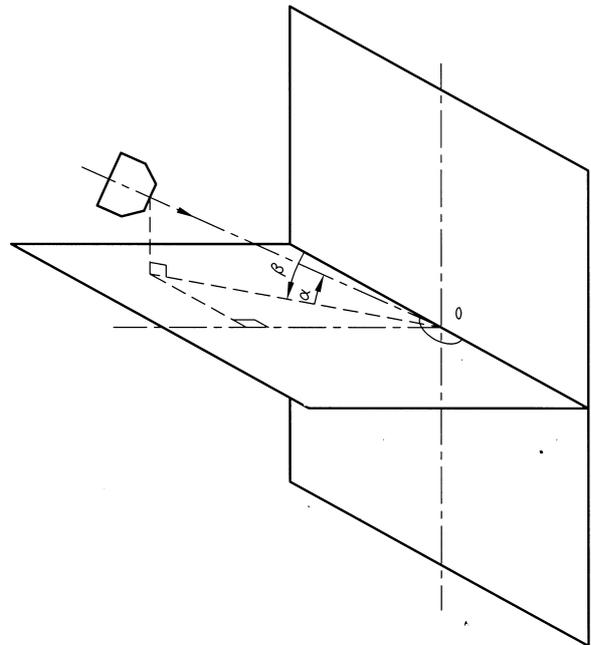


Figure B.1 — Test apparatus for type C₁ appliances

Annex C (normative)

Test apparatus for type C₂₁ appliances (see 7.7.2.2.2)

A suitable test rig is shown diagrammatically in Figure 3. It consists of a completely enclosed loop of 225 mm × 400 mm rectangular ducting through which air is circulated by a bifurcated axial-flow fan. Velocity and pressure conditions are controlled by a series of single leaf dampers.

An auxiliary instantaneous water heater is supplied to provide an additional source of vitiation, its inlet being open to air and fitted with an air control damper F.

The appliance tested is mounted on the longest side of the duct. It is positioned at least 2 m above the lower horizontal base limb of the rig, with at least 1 m of vertical duct above it.

Access panels are provided on the back of the mounting panels to facilitate the fitting of the sampling probes and temperature sensors. The flow velocity in the duct may be measured by an anemometer placed 1 m above the lower horizontal base limb. A calibration factor is used to convert the anemometer reading to the mean flow. To cover the range of rate 0,3 m/s to 5 m/s, two interchangeable anemometers may be used.

The test rig is designed to be used either open or closed circuit, or in any intermediate condition between these extremes. In practice, either the open circuit or an intermediate condition is required for the specified tests.

The conditions required for the tests of 7.7.2.2.2 are obtained as follows :

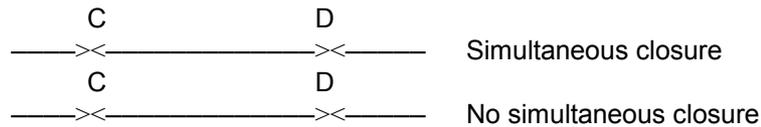
- with dampers E and F closed, the fan is started. The degree of vitiation and the velocity in the duct are controlled by means of dampers A, B, C and D. If the degree of vitiation has to be augmented, damper F is opened and the auxiliary water heater is lit ;
- the proportion of fresh air to recirculated air is controlled by combinations of adjustments to dampers A, B and C ;
- damper D provides an overriding control of the flow rate.

When necessary, water may be passed through the finned heat exchanger X in order to reduce the temperature of the circulated combustion products, measured at Y, to within the limits specified in 7.7.2.2.2. In practice, if the duct is made of metal it is probable that this heat exchanger will not be required.

Annex D (informative)

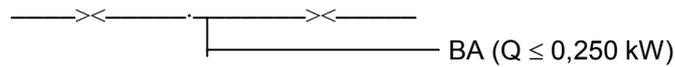
Examples of composition of the gas circuit

D.1 Direct ignition of the main burner (MB)

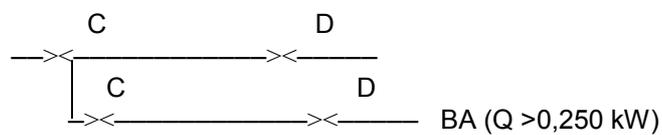
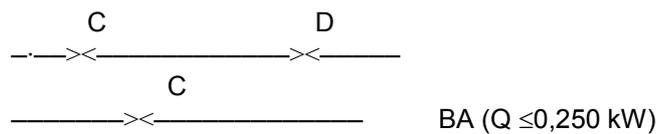
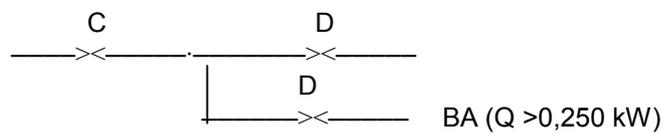
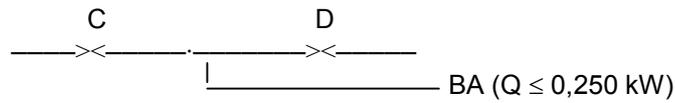


D.2 Ignition of the main burner by an ignition burner (IB)

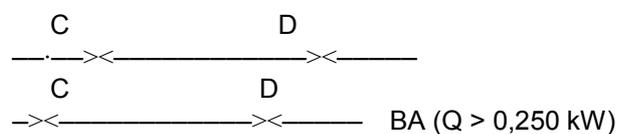
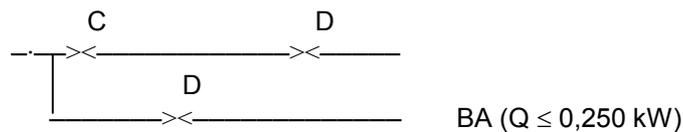
D.2.1 Permanent IB



D.2.2 Intermittent IB



D.2.3 Alternating IB



Annex E (normative)

Soundness test - Volumetric method

E.1 Equipment

A piece of apparatus is used that is constructed in accordance with the diagram of Figure 1, with the stated dimensions in millimetres.

The equipment is made of glass. Taps 1 to 5 are also of glass and fitted with a spring. The liquid used is water.

The distance L between the water level in the constant level vessel and the extremity of tube G is adjusted so that the height of the water corresponds to the test pressure.

The test rig is installed in an air-conditioned room.

E.2 Test method

The pressure of the compressed air, upstream of tap 1, is adjusted to the test pressure by means of a pressure regulator F .

All taps 1 to 5 are closed. The sample B to be tested is connected to the tube. The downstream tap K is closed.

Tap 2 is opened. When the water in the constant level vessel D spills over to the overflow E , tap 2 is closed.

Taps 1 and 4 are opened. By means of inlet A , the pressure is established in the burette H and in the device. Tap 1 is then closed.

Tap 3 is opened. 15 min is allowed to elapse in order for the air in the test equipment (and sample) to reach thermal equilibrium.

Any leak is shown by an overflow of water from tube G into the burette H .

Annex F (informative)

Guidelines for extension to other categories

When an appliance complies with the requirements for one or several categories, to establish its conformity with one or several other categories, it is necessary to check that the appliance satisfies all the requirements of this or these new categories.

To this end, the tests required for the new category(ies) shall be compared to those carried out for the previous category(ies), to establish which supplementary tests are necessary.

These supplementary tests will be limited to the minimum necessary to ensure that the appliance will comply with the requirements applicable to the new category(ies).

Annex G (informative)

Protection against electric shock for high voltage ignition devices (see 6.1.10)

Extract from prEN 50165:1995 "Electrical equipment of non-electrical heating appliances for household and similar purposes. Safety requirements".

Protection against accessibility to live parts

Apply clause 8 of EN 60335-1 with the following supplement:

G.1 The accessible parts of ignition circuits shall be protected against access with the test finger if the following limits are exceeded :

— pulse spark ignition:

A maximum admissible discharge of 100 μ As per pulse and a maximum pulse duration of 0,1 s measured from the beginning of the pulse until decreasing to 10% of the peak value. The interval between two pulses shall be $\geq 0,25$ s (see Figure G.1) ;

— continuous spark ignition:

— maximum permissible no load voltage : 10 kV (peak) ;

— maximum permissible current : 0,7 mA (peak).

If the no load voltage exceeds 10 kV

— the discharge shall not exceed : 45 μ As ;

— with a maximum permissible current: 0,7 mA (peak) ;

— pulse repetition ignition :

— a maximum admissible discharge of 45 μ As per pulse and a maximum pulse duration of 0,1 ms measured from the beginning of the pulse until decreasing to 10% of the peak value ;

— with a maximum permissible current: 25 Hz.

NOTE 1 Detailed information is given in IEC 479-1 and IEC 479-2.

NOTE 2 For normal and abnormal operation. The limits also concern manually operated ignition means (piezo-electric or magnetic igniters) and those which are not fed by the line voltage supply.

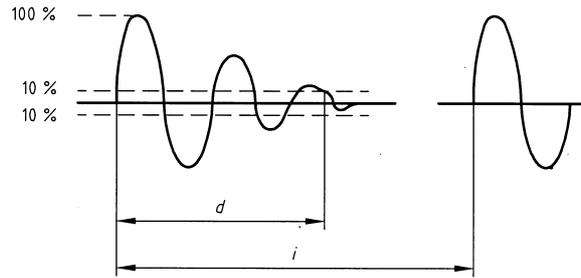
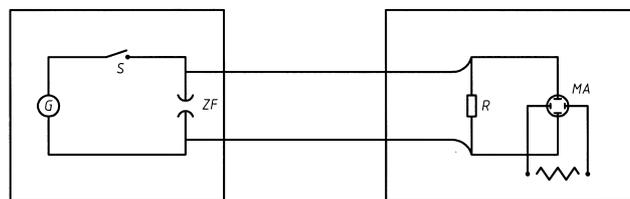


Figure G.1 — Voltage curve at resistance R

Compliance is checked at nominal supply voltage using suitable measuring equipment, an example of which is given in Figure G.2:



Appliance ignition device

G voltage supply

S switch

ZF spark gap

Measurement equipment

R measurement resistor

MA voltage measuring instrument

NOTE A 20 Mhz oscilloscope with a high voltage test head $100\text{ M}\Omega$, 2 kV D.C. (100 kHz) and 3pF internal capacitance is an example of a suitable measuring instrument.

Figure G.2 — Test rig for ignition devices

The pulse duration is measured first at the spark gap (ZF) with the measuring instrument (MA). Resistance R is $\geq 100\text{ M}\Omega$.

The pulse discharge is calculated by the measured voltage curve (by a suitable instrument) at resistance R . Value of $R = 2\text{ k}\Omega$.

The no-load voltage (peak) is measured at the spark gap (ZF), which is prevented from sparking. The resistance R is $\geq 100\text{ M}\Omega$.

The current is calculated by the measured voltage curve at resistance R . Value of $R = 2\text{ k}\Omega$.

G.2 For ignition means with several spark gaps, the energy of each has to be measured separately and the spark energy with the most unfavorable result will be assessed.

Replace 8.1.5 by :

G.3 Where an appliance has parts which require adjustment (after removal of non-detachable parts) under operating conditions, adjacent live parts shall be protected against accidental contact.

Compliance is checked by applying a cylindrical rod according to IEC 335-2-14, having a diameter of 40 mm and a hemispherical end, with straight access perpendicular to the front only. No live part shall be contacted.

Annex H (informative)

Examples of marking on the appliance

Types of gas - gas pressures - categories - countries of destination.

H.1 Data plate (see 5.1.1)

Group of categories and countries for which the appliance is designed (direct and indirect destinations).

II _{2H3P}	II _{2H3B/P}	II _{2L3B/P}	II _{2ELL3B/P}	III _{1c2E+3+}	III _{1ace2H3+}
GB	CH	NL	DE	FR	ES

H.2 Supplementary markings (see 5.1.2 and H.1)

EXAMPLE 1 Group of direct destinations second family gases, for an appliance for which adjustment 2E is different to the adjustment common to 2H and 2E.

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td colspan="2" style="padding: 2px;">CH - DE - ES - GB</td></tr> <tr><td style="padding: 2px;">2H - 2E</td><td style="padding: 2px;">G 20 - 20 mbar</td></tr> </table>	CH - DE - ES - GB		2H - 2E	G 20 - 20 mbar	or	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td colspan="2" style="padding: 2px;">FR</td></tr> <tr><td style="padding: 2px;">2E+</td><td style="padding: 2px;">G 20/G 25 - 20/25 mbar</td></tr> </table>	FR		2E+	G 20/G 25 - 20/25 mbar
CH - DE - ES - GB										
2H - 2E	G 20 - 20 mbar									
FR										
2E+	G 20/G 25 - 20/25 mbar									

EXAMPLE 2 Group of direct destinations, second family gases, for an appliance for which adjustment 2E is different to the adjustment common to 2H and 2E+.

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td colspan="2" style="padding: 2px;">CH - ES - FR - GB</td></tr> <tr><td style="padding: 2px;">2H</td><td style="padding: 2px;">G 20 - 20 mbar</td></tr> <tr><td style="padding: 2px;">2E+</td><td style="padding: 2px;">G 20/G 25 - 20/25 mbar</td></tr> </table>	CH - ES - FR - GB		2H	G 20 - 20 mbar	2E+	G 20/G 25 - 20/25 mbar	or	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td colspan="2" style="padding: 2px;">DE</td></tr> <tr><td style="padding: 2px;">2E</td><td style="padding: 2px;">G 20 - 20 mbar</td></tr> </table>	DE		2E	G 20 - 20 mbar
CH - ES - FR - GB												
2H	G 20 - 20 mbar											
2E+	G 20/G 25 - 20/25 mbar											
DE												
2E	G 20 - 20 mbar											

EXAMPLE 3 Group of direct destinations, second family gases, for an appliance for which the adjustment is common to 2H, E and E+.

CH - DE - ES - FR - GB	
2H - 2E	G 20 - 20 mbar
2E+	G 20/G 25 - 20/25 mbar

EXAMPLE 4 Group of direct destinations, first family gases, for an appliance adjusted for 1a.

ES	
1a	G 110 - 8 mbar

EXAMPLE 5 Group of direct destinations, first family gases, for an appliance adjusted to 1c.

ES - FR	
1c	G 130 - 8 mbar

EXAMPLE 6 Group of direct destinations, third family gases, for an appliance with different gas supply pressures.

CH - DE		or	NL	
3B/P	G 30/G 31 - 50 mbar		3B/P	G 30/G 31 - 30 mbar

Annex J (normative)

Marking on the appliance and its packaging - Explicit identification of gas types following the use declared by the countries in their official language(s)

Table J.1

Country	First family gases			
	G 110	G 120	G 130	G 150
AT				
BE				
CH				
DE	<u>Stadtgas</u> Gruppe a	<u>Stadtgas</u> Gruppe b		
DK	Bygas			
ES	Gas manufacturado		Aire propanado	Aire metanado
FI				
FR ^a			Air propané/ Air butané	
GB				
GR				
IE				
IS				
IT	G 110 ou Gas di Città			
LU				
NO				
NL				
PT				
SE				

^a The meaning of the symbol corresponding to the type of gas shall be explained in detail in the technical instructions.

With regard to the appliance and its packaging, if any additional marking is intended by the manufacturer to explain the symbol, this text shall be in conformity with the designations given in this table. In the case of pressure couples, the two designations of the family shall be mentioned.

Table J.2

Country	Second family gases		Third family gases	
	G 20	G 25	G 30	G 31
AT	Erdgas		Flüssiggas	Flüssiggas
BE	Aardgas ou Gaz naturel	Aardgas ou Gaz naturel	Butaan, Butane	Propaan, Propane
CH				
DE	Erdgas E $W_{0,n} = 15,0 \text{ kWh/m}^3$	Erdgas LL $W_{0,n} = 12,4 \text{ kWh/m}^3$	<u>Flüssiggas</u> B	<u>Flüssiggas</u> P
DK	Naturgas		F-Gas	F-Gas
ES	Gas Natural		Butano	Propano
FI	Maakaasu Naturgas		Butaani, Butan	Propaani, Propan
FR ^a	Gaz Naturel Lacq	Gaz Naturel Groningue	Butane	Propane
GB	Naturel Gas		Butane	Propane
GR				
IE	Naturel Gas		Butane	Propane
IS				
IT	G 20 ou Gas naturale ou Gas metano		G 30/G 31 ou GPL	G 30/G 31 ou GPL
LU				
NO			Butan	Propan
NL				
PT	Gás Natural		Butano	Propano
SE				

^a The meaning of the symbol corresponding to the type of gas shall be explained in detail in the technical instructions.

With regard to the appliance and its packaging, if any additional marking is intended by the manufacturer to explain the symbol, this text shall be in conformity with the designations given in this table. In the case of pressure couples, the two designations of the family shall be mentioned.

Annex K **(informative)**

A-deviations

A-deviation: National deviation due to regulations, the alteration of which is for the time being outside the competence of the CEN/ CENELEC member.

“This European Standard falls under Directive 90/396/EEC on the approximation of the laws of the member states relating to appliances burning gaseous fuels.

NOTE (CEN/CENELEC IR Part 2, 3.1.9) Where standards fall under EC Directives, it is the view of the Commission of the European Communities (OJ. No. G 59, 9.3.1982) that the effect of the decision of the court of Justice in case 815/79 Cremonini/Vrankovich (European Court Reports 1980, p. 3583) is that compliance with A-deviations is no longer mandatory and that the free movement of products complying with such a standard should not be restricted except under the safeguard procedure provided for in the relevant Directive.

A-deviations in an EFTA country are valid instead of the relevant provisions of the European Standard in that country until they have been removed”.

A-deviation for Switzerland:

For gas-fired storage water heaters for the production of domestic hot water, the limit values for the flue losses and for the emission of CO and NO_x of the Swiss law (Luftreinhalte – Verordnung, LRV) of 1985-12-16 (state from 1996-01-01) are applicable. In addition, the combustion products must be evacuated at roof level.

Annex L **(normative)**

Special national conditions

Special national condition : National characteristic or practice that cannot be changed even over a long period, e.g. climatic conditions, electrical earthing conditions. If it affects harmonization, it forms part of the standard or harmonization document.

For the countries in which the relevant national conditions apply, these provisions are normative, for other countries they are informative.

The installation rules in the United Kingdom specify the use of a combined temperature and pressure relief valve to prevent stored water temperatures exceeding 100 °C.

Annex ZA (informative)

Clauses of this European Standard addressing essential requirements or other provisions of EU Directives

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 90/396/EEC.

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

The following subclauses of this standard are intended to support the requirements of the "Gas Appliances" Directive.

The following subclauses of this standard are Conformity to the subclauses of this standard is one of the means of meeting the specific essential requirements of the Directive concerned and the corresponding EFTA regulations.

Table ZA.1

Essential requirement	Object	Subclauses or clauses of the standard complying wholly or in part to the essential requirement
Annex 1 - General conditions		
1	General conditions	↓
1.1	Safety of operation	1 (1st para.)
1.2	Marking of the appliance with : - technical instructions for the installer - instructions for the use and maintenance for the user - warnings on the appliance and on the packaging in the official language(s)	5.2.1 to 5.2.3 5.2.2 5.1 5.3
1.2.1	Contents of the technical instructions with, amongst other things : - type of gas - supply pressure - new air rate - combustion products discharge - burner/heating element assembly	5.2.1 to 5.2.3 5.5.1.1 (1st indent) to 5.2.1.2 5.5.1.1 (1st indent) to 5.2.1.2 5.2.1.4 5.2.1.4 not applicable
1.2.2	Contents of the instructions on use and maintenance	5.2.2
1.2.3	Warnings on the appliance and packaging - gas type - supply pressure - installation in ventilated rooms	5.1 5.1.1 (6th indent) to 5.1.2 5.1.1 (7th indent) to 5.1.2 5.1.4.2 to 5.1.4.3
<i>"to be continued"</i>		

Table ZA.1 (to be continued)

Essential requirement	Object	Subclauses or clauses of the standard complying wholly or in part to the essential requirement
1.3	Equipment (auxiliary equipment)	6.2
2	Materials	↓
2.1	Material characteristics	6.1.2
2.2	Guarantee of material properties important for safety	not applicable
3	Design and construction	↓
3.1	General	
3.1.1	Resistance to constraints	6.1.3 to 7.2.3
3.1.2	Condensation	6.1.3 (last indent) to 6.1.5.4 to 7.13 to 7.14
3.1.3	Risk of explosion in the event of fire of external origin	6.1.2
3.1.4	Water and bleed air penetration into the gas circuit	6.1.5.2 to 6.1.5.3 to 6.1.5.4 to 6.1.6.1 to 6.4 to 7.2.1
3.1.5	Safe operation in the event of normal fluctuation of auxiliary energy	6.2.6.2.2 to 7.9.1.1 (1st indent) to 7.9.2.1 to 7.9.3.2.1
3.1.6	No danger in the event of abnormal fluctuation of auxiliary energy	6.1.11 to 7.9.1.1 (2nd indent) to 7.9.2.1
3.1.7	Hazards of electrical origin	6.1.10
3.1.8	Soundness of pressurized parts	7.2.3
3.1.9	No danger in the event of failure of safety and control devices : - flame supervision device - combustion products discharge safety device (type B _{11BS}) - automatic burner control systems - overheat protection	6.2 6.2.7.2 (2nd para.) 6.2.8 (last para.) 6.2.7.3 6.2.9 (last para.)
3.1.10	No problem with the safety devices in the event of failure of the adjustment devices	6.2.9 (4th para)
3.1.11	Protection of parts set by the manufacturer	6.2.3 to 6.3
3.1.12	Marking of taps and control or adjustment devices	6.2.1 to 6.2.2
3.2	Burnt gas release	
3.2.1	Risk of gas leakage	6.1.5.2 to 6.1.6.1 to 7.2.1
3.2.2	Risk of gas accumulation in the appliance	6.1.5.2 to 6.1.6.1 to 7.2.1
3.2.3	Risk of gas accumulation in rooms	6.1.5.2 to 6.1.6.1 to 7.2.1
3.3	Ignition During normal use of the appliance : - quiet ignition and spark restoration - reliable cross-lighting	7.7

"to be continued"

Table ZA.1 (end)

Essential requirement	Object	Subclauses or clauses of the standard complying wholly or in part to the essential requirement
3.4 3.4.1	Combustion During normal use of the appliance : - reliable flame stability - no impermissible concentration of substances harmful to health	7.7 7.12
3.4.2	During normal use of the appliance, no unspecified release of combustion products	6.1.6.2 to 6.1.7 to 7.2.2
3.4.3	In the event of abnormal draught conditions for appliances connected to a flue (type B _{11BS}) no release of a dangerous quantity of combustion products into the room	6.2.8 to 7.9.6 to 7.12.2.3.1
3.4.4	Unconnected appliances	not applicable
3.5	Rational use of energy : - efficiency - maintenance consumption	8 8.1 8.2
3.6	Temperatures	
3.6.1	Floor and adjacent walls	7.6.2
3.6.2	Knobs	7.4
3.6.3	Temperature of external surfaces of an appliance intended for domestic use	7.6.1
3.7	Foodstuffs and water used for domestic hot water purposes	Foreword to 6.1.2
Annex II - Attestation of conformity procedures		1 (4th and 5th paras.)
Annex III - Marking and inscription		
1	CE marking	
2	Inscription on appliance or its data plate: CE marking and : - manufacturer's name or identification symbol - trade name - type of electrical supply - appliance category and installation information	not applicable 5.1.1

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