BRITISH STANDARD

BS EN 613:2001

Incorporating amendment no. 1 and corrigendum no. 1

Independent gas-fired convection heaters

ICS 97.100.20

BSI British Standards

National foreword

This British Standard is the UK implementation of EN 613:2000, incorporating amendment A1:2003. Together with BS EN 1266:2002 it supersedes BS 6332-4:1983, which is withdrawn.

Users of this standard will wish to note that the UK voted against the amendment to it when it was proposed by CEN. This was because the committee representatives unanimously believed that safety issues have not been properly addressed for all appliances, in that the test of **6.5.1.2** is not carried out on all glass-fronted appliances that come within the standard.

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

The UK participation in its preparation was entrusted to Technical Committee GSE/36, Independent gas-fired space heaters.

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

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

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

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December 2000

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April 2003

ICS 97.100.20

Supersedes HD 1002:1994

English version

Independent gas-fired convection heaters

Appareils de chauffage indépendants à convection utilisant les combustibles gazeux

Konvektions-Raumheizer für gasförmige Brennstoffe

This European Standard was approved by CEN on 13 July 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 Management Centre 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 Management Centre 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, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 62, Independent gas-fired space heaters, the Secretariat of which is held by BSI.

This European Standard replaces HD 1002:1994.

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 June 2001, and conflicting national standards shall be withdrawn at the latest by June 2001.

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.

Foreword to amendment A1

This document (EN 613:2000/A1:2003) has been prepared by Technical Committee CEN/TC 62, Independent gas-fired space heaters, the Secretariat of which is held by BSI.

This Amendment to the European Standard EN 613:2000 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2003, and conflicting national standards shall be withdrawn at the latest by October 2003.

This document 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, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies the requirements and test methods for the construction, safety, marking and rational use of energy of independent gas-fired convection heating appliances, hereafter referred to as appliances.

This standard is applicable to types B_{11AS}, B_{11BS}, B_{11CS} (commonly referred to in this standard as type B_1 appliances) and type C_{11} independent convection heating appliances burning gas:

- that incorporate a natural draught burner;

- that are connected directly to an open flue or to a device to evacuate the products of combustion (open-flued appliances, balanced-flued appliances);

- that are wall mounted, free-standing or built-in;

- that have a nominal heat input not exceeding 20 kW (based on the net calorific value).

In addition, this standard is applicable to live fuel effect appliances.

This standard is not applicable to:

- open fronted appliances as specified in prEN 13278;

- decorative fuel effect appliances as specified in EN 509;

- catalytic combustion appliances;

- appliances in which the supply of combustion air and/or evacuation of products of combustion is achieved by mechanical means;

- ducted-air appliances;

- appliances installed by means of a closure plate (see 3.3.3.3).

This standard is only applicable to appliances which are intended to be type tested.

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

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 (including amendments).

EN 88:1991 *Pressure governors for gas appliances for inlet pressure up to 200 mbar*

EN 125:1991 *Flame supervision devices for gas-burning appliances — Thermo-electric flame supervision devices*

EN 126:1995 *Multifunctional controls for gas burning appliances*

A1 EN 161 A1 *Automatic shut-off valves for gas burners and gas appliances*

EN 257:1992 *Mechanical thermostats for gas burning appliances*

EN 298:1993 *Automatic gas burner control systems for gas burners and gas burning appliances with or without fans*

EN 437:1993 *Test gases — Test pressures — Appliance categories*

A1 EN 50165 *Electrical equipment of non-electric appliances for household and similar purposes — Safety requirements*. A1

EN 60335-1:1994 *Safety of household and similar electrical appliances*
Part 1: General requirements (IEC 60335-1:1991, modified)

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

EN 60730-2-9:1995 *Automatic electrical controls for household and similar use*
Part 2: Particular requirements for temperature sensing controls (IEC 60730-2-9:1992, modified)

A1 EN ISO 3166-1:1997 *Codes for the representation of names of countries and their subdivisions — Part 1: Country Codes (ISO 3166-1:1997)* A1

CR 1404:1994 *Determination of emissions from appliances burning gaseous fuels during type testing*

ISO 7-1:1994 *Pipe threads where pressure-tight joints are made on the threads —*
Part 1: Dimensions, tolerances and designation

ISO 228-1:1994 *Pipe threads where pressure-tight joints are not made on the threads —*
Part 1: Dimensions, tolerances and designation

ISO 274:1975 *Copper tubes of circular section — Dimensions*

3 Terms and definitions

For the purpose of this standard the following terms and definitions apply:

3.1 Independent gas-fired convection heaters

3.1.1 convection heater: appliance that is designed to heat a room mainly by the emission of air heated by convection. Such an appliance may also contain radiant heating elements provided that it complies with all the requirements of this standard

3.1.2 forced convection heater: convection appliance that incorporates a fan and thus allows an acceleration of the circulation of the air in contact with the heating body. Such an appliance is designed to discharge air directly into the room in which the appliance is installed and not to be connected to a warm air distribution system

3.1.3 live fuel effect convection heater: convection appliance which simulates the visual effect of a solid fuel appliance

3.1.4 open-fronted appliance: appliance which has exposed flames or exposed incandescent areas

3.1.5 working surfaces: parts of an appliance, which, due to the nature of the appliance, have temperatures exceeding the limits specified in 6.4.1 excluding parts that are likely to be touched during operations carried out in the normal use of the appliance, for example, the area adjacent to control knobs

Working surfaces do not include that part of any surface within 25 mm of parts that have to be touched or removed during normal operation of the appliance.

3.1.6 convection fan: device to assist in the distribution of heated air

3.2 Gases

3.2.1 reference conditions:

- for calorific values, temperature: 15 °C;

- for gas and air volumes dry, brought to 15 °C and an absolute pressure of 1 013,25 mbar.

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

A distinction is made between:

- the gross calorific value in which the water produced by combustion is assumed to be condensed.

  Symbol: H_s

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

  Symbol: H_i

Units: either:

- megajoules per cubic metre (MJ/m^3) of dry gas at the reference conditions; or

- megajoules per kilogram (MJ/kg) of dry gas.

[EN 437:1993]

3.2.3 relative density: ratio of the masses of equal volumes of dry gas and dry air at the same conditions of temperature and pressure

Symbol: d

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

Symbol: gross Wobbe index: W_s

net Wobbe index: W_i

Units: either:

- megajoules per cubic metre (MJ/m^3) of dry gas at the reference conditions; or

- megajoules per kilogram (MJ/kg) of dry gas.

[EN 437:1993]

3.2.5 test pressures: gas pressures used to verify the operational characteristics of appliances using combustible gases, consisting of normal and limit pressures

They are expressed in millibar (mbar).

NOTE: 1 mbar = 100 Pa

3.2.6 normal pressure: pressure under which appliances operate in nominal conditions, when supplied with the corresponding reference gas

Symbol: p_n

3.2.7 limit pressures: pressures representative of the extreme variations in the appliance supply condition

Symbols: maximum pressure: p_{max}

minimum pressure: p_{min}

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

- the higher pressure corresponds only to gases of low Wobbe index; and

- the lower pressure corresponds to gases of high Wobbe index.

[EN 437:1993]

3.3 Appliance construction

3.3.1 The gas circuit

3.3.1.1 inlet connection: part of the appliance intended to be connected to the gas supply

3.3.1.2 mechanical joint: connection device assuring soundness in an assembly of several parts, generally of metal

NOTE: for example the following:

- cone seated joints;
- toroidal sealing rings (O-rings);
- flat joints;
- metal to metal joints.

3.3.1.3 gas circuit: part of an appliance that conveys or contains the gas between the appliance gas inlet connection and the burner(s)

3.3.1.4 gas restrictor: non-adjustable device which is placed in the gas circuit so 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 rate

3.3.1.5 gas rate adjuster: component intended for the manufacturer or installer to set the gas rate to each burner at a predetermined value according to the supply conditions

The adjustment may be progressive (screw adjuster) or discontinuous (changing restrictors).

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

The action of setting this device is called ‘setting the gas rate’.

3.3.1.6 gas rate control: component allowing the user to open or close the gas supply to one or more burners, which may also be used to adjust the gas rate of certain burners to a predetermined value, called the ‘reduced rate’, and which may be a ‘tap’

3.3.1.7 injector: component that admits the gas into a burner

3.3.1.8 start gas: initial quantity of gas ignited to give a flame which is used to ignite the main burner, which may be discharged through a separate ignition burner or part of the main burner

3.3.2 Burner

3.3.2.1 main burner: burner that assures the thermal function of an appliance, usually called simply 'burner'

3.3.2.2 ignition burner: separate burner intended to light the main burner

3.3.2.2.1 permanent ignition burner: ignition burner that operates continuously throughout the whole period that the appliance is in use

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

3.3.2.3 fixed primary aeration restrictor: non-adjustable device which limits the supply of primary air to a burner

3.3.3 Combustion products circuit

3.3.3.1 flue outlet: part of a type B appliance (see 4.2) that connects with a flue to evacuate the products of combustion

3.3.3.2 draught diverter: device placed in the combustion products circuit to reduce the influence of flue-pull and to minimize the effect of down-draught on the burner flame stability and combustion

3.3.3.3 closure plate: non-combustible plate used to cover and seal the front plane of a builder's opening, or fireplace opening, such that when the appliance is installed, any air flowing from the room into the flue does so in accordance with the design requirements of the appliance

This plate contains an aperture through which the flue outlet spigot of the appliance projects into the cavity of the builder's opening, or fireplace recess, but is not connected to the flue.

The plate may be a separate component, or an integral part of the appliance, e.g. the back panel, but in either case it is to be considered as part of the appliance.

3.3.3.4 builder's opening: enclosure constructed by the builder to accommodate fireplace components

3.3.3.5 fireplace opening: aperture formed in the face of the builder's opening, the fireplace recess or fire surround if fitted

3.3.3.6 fireplace recess: recess formed by the inclusion of fireplace components in the builder's opening

3.3.4 Auxiliary equipment

3.3.4.1 pressure governor: device that maintains, within a fixed range, a constant downstream pressure, independent of the upstream pressure and/or the gas rate

3.3.4.2 ignition device: device that ignites one or more burners

3.3.4.3 flame supervision device: device, including a sensing element, that causes the gas supply to a burner to be opened or closed according to the presence or absence of the flame that activates the sensing element

3.3.4.4 combustion products discharge safety device: device that automatically shuts off the gas supply to the main burner, and perhaps to the ignition burner, when there is unacceptably high spillage of combustion products from the draught diverter

3.3.4.5 atmosphere sensing device: device designed to shut off the gas supply before the combustion products of the surrounding atmosphere reach a set value

3.3.4.6 control knob: component designed to be moved by hand in order to operate an appliance control (tap, thermostat, etc.)

3.3.4.7 programming unit: unit which reacts to signals from control and safety devices, gives control commands, controls the start up sequence, supervises the burner operation and causes controlled shut-down, and if necessary safety shut-down and lock-out

The programming unit follows a predetermined sequence of actions and always operates in conjunction with a flame detector device.

3.3.4.8 flame detector device: device by which the presence of a flame is detected and signalled

It can consist of a flame sensor, an amplifier and a relay for signal transmission. These parts, with the possible exception of the actual flame sensor, may be assembled in a single housing for use in conjunction with a programming unit.

3.3.4.9 automatic burner system: burner system in which, when starting from the completely shut-down condition, the gas is ignited and the flame is detected and proved and the main gas valve(s) is actuated without manual intervention

3.3.4.10 restart interlock (manual): device which prevents the restoration of the gas supply to the main burner, or to the main burner and ignition burner, until the end of the extinction delay time

3.4 Adjusters and controls

3.4.1 setting an adjuster: action of immobilizing an adjuster in position by some means such as a screw, etc.

It is said that the adjuster is "set" in this position.

3.4.2 sealing an adjuster: procedure by which after setting an adjuster, material is added such that any attempt to alter the adjustment setting is apparent

A factory sealed pre-set adjuster is considered to be non-existent.

A pressure governor is considered to be non-existent if it has been factory sealed in the fully opened position.

3.4.3 putting a control out of service: procedure by which a control (of temperature, pressure, etc.) is put out of action and sealed in this position

The appliance then functions as if this device had been removed.

3.5 Appliance performance

3.5.1 Gas rates

3.5.1.1 volumetric flow rate: volume of gas consumed by the appliance in unit time during continuous operation

Symbol: V

Units: cubic metres per hour (m^3/h), litres per minute (l/min), cubic decimetres per hour (dm^3/h), or cubic decimetres per second (dm^3/s).

[EN 437:1993]

3.5.1.2 mass flow rate: mass of gas consumed by the appliance in unit time during continuous operation

Symbol: M

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

[EN 437:1993]

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

Symbol: Q

Unit: kilowatt (kW)

[EN 437:1993]

3.5.1.4 nominal heat input: value of the heat input declared by the manufacturer

Symbol: Q_n

Unit: kilowatt (kW)

3.5.2 Gas combustion

3.5.2.1 flame stability: state of the flames resting in a stable manner on the burner ports or the flame contact area provided by the design with no flame lift or light-back

3.5.2.2 flame lift: phenomenon characterized by the total or partial lifting of the base of the flame from the burner port or the flame contact area provided by the design

3.5.2.3 light-back: phenomenon characterized by the entry of a flame into the body of a burner

3.5.2.4 light-back at the injector: phenomenon characterized by ignition of the gas at the injector, either as a result of the flame entering the burner or by the propagation of a flame around the outside of the burner

3.5.2.5 sooting: phenomenon characterized by deposits of soot on the surfaces of parts of the appliance in contact with the products of combustion or with the flame, or as particulate matter in the combustion products

3.5.2.6 yellow tipping: phenomenon characterized by the appearance of yellow colouring at the top of the blue cone of an aerated flame

3.5.3 safety time: interval between the ignition burner gas valve, the start gas valve or main gas valve, as applicable, being energized and the ignition burner gas valve, start gas valve or main gas valve, as applicable, being de-energized if the flame detector signals the absence of a flame

3.5.4 extinction delay time: time that elapses between the disappearance of the flame and the interruption of the gas supply

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

3.5.6 thermal equilibrium: operating state of the appliance, corresponding to a particular setting of the input, in which the flue gas temperature does not change by more than ±2 K over a period of 10 min

3.5.7 controlled shutdown: process by which a control device (on the appliance or external to it) causes the gas supply to the main burner to be stopped immediately

3.5.8 safety shutdown: process which is initiated immediately in response to the signal from a limiting device or sensor and which causes any burner to shut down

3.5.9 non-volatile lockout: shutdown condition such that a start can only be accomplished by a manual reset

3.5.10 volatile lockout: shutdown condition such that a start can be accomplished by restoration of the electrical supply after its loss

3.6 Marking of the appliance and packaging

3.6.1 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.

3.6.2 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 shall be made in order that it can be utilized safely and correctly in the country.

4 Classification of appliances

4.1 Classification according to the nature of the gases used (categories)

4.1.1 *Classification of gases*

Gases are classified into three families, possibly divided into groups according to the value of the Wobbe index. Table 1 specifies the families and groups of gas used in this standard.

Table 1 — Classification of gases

Gas families and groups	Gross Wobbe index at 15 °C and 1 013,25 mbar	
	minimum	maximum
	(MJ/m^3)	(MJ/m^3)
First family		
Group a	22,4	24,8
Second family	39,1	54,7
Group H	45,7	54,7
Group L	39,1	44,8
Group E	40,9	54,7
Third family	72,9	87,3
Group B/P	72,9	87,3
Group P	72,9	76,8
Group B	81,8	87,3

4.1.2 *Appliance categories*

4.1.2.1 *General*

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

The definition of categories follows in 4.1.2.2, 4.1.2.3 and 4.1.2.4.

In each country, taking account of the local gas distribution conditions (gas composition and supply pressures), only some of the categories defined in 4.1.2.2, 4.1.2.3 and 4.1.2.4 are marketed.

The national situations concerning the marketing of these appliance categories in each country, and the corresponding supply pressures, are given in Tables A.1 and A.2 (see also in A.3 the special categories marketed locally and nationally corresponding to the special gases and supply pressures indicated in Table A.4; conditions which are particular to a country are given in annex K).

4.1.2.2 *Category I*

Appliances of category I are designed exclusively for the use of gases of a single family or of a single group.

4.1.2.2.1 *Appliances designed for use on first family gases only*

Category I_{1a}: appliances using only gases of Group a of the first family at the prescribed supply pressure. (This category is not used.)

4.1.2.2.2 *Appliances designed for use on second family gases only*

Category I_{2H}: appliances using only gases of Group H of the second family at the prescribed supply pressure.

Category I_{2L}: appliances using only gases of Group L of the second family at the prescribed supply pressure.

Category I_{2E}: appliances using only gases of Group E of the second family at the prescribed supply pressure.

Category I_{2E+}: appliances using only gases of Group E of the second family, and operating with a pressure couple without adjustment on the appliance. The appliance gas pressure regulating device, if it exists, is not operative in between the two normal pressures of the pressure couple.

4.1.2.2.3 *Appliances designed for use on third family gases only*

Category $I_{3B/P}$: appliances capable of using the third family gases (propane and butane) at the prescribed supply pressure.

Category I_{3+}: appliances capable of using gases of the third family (propane and butane) and operating with a pressure couple without adjustment of the appliance. However, for certain types of appliance, specified adjustment of the primary combustion air may be permitted when changing from propane to butane and vice versa. No gas pressure regulating device is permitted on the appliance.

Category I_{3P}: appliances using only gases of Group P of the third family (propane) at the prescribed supply pressure.

4.1.2.3 *Category II*

Appliances of category II are designed for use on gases of two families.

4.1.2.3.1 *Appliances designed for use on gases of the first and second families*

Category II_{1a2H}: appliances capable of using gases of Group a of the first family and gases of Group H of the second family. The first family gases are used under the same conditions as for category I_{1a}. The second family gases are used under the same conditions as for category I_{2H}.

4.1.2.3.2 *Appliances designed for use on gases of the second and third families*

Category $II_{2H3B/P}$: appliances capable of using gases of Group H of the second family and gases of the third family. The second family gases are used under the same conditions as for category I_{2H}. The third family gases are used under the same conditions as for category $I_{3B/P}$.

Category II_{2H3+}: appliances capable of using gases of Group H of the second family and gases of the third family. The second family gases are used under the same conditions as for category I_{2H}. The third family gases are used under the same conditions as for category I_{3+}.

Category II_{2H3P}: appliances capable of using gases of Group H of the second family and gases of Group P of the third family. The second family gases are used under the same conditions as for category I_{2H}. The third family gases are used under the same conditions as for category I_{3P}.

Category $II_{2L3B/P}$: appliances capable of using gases of Group L of the second family and gases of the third family. The second family gases are used under the same conditions as for category I_{2L}. The third family gases are used under the same conditions as for category $I_{3B/P}$.

Category II_{2L3P}: appliances capable of using the gases of Group L of the second family and gases of Group P of the third family. The second family gases are used under the same conditions as for category I_{2L}. The third family gases are used under the same conditions as for category I_{3P}.

Category $II_{2E3B/P}$: appliances capable of using gases of Group E of the second family and gases of the third family. The second family gases are used under the same conditions as for category I_{2E}. The third family gases are used under the same conditions as for category $I_{3B/P}$.

Category II_{2E+3+}: appliances capable of using gases of Group E of the second family and gases of the third family. The second family gases are used under the same conditions as for category I_{2E+}. The third family gases are used under the same conditions as for category I_{3+}.

Category II_{2E+3P}: appliances capable of using gases of Group E of the second family and gases of Group P of the third family. The second family gases are used under the same conditions as for category I_{2E+}. The third family gases are used under the same conditions as for category I_{3P}.

4.1.2.4 *Category III*

Category III appliances are designed for use on gases of all three families.

This category is not in general use.

Category III appliances which are marketed in certain countries are given in A.3.

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

Appliances are classified into types according to the method of evacuation of the products of combustion and of admission of the combustion air:

Type B: An appliance intended to be connected to a flue which evacuates the products of combustion to the outside of the room containing the appliance. The combustion air is drawn directly from the room.

Type B_1: A type B appliance incorporating a draught diverter.

For the purposes of this standard a type B_1 appliance is an appliance that is connected directly or by means of an adaptor to a flue and where a closure plate is not considered to be an adaptor.

Type B_{11}: A natural draught type B_1 appliance designed for a natural draught flue.

Type B_{11AS}: A type B_{11} appliance fitted with an atmospheric sensing device to prevent the release of combustion products in a dangerous quantity into the room under abnormal draught conditions.

Type B_{11BS}: A type B_{11} appliance fitted with a combustion products discharge safety device to prevent the release of combustion products in a dangerous quantity into the room under abnormal draught conditions.

Type B_{11CS}: A type B_{11} appliance not fitted with an atmospheric sensing device or combustion products discharge safety device, but is constructed to prevent the release of combustion products in a dangerous quantity into the room under abnormal draught conditions.

Type C: An appliance in which the combustion circuit (air supply, combustion chamber, heat exchanger, and evacuation of the combustion products) is sealed with respect to the room in which the appliance is installed.

Type C_1: A type C appliance which is designed for connection via ducts to a horizontal terminal which at the same time admits fresh air to the burner and discharges the products of combustion to the outside through orifices which are either concentric or close enough together to come under the same wind conditions.

Type C_{11}: A natural draught type C_1 appliance.

5 Constructional requirements

5.1 General

5.1.1 Conversion to different gases

5.1.1.1 *General*

In accordance with the definitions given in 4.1.2.2, 4.1.2.3 and 4.1.2.4, the only acceptable modifications and/or adjustments when converting from a gas of one group or family to another group or family and/or for adapting to different gas distribution pressures, are given in 5.1.1.2 to 5.1.1.4 for each appliance category.

For type B_{11AS} appliances, when the operation of atmospheric sensing devices depends upon the characteristics of the gas (including pressure), a change of the complete atmosphere sensing device is required when converting from a gas of one family to a gas of another family, or from one pressure or pressure couple to another within the third family, if this is specified in the manufacturer's instructions.

5.1.1.2 *Category I*

Categories I_{2H}, I_{2L}, I_{2E}, I_{2E+}: Modification and/or adjustment of the appliance is not applicable.

Category I_{3+}: No modification and/or adjustment of the appliance except for replacement of the injectors or restrictors in order to convert from one pressure couple to another (e.g. 28 mbar to 30 mbar/37 mbar <=> 50 mbar/67 mbar). Exchange of fixed primary aeration restrictor when changing from one pressure couple to another, or from one pressure to another within a pressure couple, is permitted.

Category I_{3P}, $I_{3B/P}$: No modification and/or adjustment of the appliance with respect to a change of gas. For a change of pressure range, replacement of injectors, and adjustment of gas rates and exchange of fixed primary aeration restrictor is permitted.

5.1.1.3 *Category II*

5.1.1.3.1 *Appliance categories designed for use on gases of the first and second families*

The following modifications and/or adjustments are permitted but only when converting from a gas of one family to a gas of another family:

- adjustment of the gas rate with, if necessary, a change of injectors, restrictors or governor;

- replacement of a burner assembly;

- replacement of complete ignition burners or some of its parts;

- exchange of fixed primary aeration restrictor.

If the appliance is intended to function without an operational governor for use with gases of the second family, it is obligatory to put the governor out of service in these circumstances (see 5.2.6).

It is obligatory to put gas rate adjusters out of service for use with gases of the second family (see 3.4.2).

5.1.1.3.2 *Appliances categories designed for use on gases of the second and third families*

The following modifications and/or adjustments are permitted but only when converting from a gas of one family to a gas of another family:

- adjustment of the gas rate with, if necessary, a change of injectors, restrictors or governor;

- replacement of a burner assembly;

- replacement of complete ignition burner or some of its parts;

- exchange of the fixed primary aeration restrictor.

The governor shall be put out of service where this is required in accordance with the requirements of 5.2.6.

Gas rate adjusters shall be put out of service in accordance with requirements of 5.2.2.

The following modifications and/or adjustments are permitted when changing from one pressure couple to another or from one pressure range to another:

- replacement of the injectors or restrictors in order to convert from one pressure couple to another within the third family (e.g. 28 mbar to 30 mbar/37 mbar <=> 50 mbar/67 mbar);

- exchange of fixed primary aeration restrictor when changing from one pressure couple to another or from one pressure to another within a pressure couple is permitted.

For a change of pressure range in the case of appliance categories using third family gases without a pressure couple (i.e. “3P” and “3B/P”), replacement of injectors, adjustment of the gas rates and exchange of fixed primary aeration restrictor is permitted.

5.1.1.4 *Category III*

Category III appliances admitted in certain countries are given in A.3.

5.1.2 Materials and method of construction

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

In particular, when the appliance is installed according to the manufacturer's instructions and national installation requirements, all components shall withstand the mechanical, chemical and thermal conditions to which they may be subjected during use.

Sheet metal parts in contact with products of combustion and not made of corrosion-resistant material shall be coated with an effective protection against corrosion, e.g. enamel.

Asbestos or materials containing asbestos shall not be used.

If condensation is produced at the start-up and/or during the normal operation of the appliance, it shall not cause a deterioration in the construction of the appliance and/or materials used so as to affect the safety of the appliance. The design of an appliance shall be such that condensate cannot drip onto the floor.

5.1.3 Accessibility for use and maintenance

Any control placed in the gas circuit shall be so arranged that any adjustment, maintenance or exchange is easy.

▌A1⟩ Removable parts shall be so designed or marked that they are easy to reassemble correctly according to the manufacturer's instructions and any incorrect assembly shall be obvious. ⟨A1▐

It shall be possible to complete all the operations of removal and reassembly of parts which the user has to carry out in the course of routine maintenance as explained in the user's instructions, without the aid of a tool.

Removable parts shall be dismountable for maintenance by a service engineer using ordinary tools, such as a screwdriver or a spanner.

For a type C_{11} appliance, the soundness of the combustion circuit shall be maintained after reassembly and, if required, after replacing the sealing gasket following cleaning or maintenance operations.

An appliance shall be capable of being fixed securely. The installation instructions shall give relevant and precise information.

When the combustion circuit of an appliance incorporates a door which is required to be opened or a panel which is required to be removed, it shall be difficult to close the door or replace the panel incorrectly.

If the above operation does not require the use of a tool, this operation shall not be obvious and the procedure shall be specified in the instructions for use and maintenance (see 8.2.3).

In the case where a special tool is supplied by the manufacturer, this tool shall be removable once the above operation has been completed.

5.1.4 Connections

5.1.4.1 *Appliance inlet connection*

For appliance inlet connections see A.5.

The appliance inlet connection shall be one of the following types:

a) a thread conforming to ISO 228-1:1994. In this case the end of the gas inlet connection shall have a flat annular surface at least 3 mm wide for thread sizes 1/2" and 3/8" and at least 2,5 mm wide for thread size 1/4", to allow the interposition of a sealing washer. When the end of the gas inlet connection has a thread of nominal size 1/2", it shall be possible to insert a gauge of 12,3 mm diameter to a depth of at least 4 mm;

b) a thread conforming to ISO 7-1:1994;

c) a compression fitting suitable for copper tube conforming to Table 2 of ISO 274:1994;

d) a straight tube at least 30 mm long, the end of which is cylindrical, smooth and clean, to allow connection by means of a compression fitting as specified in c);

e) a cone-seated union.

5.1.4.2 *Access to the inlet connection*

The position of the connection shall be such that connection to the gas supply can be made easily with tools in common use.

5.1.5 Soundness of the gas circuit

Holes for screws, studs, etc. intended for the assembly of components shall not open into the gasways. The residual wall thickness shall be at least 1 mm.

Brackets for supporting components shall not be interposed in any gas-carrying joints.

The soundness of components and assemblies connected to the gas circuit and likely to be dismantled for routine maintenance at the consumer's premises, with the exception of taps and cocks, shall be assured by means of mechanical joints, e.g. metal to metal joints, O-ring joints or packing, but excluding the use of any sealing compound such as tape, mastic or paste. The soundness shall be maintained after dismantling and reassembly.

Sealing compounds may be used for permanent threaded assemblies and injectors and grease for taps and cocks. The sealing material shall remain effective under normal conditions of appliance use.

The soundness of the gas circuit assemblies shall not be achieved by means of soft solder for which the lowest temperature of the melting range, after application, is less than 450 °C.

5.1.6 Soundness of the combustion circuit

5.1.6.1 *Type B_1 appliances*

The soundness of an appliance up to the draught-diverter shall be effected by mechanical means only, with the exception of those parts which do not require to be disconnected for routine maintenance, which may be joined with mastic or paste in such a way that permanent soundness is assured under normal conditions of use.

Parts which may be removed for routine maintenance shall be so designed and arranged that soundness is assured after reassembly.

5.1.6.2 *Type C_{11} appliances*

The soundness of the heating body and of the connection of an appliance to the combustion air inlet and the products outlet ducts (type C_{11}) shall be effected by mechanical means only.

However, those parts of the assembly which do not require to be dismantled for routine maintenance may be joined with mastic or paste in such a way that permanent soundness is assured under normal conditions of use.

The construction of the whole assembly shall ensure soundness in relation to the room in which an appliance is installed.

Parts which may be removed for routine maintenance shall be so designed and arranged that soundness is assured after reassembly.

5.1.6.3 *Built-in appliances*

If an appliance is supplied in several sub-groups which have to be assembled on installation, it shall be possible to carry out this operation without ambiguity when assembling in accordance with the manufacturer's instructions. If a special tool is required it shall be supplied by the manufacturer.

Any components or materials necessary to assemble these sub-groups shall be supplied by the manufacturer.

5.1.7 Supply of combustion air and evacuation of combustion products

5.1.7.1 *General*

The appliance shall include the whole of the combustion circuit, from the entry of the combustion air to the appliance to the combustion products outlet.

5.1.7.2 *Type B_1 appliances*

A type B_1 appliance shall have, as an integral part of the appliance, a draught-diverter.

The flue socket shall be female with a circular terminal section, and allow connection, if necessary by means of an adapting piece supplied with the appliance, to a flue pipe of a diameter which meets the requirements in force in the country where the appliance is to be installed (see Table A.6).

A1 It shall be possible to insert into the socket, or adaptor, a pipe, with an outside diameter of (D - 2) mm, for a distance of at least equal to:

a) 30 mm for a horizontal connection,

b) 15 mm for a vertical connection;

but it shall be impossible to insert it to such a depth that the evacuation of the products of combustion is impaired.

NOTE: Where D is the nominal internal diameter of the appliance outlet. A1

The appliance shall be constructed to prevent the release of combustion products in a dangerous quantity into the room under abnormal draught conditions (see 6.9).

5.1.7.3 *Type C_{11} appliances*

The external surfaces of the terminal shall not have openings that allow the insertion of a 16 mm diameter ball into the ducts.

It shall not be possible to directly see the burner and ignition burner flames through the terminal.

Any accessories (e.g. wall liner, terminal guard, etc.) shall be specified or supplied by the manufacturer.

The terminal for type C_{11} appliances and the assembly instructions shall be provided by the manufacturer. The ducts for the entry of combustion air and evacuation of combustion products need not be supplied if the instructions give the specifications of the ducts.

5.1.7.4 *Built-in appliances*

A built-in appliance shall be so designed that the combustion air inlet is unimpaired when the appliance is installed in accordance with the manufacturer's instructions.

5.1.8 Electrical equipment

[A1] The electrical equipment of the appliance shall be so designed and constructed as to obviate hazards of an electrical origin. The appliance shall comply with the requirements of EN 50165 which covers such hazards. [A1]

[A1] *Text deleted.* [A1]

If the appliance is fitted with electronic components or electronic systems providing a safety function, these shall comply with the relevant requirements of EN 298:1993 with regard to electromagnetic compatibility 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 60529:1991 to give the degree of personal protection against contact with dangerous electrical components.

5.1.9 Safety in the event of fluctuation, interruption and restoration of the auxiliary energy

[A1] **5.1.9.1** *Interruption and restoration*

When interruption and subsequent restoration affects safety, then interruption and subsequent restoration of the electricity supply at any time during the starting up or operation of the appliance shall result in either safety shutdown, or, the appliance shall comply with 6.5.3.

5.1.9.2 *Fluctuation* [A1]

The appliance is deemed to be safe in the event of normal and abnormal fluctuation of the mains voltage supply by carrying out the test 7.7.3.1 and complying with the requirements of 6.5.3 and 6.7.1 b).

5.1.10 Confirmation of operation

The operator shall be able at all times to ensure visually that the appliance is in operation. For live fuel effect appliances, after turning the appliance off the fuel bed may continue to glow for a time and a "cooling down" period shall be taken into account. In all appliances where mirrors are used, they shall retain their optical properties.

Where the operator is unable to see the main burner an indirect means of signalling (e.g. control lamp) is required. In this case, it shall not be possible for the signal of the existence of the flame to be confused with a signal for any malfunction, apart from that of a malfunction of the flame control itself, which should be expressed by the indication of an absence of flame.

5.2 Adjusting, control and safety devices

5.2.1 General

Any multifunctional control shall comply with EN 126:1995.

The functioning of any safety device shall not be overruled by that of any control device.

Any adjuster or control which is not intended to be altered by the user or the installer shall be sealed such that any unauthorized adjustment is obvious (see 3.4.2).

NOTE: Paint may be used for sealing, provided that it withstands the temperature to which it is subjected during normal operation of the appliance.

5.2.2 Gas rate adjusters

It shall be possible to seal gas rate adjusters (e.g. with paint) after adjustment; this seal shall resist the heat to which it is subjected during normal operation of the appliance. The adjusting screws shall be so located that they cannot fall into the gasways.

Gas rate adjusters shall be so designed that they are protected against adjustment by the user once the appliance has been installed and put into service.

The soundness of the gas circuit shall not be put at risk by the presence of gas rate adjusters.

〚A1〛 Appliances in categories $I_{2H,}$, I_{2L}, I_{2E}, I_{2E+}, $I_{3B/P}$, I_{3P}, $I_{3+,}$ $II_{2H3B/P}$, $II_{2H3+,}$ II_{2H3P}, II_{2L3P}, $II_{2L3B/P}$, $II_{2E3B/P}$, II_{2E+3+} and II_{2E+3P} shall not be fitted with gas rate adjusters. However, governed appliances in all of these categories except categories I_{2E+} and II_{2E+3+} may have a gas rate adjuster consisting of an adjusting screw on the gas governor. 〈A1〛

Appliances in category II_{1a2H} and all categories in III shall have a gas rate adjuster for first family gases.

For appliances in category II_{2H3+} having an adjuster which is the governor adjusting screw (see 3.3.1.5), it shall be possible to put this device out of service when these appliances are supplied with a third family gas, and the same applies for appliances in category II_{1a2H} when they are supplied with a second family gas. For appliances in category II_{2E+3P} having a gas rate adjuster, it shall be possible to put these devices out of service fully or partially (see 5.2.6) when these appliances are supplied with a second family gas.

The adjusters shall be moveable only with the use of a tool and they shall be capable of being set in the operating position.

5.2.3 Aeration adjuster

An aeration adjuster shall be set and sealed by the manufacturer.

5.2.4 Shut-off valves

5.2.4.1 *General*

An appliance shall have a device that will allow the gas to the burner and to any ignition burner to be shut off as required. Operation of this device may be manual or automatic, but the shut-off shall be effected without delay, for example it shall not be subject to the inertia time of the safety device.

The gas line shall be fitted with either a thermoelectric device or a valve of Class A, B or C to shut off the gas supply to the main burner and ignition burner, if any.

NOTE: The flame detector may operate on this valve.

Appliances shall have, in addition, a second valve.

5.2.4.2 *Manual valve system*

For a manual valve system the second valve may be combined with the first valve to make a single device which incorporates a gas tap and a flame supervision device.

To indicate a reduced rate position, the tap shall have either a stop at the end of the travel when the reduced rate position is beyond the full-on position, or an arrest position when the reduced rate position is situated between the full-on and the off positions.

If an appliance has two separate shut-off devices, one for the burner and one for the ignition burner, the controls for these devices shall be interlocked in such a way that it is impossible for the main burner to be supplied before the ignition burner. If the burner and ignition burner are served by a single shut-off device, the ignition burner ignition position shall be indicated by a stop or notch that provides a definite arrest. It shall be possible to operate the shut-off and unlocking device with one hand only.

If a control knob operates by turning, movement in a clockwise direction by a user facing the knob shall close the gasway.

5.2.4.3 *Automatic valve systems*

Any electrically operated automatic shut-off valve shall comply with ▌A1⟩ EN 161. ⟨A1▐

Examples of gas valve arrangements for automatic controls are given in annex D. Any other arrangement giving at least an equivalent level of safety is permissible.

When a single push button operates a safety device that controls both burner and ignition burner, no markings are required if incorrect operation is not possible.

5.2.4.4 *Control knob*

A control knob shall be designed and placed so that it can neither be mounted incorrectly nor move by itself.

The "off" position on a tap shall be marked indelibly and clearly, as a disc. Other positions shall be marked and these markings chosen by the manufacturer.

5.2.5 Flame supervision devices

An appliance shall have a flame supervision device. It shall control the gas supply to the main burner and to any ignition burner if fitted.

Heat sensitive flame supervision devices of the thermoelectric type shall comply with EN 125:1991.

In the event of failure of the means of sensing, the appliance shall be safe.

5.2.6 Pressure governors

Pressure governors shall comply with EN 88:1991.

An appliance in category I_{3+} shall not have a pressure governor.

The pressure of appliances of category I_{2E+}, and all other categories which have the index "E+", shall not be governed. However, if a gas pressure governor is fitted, it shall not function within the range of the two normal pressures of the second family pressure couple, i.e. 20 mbar to 25 mbar.

Governors are optional for an appliance in the other categories.

For appliances in categories II_{2H3+} and II_{2E+3+}, it shall be possible to put the pressure governor, if any, out of service when using third family gases. For appliances in categories II_{2E+3+} and II_{2E+3P}, it shall be possible to put the pressure governor partially out of service when they are supplied with second family gases such that the pressure governor is not operational in the range of the normal pressures of the second family pressure couple, i.e. 20 mbar to 25 mbar.

The design and accessibility of the pressure governor shall be such that it can be easily adjusted or put out of service for use with another gas, but precautions shall be taken to make unauthorized interference with the adjustment difficult.

5.2.7 Automatic burner control system

If an appliance is fitted with an automatic burner control system, it shall comply with EN 298:1993.

5.2.8 Thermostats

Any mechanical thermostat shall comply with EN 257:1992.

Any electrical thermostat shall comply with EN 60730-2-9:1995.

Any thermostat control handle shall be placed in an accessible location; its positions shall be marked with graduations.

5.2.9 Spillage monitoring system

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 (See 6.9).

Any safety device used for this purpose shall:

- not have any adjustment other than that made and sealed by the manufacturer;

- be so designed that it cannot be removed or dismantled without the use of a tool;

- have electrical insulation that will withstand the thermal and chemical stresses resulting from spillage of the combustion products;

- be designed such that interruption of any link between the sensor and the device shall cause safety shutdown, if necessary after a waiting time.

5.2.10 Manually operated devices

The operation of push buttons, switches, etc., incorrectly or out of sequence shall not adversely affect the safety of an automatic burner control system.

5.3 Ignition devices

5.3.1 Direct ignition of the main burner

Direct ignition of the main burner is allowable for appliances which:

a) incorporate an automatic ignition system; or

b) have a heat input less than or equal to 4 kW during the ignition procedure.

5.3.2 Ignition burner

The heat input of the ignition burner shall not exceed 0,3 kW.

The ignition burner shall be so positioned that its products of combustion are evacuated with those of the burner. The position of the ignition burner shall be fixed relative to that of the burner.

If the ignition burner(s) differ(s) according to the nature of the gas used it (they) shall be marked, and easily replaced. This requirement applies to parts of ignition burners, e.g. their injectors, if it is necessary to change only those parts.

Ignition burners shall be protected against blockage by gas-borne particulate matter.

Where the ignition burner rate is ungoverned, a means of adjusting the gas rate is mandatory for an appliance using first family gas, optional on second family gases, and forbidden on third family gases. However, this is optional for first family gases when, at a pressure of 15 mbar, the heat input of the ignition burner is less than 0,17 kW with the reference gas.

The adjuster may be omitted if the ignition burner and/or injector can be easily changed to suit the gas used.

For a type B_1 appliance, it shall be easy to ignite the ignition burner with a match unless a special device is provided for igniting the ignition burner.

A type C_{11} appliance shall be provided with an integral ignition device. It shall be possible to ignite the ignition burner of such an appliance with the combustion chamber closed.

5.4 Flame supervision systems

5.4.1 General

An appliance shall have a flame supervision device. It shall control the gas supply to the main burner and to any ignition burner, if fitted.

A flame supervision device shall be securely located in relation to every component with which it is designed to operate.

5.4.2 Appliances with automatic burner systems

The manufacturer shall specify the safety time (see 6.10.2.2).

Upon flame failure during the running condition, the flame supervision device shall cause non-volatile lock-out, except in the case of appliances with direct ignition of the main burner, in which case:

a) spark restoration within 1 s is allowable; or

b) a single restart attempt is allowed within 10 s.

In the event that re-ignition is unsuccessful during either of these periods, non-volatile lock-out shall occur.

5.5 Burners

A1 Every removable injector and/or removable restrictor shall carry an indelible means of identification preventing any confusion. A1

The section of the flame ports shall not be adjustable.

Removal and replacement of the burner in accordance with the manufacturer's instructions shall be possible with commercial tools (i.e. tools which are available on the open retail market).

The burner position shall be well defined and the burner shall be difficult to fit incorrectly.

The relative position between the burner(s) and injector(s) shall be well defined.

A1 *Text deleted.* A1

A1 5.6 Gas pressure test points A1

A pressure test point shall be provided on the appliance for measurement of the manufacturer's stated pressure. An ungoverned appliance shall have one pressure test point and a governed appliance shall have two pressure test points, one to measure the appliance inlet pressure and another upstream of the burner.

The pressure test nipple shall have an external diameter of $(9\ ^{0}_{-0,5})$ mm and a useful length of at least 10 mm for connection to tubing. The test point hole diameter shall not be greater than 1 mm at its narrowest point.

6 Operational requirements

6.1 General

Unless otherwise specified the test gases and conditions of test are given in 7.1.

6.2 Soundness of the gas circuit and combustion products circuit, and evacuation of the combustion products

6.2.1 Soundness of the gas circuit

The gas circuit shall be sound. It is deemed to be sound if, when tested as described in 7.2.1, the leakage of air does not exceed 100 cm^3/h irrespective of the number of components, whether mounted in series or parallel on the appliance.

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

6.2.2.1 *Type B_1 appliances*

Soundness of the combustion products circuit shall meet one of the following requirements, depending on the test method:

a) If a spillage plate is used, when the appliance is tested as described in 7.2.2.1 a), the products of combustion shall issue only at the outlet of the flue socket; or

b) If a hood is used, when the appliance is tested as described in 7.2.2.1 b), any leakage shall not exceed 0,04 m^3/h per kW of heat input.

6.2.2.2 *Type C_{11} appliances*

When the appliance is tested as described in 7.2.2.2, the leakage of compressed air shall not exceed the following:

a) for appliances less than or equal to 12 kW heat input, 0,25 m^3/h per kW of heat input;

b) for appliances greater than 12 kW heat input, a maximum of 3 m^3/h.

6.2.2.3 *Supplementary tests*

For an appliance incorporating a door which is required to be opened, or a panel which is required to be removed, during ignition of the ignition burner and/or maintenance and cleaning of the appliance, when tested as described in 7.2.2.3 it shall comply with 6.2.2.1 or 6.2.2.2, as appropriate.

6.2.3 Escape of unburnt gas (type B_1 appliances only)

When the appliance is tested as described in 7.2.3, there shall be no escape of an ignitable quantity of gas between the injector outlet and the external surface of the burner, excluding the flame ports.

6.3 Heat inputs

6.3.1 Nominal heat input

When calculated in accordance with 7.3.1:

a) for an appliance without a gas rate adjuster, under the test conditions described in 7.3.2, the heat input obtained at normal test pressure shall be within ±5 % of the nominal heat input;

b) for an appliance with a gas rate adjuster but no pressure governor, the heat input shall be at least equal to the nominal heat input when measured under the conditions given in 7.3.3 test No. 1 and shall not exceed the nominal heat input when measured under the conditions given in test No. 2 of 7.3.3;

c) an appliance with a pressure governor shall comply with 6.6.

6.3.2 Start gas heat input

When tested as described in 7.3.4 the heat input[1)] shall be as specified by the manufacturer (see 5.3).

6.3.3 Reduced rate

When tested as described in 7.3.5, any reduced rate specified by the manufacturer shall be within ±10 % of the specified rate.

6.4 Temperature of various parts of the appliance

6.4.1 Temperature of external parts of the appliance

When tested as described in 7.4.1, the surface temperature of the control handles and of all the parts that have to be manipulated during normal operation of the appliance, measured only in the areas intended to be touched, shall not exceed the ambient temperature by more than:

35 K for metals and equivalent materials;

45 K for porcelain and equivalent materials;

60 K for plastics and equivalent materials.

The temperature of those parts of the appliance other than working surfaces (see 3.1.5) shall not exceed the ambient temperature by more than:

80 K for base metal;

95 K for enamelled steel, coated or painted metals and equivalent materials;

100 K for plastics, rubber or wood.

[1)] The heat input based on gross calorific value is related to the net value for the five reference gases as follows:

G 110 $Q\ (H_s) = 1{,}136\ Q\ (H_i)$
G 120 $Q\ (H_s) = 1{,}133\ Q\ (H_i)$
G 20 $Q\ (H_s) = 1{,}111\ Q\ (H_i)$
G 25 $Q\ (H_s) = 1{,}110\ Q\ (H_i)$
G 30 $Q\ (H_s) = 1{,}083\ Q\ (H_i)$

6.4.2 Temperature of components

When the appliance is tested as described in 7.4.2, the temperature of any component (including taps) shall not exceed that declared by the component manufacturer.

6.4.3 Temperature of floor, shelf and walls

6.4.3.1 For appliances intended to be installed on, or against, non-combustible surfaces, when tested as described in 7.4.3.1, the temperature at any user touchable point of the floor on which an appliance is to be placed and that of the walls at the sides and back of the appliance and shelf, shall not exceed the ambient temperature by more than 80 K.

6.4.3.2 For appliances intended to be installed on combustible surfaces, when tested as described in 7.4.3.1, the temperature at any point of any floor on which an appliance is to be placed and that of the walls at the sides and back of the appliance and shelf, shall not exceed the ambient temperature by more than 60 K.

NOTE: For built-in appliances which are exclusively for installation in an enclosure made of refractory material, the test described in 7.4.3.1 and 7.4.3.2 is not carried out.

6.5 Ignition, cross-lighting and flame stability

6.5.1 Ignition and cross-lighting

6.5.1.1 *All appliances*

When tested as described in Test Nos. 1 to 3 of 7.5.1.1, smooth and correct ignition and cross-lighting shall be assured and the appliance shall continue to operate safely.

For piezo ignition devices, the appliance shall successfully ignite on at least eight out of ten attempts.

For an appliance with a room thermostat, a reduced rate position is not mandatory but if there is one, correct burner ignition shall be assured.

6.5.1.2 *Supplementary tests*

When tested as described in 7.5.1.2, there shall be no hazard to the user or damage to the appliance which affects safety.

NOTE: This test is not applied to manual systems with a restart interlock and automatic systems with a safety time less than or equal to 10 s.

6.5.2 Flame stability (all appliances)

When tested as described in 7.5.2 the flames shall be stable. A slight tendency to lift at the moment of ignition is acceptable.

6.5.2.1 *Effect of room draughts* (for type B_1 appliances)

The flames shall be stable when tested as described in 7.5.3.

6.5.2.2 *Effect of down draughts* (for type B_1 appliances)

The flames shall be stable when tested as described in the second test given in 7.7.3.2.

6.5.2.3 *Wind tests* (for type C_{11} appliances)

When the appliance is tested as described in 7.5.4, ignition of the ignition burner, ignition of the main burner by the ignition burner and cross-lighting of the main burner, as well as the stability of the ignition burner and main burner, shall be correct. Slight flame disturbance is acceptable but there shall be no flame extinction.

6.5.3 Fluctuation of the auxiliary energy

When tested as described in 7.7.3.1 the appliance shall ignite and remain in operation.

6.6 Pressure governors

When tested in accordance with 7.6.1 the rate shall not differ by more than +7,5 % and -10 % for first family gases, and by more than ±5 % for second and third family gases, from the rate obtained at the normal test pressure, when the upstream pressure is varied between the minimum and maximum values given in 7.1.4 for the reference gases of the relevant category.

Where the function of the governor has been annulled by the manufacturer, as given in 7.6.2, the relationship between the flow rate and the square root of the pressure shall remain constant when the inlet pressure is varied between its minimum and maximum values.

6.7 Combustion

6.7.1 CO concentration for all appliances

The CO concentration in the air-free, dry products of combustion measured as described in 7.7.1 shall not exceed:

a) 0,10 % when the appliance is supplied with reference gas under the test conditions described in 7.7.2.1;

b) ▌A1⟩ 0,2 % when the appliance is supplied with the incomplete combustion limit gas under the test conditions described in 7.7.2.2, and under all test conditions described in 7.7.3, excluding 7.7.3.1 a), including the arithmetic mean calculated as given in 7.7.3.3. ⟨A1▐

6.7.2 Measurement of oxides of nitrogen, NO_x (all appliances)

When tested as described in 7.7.4, the NO_x concentration in the air-free, dry products of combustion shall not exceed the limit for the declared class given in Table 2.

For third family gases and for appliances required to be tested on the reference gas G 30 the limits are multiplied by a factor of 1,3. For appliances required to be tested on the reference gas G 31 the limits are multiplied by a factor of 1,2.

Table 2 — NO_x concentration limits

Classes	NO_x concentration/limits mg/kWh
1	350
2	260
3	200
4	150
5	100

6.8 Sooting (live fuel effect appliances only)

6.8.1 Cold condition

When tested as described in 7.8.3.1 and 7.8.3.2, the smoke number shall be less than or equal to 3.

6.8.2 Hot condition

When tested as described in 7.8.3.1 and 7.8.3.3, the smoke number shall be less than or equal to 2.

A limit of less than or equal to 3 is acceptable for appliances with a category index E+.

6.8.3 Long cycle condition

If, on completion of the tests in accordance with 7.8.3.1 and 7.8.3.2 and 7.8.3.3 inclusive, soot is observed[2)] on the burner or fuel bed, then test 7.8.3.4 shall be carried out.

When tested as described in 7.8.3.4, the increase in the CO concentration of the dry, air-free products of combustion shall not exceed 0,06 percent.

If, before the end of the test, this increase is exceeded, or an excessive amount of soot has been deposited on the burner or fuel bed, the appliance shall be deemed unsatisfactory.

[2)] Fine powdery deposits are ignored.

6.9 Spillage monitoring system

6.9.1 Atmosphere sensing device (type B_{11AS} appliances only)

When tested as described in 7.9.1 and 7.9.2, the appliance shall go to safety shutdown before the CO concentration of the atmosphere of the test room exceeds 200×10^{-6} (V/V).

6.9.2 Combustion products discharge safety device (type B_{11BS} appliances only)

6.9.2.1 *Nuisance shutdown*

When the appliance is tested as described in 7.9.1, 7.9.3.1 and 7.9.3.2, safety shutdown shall not occur.

6.9.2.2 *Shutdown times*

When the appliance is tested as described in 7.9.1, 7.9.3.1 and 7.9.3.3, the shutdown times given in Table 3 shall not be exceeded.

Table 3 — Shutdown times

Degree of blockage	**Diameter of opening in the blocking plate** d	**Maximum shutdown time** s	
		Q_n	Q_m
Complete blockage	0	200	$200 \frac{Q_n}{Q_m}$
Partial blockage	0,6 D or 0,6 D'	600	
where: D is the internal diameter of the test flue at its top; D' is the hole diameter obtained at the point at which spillage occurs; Q_n is the nominal heat input; Q_m is the minimum heat input for modulating appliances or appliances with several rates.			

Where safety shutdown occurs, automatic restart shall be possible only after a minimum waiting time of 10 min. The manufacturer shall state in the technical instructions the actual waiting time of the appliance.

6.9.3 Type B_{11CS} appliances

When tested as described in 7.9, the appliance shall comply with 6.9.1 or 6.9.2, as appropriate.

6.10 Flame supervision device

6.10.1 Thermoelectric device

6.10.1.1 *Cold condition*

When tested as described in 7.10.1.1, any flame supervision device shall hold open the valve in not more than 60 s from the cold condition.

No device shall require more than 20 s of sustained manual operation.

6.10.1.2 *Hot condition*

When tested as described in 7.10.1.2, any flame supervision device shall close the valve from the fully heated condition within 60 s.

6.10.2 Automatic burner control system

6.10.2.1 *Manually operated devices (e.g. push button)*

When tested as described in 7.10.2.1, the rapid (on and off) manual operation of any start switch shall not set up a hazardous condition.

6.10.2.2 *Safety time*

The safety time specified by the manufacturer (see 5.4.2) is verified as described in 7.10.2.2.

6.10.2.3 *Extinction delay time*

When tested as described in 7.10.2.3, the time for the flame supervision device to de-energize the burner safety shut-off valves upon flame failure shall be not more than 3 s.

6.11 Efficiency

The manufacturer shall specify the efficiency class of the appliance.

When the appliance is tested as described in 7.11.1, the efficiency obtained (see 7.11.2) with the appliance operating at its nominal heat input shall be at least as given in Table 4, depending upon class:

- Convection heaters shall be of Class 1;
- Combination live fuel effect/convector appliances shall be of either Class 1 or Class 2.

Table 4 — Efficiency

A1

Efficiency Class	Minimum net Efficiency[a] for appliances of heat input greater than 5 kW[b]	Minimum net Efficiency[a] for appliances of heat input less than or equal to 5 kW[b]
1	82[a] %	80[a] %
2	65[a] %	65[a] %

[a] The efficiency value η based on gross calorific value is related to the net value for the five reference gases as follows:

G 110 net value = 0,880 × gross value;

G 120 net value = 0,882 × gross value;

G 20 net value = 0,900 × gross value;

G 25 net value = 0,901 × gross value;

G 30 net value = 0,923 × gross value.

[b] The heat input based on gross calorific value is related to the net value for the five reference gases as follows:

G 110 gross value = 1,136 × net value;

G 120 gross value = 1,133 × net value;

G 20 gross value = 1,111 × net value;

G 25 gross value = 1,110 × net value;

G 30 gross value = 1,083 × net value.

A1

7 Test methods

7.1 General

7.1.1 Characteristics of test gases: reference and limit gases

Appliances are intended for use with gases of various qualities. One of the aims of this standard is to check that the performance of an appliance is satisfactory for each family or group of gases and for the pressures for which it is designed, if necessary using the adjusting devices.

The characteristics of the reference and limit gases are given in Tables 6 and 7. These are extracted from EN 437:1993.

7.1.2 Conditions for preparation of test gases

The composition of the gases used for the tests shall be as close as possible to that given in Table 6. For the preparation of the gases, the following rules shall be observed:

a) the Wobbe index of the gas used shall be within ±2 % of the value indicated in Table 6 for the corresponding test gas (this tolerance includes any variations due to measuring equipment);

b) the constituents used for the preparation of the mixtures shall have at least the following purity:

- nitrogen N_2 99 %
- hydrogen H_2 99 %
- methane CH_4 95 %
- propene C_3H_6 95 %
- propane C_3H_8 95 %
- butane C_4H_{10}[3)] 95 %

} with a total concentration of hydrogen, carbon monoxide and oxygen below 1 % and a total concentration of nitrogen and carbon dioxide below 2 %

However, these conditions are not obligatory for each of the components if the final mixture has a composition identical to that of a mixture which would have been from components satisfying the preceding conditions. One can therefore, in order to make up a mixture, start with a gas already containing, in suitable proportions, several components of the final mixture.

[3)] Any mixture of iso-butane and n-butane can be used.

However, for gases of the 2nd family:

- for the tests carried out with reference gases, G 20 or G 25, a gas belonging respectively to either Group H, L, or Group E may be used even if its composition does not satisfy the above conditions, provided that after the addition of either propane or nitrogen as appropriate, the final mixture has a Wobbe index within ±2 % of the value given in the table for the corresponding reference gas;

- for the preparation of the limit gases, another gas may be used as the base gas instead of methane:

  - for limit gases G 21, G 222 and G 23, a natural gas of Group H may be used;

  - for limit gases G 27 and G 231, a natural gas of Group H or of Group L or of Group E may be used;

  - for the limit gas G 26, a natural gas of Group L may be used.

In all cases, the final mixture obtained by adding propane or nitrogen shall have a Wobbe index within ±2 % of the value given in Table 6 for the corresponding limit gas and the hydrogen content of the final mixture shall be as given in Table 6.

Table 5 — Test gases corresponding to the appliance categories

Category	Reference gas	Incomplete combustion limit gas	Light back limit gas	Lift limit gas	Sooting limit gas
I_{2H}	G 20	G 21	G 222	G 23	G 21
I_{2L}	G 25	G 26	G 25	G 27	G 26
I_{2E} I_{2E+}	G 20	G 21	G 222	G 231	G 21
$I_{3B/P}$ I_{3+}	G 30	G 30	G 32	G 31	G 30
I_{3P}	G 31	G 31	G 32	G 31	G 31, G 32
II_{1a2H}	G 110, G 20	G 21	G 112	G 23	G 21
$II_{2H3B/P}$ II_{2H3+}	G 20, G 30	G 21	G 222, G 32	G 23, G 31	G 30
II_{2H3P}	G 20, G 31	G 21	G 222, G 32	G 23, G 31	G 31, G 32
$II_{2L3B/P}$	G 25, G 30	G 26	G 32	G 27, G 31	G 30
II_{2L3P}	G 25, G 31	G 26	G 32	G 27, G 31	G 31, G 32
$II_{2E3B/P}$ II_{2E+3+}	G 20, G 30	G 21	G 222, G 32	G 231, G 31	G 30
II_{2E+3P}	G 20, G 31	G 21	G 222, G 32	G 231, G 31	G 31, G 32
NOTE: Tests with the limit gases are carried out with the injector and adjustment corresponding to the reference gas of the group to which the limit gas used for the test belongs.					

Table 6 — Characteristics of the test gases[1)]
Gas dry at 15 °C and 1 013,25 mbar

Gas family and group	Test gases	Designation	Composition by volume %	W_i MJ/m³	H_1 MJ/m³	W_s MJ/m³	H_s MJ/m³	d
Gases of the first family[2)]								
Group a	Reference gas Incomplete combustion Flame lift and sooting limit gas	G 110	CH_4 = 26 H_2 = 50 N_2 = 24	21,76	13,95	24,75	15,87	0,411
	Light back limit gas	G 112	CH_4 = 17 H_2 = 59 N_2 = 24	19,48	11,81	22,36	13,56	0,367
Gases of the second family								
Group H	Reference gas	G 20	CH_4 = 100	45,67	34,02	50,72	37,78	0,555
	Incomplete combustion Sooting limit gas	G 21	CH_4 = 87 C_3H_8 = 13	49,60	41,01	54,76	45,28	0,684
	Light back limit gas	G 222	CH_4 = 77 H_2 = 23	42,87	28,53	47,87	31,86	0,443
	Flame lift limit gas	G 23	CH_4 = 92,5 N_2 = 7,5	41,11	31,46	45,66	34,95	0,586
Group L	Reference gas	G 25	CH_4 = 86 N_2 = 14	37,38	29,25	41,52	32,49	0,612
	Incomplete combustion Sooting limit gas	G 26	CH_4 = 80 C_3H_8 = 7 N_2 = 13	40,52	33,36	44,83	36,91	0,678
	Flame lift limit gas	G 27	CH_4 = 82 N_2 = 18	35,17	27,89	39,06	30,98	0,629
Group E	Reference gas	G 20	CH_4 = 100	45,67	34,02	50,72	37,78	0,555
	Incomplete combustion	G 21	CH_4 = 87 C_3H_8 = 13	49,60	41,01	54,76	45,28	0,684
	Light back limit gas	G 222	CH_4 = 77 H_2 = 23	42,87	28,53	47,87	31,86	0,443
	Flame lift limit gas	G 231	CH_4 = 85 N_2 = 15	36,82	28,91	40,90	32,11	0,617

[1)] For gases used nationally or locally, see A.3.

continued

Table 6 — Characteristics of the test gases[1)]
Gas dry at 15 °C and 1 013,25 mbar (*concluded*)

Gas family and group	Test gases	Designation	Composition by volume %	W_I MJ/m³	H_I MJ/m³	W_s MJ/m³	H_s MJ/m³	d
Gases of the third family[3)]								
Third family and Groups 3B/P and 3B	Reference gas		nC_4H_{10} = 50	80,58	116,09	87,33	125,81	2,075
	Incomplete combustion Sooting limit gas	G 30	iC_4H_{10} = 50[4)]					
	Flame lift limit gas	G 31	C_3H_8 = 100	70,69	88,00	76,84	95,65	1,550
	Light back limit gas	G 32	C_3H_6 = 100	68,14	82,78	72,86	88,52	1,476
Group 3P	Reference gas			70,69	88,00	76,84	95,65	1,550
	Incomplete combustion Sooting and flame lift limit gas	G 31	C_3H_8 = 100					
	Light back and sooting limit gas	G 32	C_3H_6 = 100	68,14	82,78	72,86	88,52	1,476

[1)] For gases used nationally or locally, see A.3.

[2)] For other groups, see A.3.

[3)] See also Table 7.

[4)] See 7.1.2 footnote 3.

NOTE: The calorific values of the third family test gases, expressed in MJ/m³ in this table, may also be expressed in MJ/kg, as shown in Table 7.

Table 7 — Calorific value of the test gases of the third family

Test gas designation	H_i MJ/kg	H_s MJ/kg
G 30	45,65	49,47
G 31	46,34	50,37
G 32	45,77	48,94

7.1.3 Practical application of test gases

7.1.3.1 *Choice of test gases*

Gases required for the tests described in clauses:

7.2 Soundness of the combustion circuit and evacuation of the combustion products;
7.3 Heat input;
7.5 Ignition; cross-lighting; flame stability;
7.6 Pressure governors; and
7.7 Combustion;

shall be as given in 7.1.1 and made up in accordance with 7.1.2.

For the tests described in other clauses it is permissible, in order to facilitate testing, to replace the reference gas by a gas actually distributed, provided that its Wobbe index is within ±5 % of that of the reference gas.

When an appliance can use gases of several groups or families, test gases selected from those listed in Table 6, and in accordance with 7.1.5.1, are used. The selected gases, for each appliance category, are listed in Table 5.

7.1.3.2 *Conditions of supply and adjustment of the burners*

7.1.3.2.1 *Initial adjustment of appliance*

Before all tests that are required to be carried out, the appliance shall be fitted with the appropriate equipment [injector(s), fixed primary aeration restrictor(s), etc.] corresponding to the gas family or gas group to which the specified test gas belongs (see Table 6). Any gas rate adjusters are set in accordance with the manufacturer's instructions using the appropriate reference gas(es) and the corresponding normal pressure(s) given in 7.1.4.

This initial adjustment of the appliance is subject to the limitations given in 5.1.1.

7.1.3.2.2 *Supply pressures*

Except where an adjustment of the supply pressure is necessary (as described in 7.1.3.2.3 and 7.1.3.2.4), the normal, minimum and maximum supply pressures to be used for testing purposes shall be in accordance with 7.1.4.

Unless otherwise specified, the initial adjustment of the appliance is not altered.

7.1.3.2.3 *Corrected pressures*

Where, in order to obtain the nominal heat input within ±2 %, it is necessary to use a supply pressure, p, different from the normal pressure, p_n, then those tests normally carried out at the minimum or maximum pressures p_{min} or p_{max} shall be carried out at the corrected pressures p' and p'' where:

$$\frac{p'}{p_{min}} = \frac{p''}{p_{max}} = \frac{p}{p_n} \qquad (1)$$

7.1.3.2.4 *Adjustment of heat inputs*

For tests requiring adjustment of the burner to the nominal or another specified heat input, it shall be ensured that the pressure upstream of the injectors is such that the heat input obtained is within ±2 % of that specified (by altering the preset adjusters or the appliance pressure governor, if adjustable, or the appliance supply pressure).

The specified heat input shall be determined in accordance with 7.3.1 and with the appliance supplied with the appropriate reference gas(es).

7.1.4 Test pressures

The values of the test pressures, i.e. the pressure to be applied at the gas inlet connection to the appliance whilst in operation, are given in Tables 8 and 9.

These pressures are used in accordance with the special national conditions given in annex A, for the country in which the appliance is to be installed.

Table 8 — Test pressures where no pressure couple exists[1)]

Pressures in millibar

Appliance categories having an index	Test gas	p_n	p_{min}	p_{max}
First family: 1a	G 110, G 112	8	6	15
Second family: 2H	G 20, G 21 G 222, G 23	20	17	25
Second family: 2L	G 25, G 26 G 27	25	20	30
Second family: 2E	G 20, G 21 G 222, G 231	20	17	25
Third family: 3B/P	G 30, G 31 G 32	29[2)]	25	35
	G 30, G 31 G 32	50	42,5	57,5
Third family: 3P	G 31, G 32	37	25	45
	G 31, G 32	50	42,5	57,5

[1)] For test pressures corresponding to gases distributed nationally or locally refer to Table A.4.

[2)] Appliances of this category may be used without adjustment at the specified supply pressures of 28 mbar to 30 mbar.

Table 9 — Test pressures where a pressure couple exists

Pressures in millibar

Appliance categories carrying as index	Test gas	p_n	p_{min}	p_{max}
Second family: 2E+	G 20, G 21 G 222	20	17	25
	G 231	(25)[1)]	17[2)]	30
Third family: 3+ (28-30/37 couple)	G 30	29[3)]	20	35
	G 31, G 32	37	25	45
Third family: 3+ (50/67 couple)	G 30	50	42,5	57,5
	G 31, G 32	67	50	80

[1)] This pressure corresponds to the use of low Wobbe index gas, but in principle no test is carried out at this pressure.

[2)] See K.1.

[3)] Appliances of this category may be used without adjustment at the specified supply pressures of 28 mbar to 30 mbar.

7.1.5 General test conditions

7.1.5.1 *General*

These general test conditions shall apply unless the test method states otherwise.

7.1.5.2 *Test room*

The appliance is installed in a well-ventilated, draught-free room which has an ambient temperature of (20 ± 5) °C; a wider temperature range is permissible provided that the test results are not affected.

7.1.5.3 *Test installation*

The appliance shall be installed in accordance with the manufacturer's instructions.

NOTE: For the convenience of carrying out tests, the appliance may be installed at a height above the floor which is other than that specified in the manufacturer's instructions, provided that this does not affect the performance of the appliance.

The gas connection and system up to and including the burner is to be examined for soundness both before and after test. The test results are deemed invalid unless the system is sound (see 6.2.1).

Test pressures are to be measured correct to 0,2 mbar and controlled so that the variation does not exceed ±0,2 mbar.

For type B_1 appliances unless otherwise specified, tests are carried out with a 1 metre long flue (see Figure 1).

A1 The test duct length for type C_{11} appliances shall be the minimum vertical length and maximum horizontal length specified by the manufacturer. A1

7.1.5.4 *Electrical supply* (where applicable)

The appliance shall be connected to an electrical supply at the nominal voltage, except where otherwise stated in the clause concerned.

7.1.5.5 *Convection fan* (where applicable)

Tests are carried out with the fan in operation, except where otherwise stated in the clause concerned.

7.2 Soundness of the gas circuit and combustion products circuit, and evacuation of the combustion products

7.2.1 Soundness of the gas circuit

The appliance gas inlet is connected to an air supply capable of being maintained constant at the appropriate pressure.

For appliances using first and/or second family gases only, the tests are carried out with an air pressure of 50 mbar; the inlet valve is tested with an air pressure of 150 mbar. For appliances using third family gases, all the tests are carried out with an air pressure of 150 mbar.

With the appliance at ambient temperature, compliance with 6.2.1 is checked under each of the following conditions:

a) Each valve in the main gas supply is tested in turn for soundness in its closed position, all other valves being open;

b) With the gas tap, the gas valve controlled by the automatic valve and the valve of the flame supervision device open, and the final unmixed gas outlets to the ignition burner and main burner sealed.

Where the design of the ignition burner is such that its gas outlet cannot be sealed, this test is carried out with the gasway to the ignition burner sealed at a convenient place. In this case, an additional test is also carried out using soap solution, to verify that there is no leakage from the ignition burner.

The method used to measure leakage shall be capable of measurement to an accuracy of at least 0,01 dm^3/h.

The tests are carried out when the appliance is delivered, and again on completion of all the appliance tests given in this standard. Any assembly in the gas circuit that has a gas-tight joint whose removal is provided for in the manufacturer's instructions shall be removed and replaced 5 times.

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

7.2.2.1 *Type B_1 appliances*

a) Spillage plate

The appliance is adjusted to its nominal heat input and tested under normal draught conditions.

Possible leaks are looked for with a dewpoint plate. A suitable method is given in C.1.

In doubtful cases, method b) should be used;

b) Hood

This method is given in C.2.

7.2.2.2 *Type C_{11} appliances*

The soundness is checked on the appliance body and on the ducts for the supply of combustion air and evacuation of the products of combustion which connect the appliance to the balanced flue terminal. The maximum permitted length of ducts are to be supplied by the manufacturer. The ducts are connected in accordance with the manufacturer's instructions at the terminal end in such a way that the seals between the ducts and the appliance and, where applicable, between the sections of the ducts, are not affected.

An outside telescopic duct may be sealed, if necessary, during the test in accordance with the manufacturer's instructions.

The appliance is connected to the maximum duct length specified by the manufacturer.

The assembly of the appliance and its ducts is to be carried out as prescribed in the manufacturer's installation instructions.

The appliance is connected to a source of compressed air in such a way that a pressure of 0,5 mbar above atmospheric pressure is maintained in the appliance and in the ducts for the combustion air and products of combustion. The pressure is measured at the point where the compressed air supply is connected to the appliance. The leakage rate is measured by a meter.

7.2.2.3 *Supplementary tests*

7.2.2.3.1 *For appliances with a door*

Open the door and then close it in accordance with the manufacturer's instructions. Carry out the test described in 7.2.2.1 or 7.2.2.2, as appropriate.

7.2.2.3.2 *For appliances with a panel*

Remove the panel and then replace it in accordance with the manufacturer's instructions. Carry out the test described in 7.2.2.1 or 7.2.2.2, as appropriate.

▌A1⟩ 7.2.3 Escape of unburnt gas-burner (Type B appliances only) ⟨A1▐

The test is carried out with reference gas at nominal heat input.

▌A1⟩ A suitable means, is used to detect gas leaks from the assembly joints which could be ignited. ⟨A1▐

If necessary, components other than those of the burner may be removed, provided that this does not affect the test.

7.3 Heat inputs

7.3.1 Nominal heat input

The nominal gas rate is the volumetric flow rate V_n or mass flow rate M_n of the gas corresponding to the nominal heat input obtained with reference gas under reference test conditions (dry gas, 15 °C, 1 013,25 mbar).

The nominal heat input Q_n in kW is given by one of the following formulae:

$$Q_n = 0{,}278\ M_n \times H_I \quad (2)$$

$$Q_n = 0{,}278\ V_n \times H_I \quad (3)$$

$$Q_n = 0{,}278\ M_n \times H_s \quad (4)$$

$$Q_n = 0{,}278\ V_n \times H_s \quad (5)$$

where:

M_n is the nominal mass flow rate in kilograms per hour (kg/h) obtained under reference conditions (dry gas, 15 °C, 1 013,25 mbar);

V_n is the nominal volumetric flow rate in cubic metres per hour (m^3/h) obtained under reference conditions (dry gas, 15 °C, 1 013,25 mbar);

H_i is the net calorific value of the reference gas in megajoules per kilogramme (MJ/kg) (formula 2) or in megajoules per cubic metre (MJ/m^3) (dry gas, 15 °C, 1 013,25 mbar) (formula 3);

H_s is the gross calorific value of the reference gas in megajoules per kilogram (MJ/kg), (formula 4), or in megajoules per cubic metre (MJ/m^3) (dry gas, 15 °C, 1 013,25 mbar), (formula 5).

The mass and volume flow rates correspond to a measurement and to a flow of reference gas under reference conditions, i.e. assuming the gas to be dry, at 15 °C and under 1 013,25 mbar pressure. In practice the values of mass and volumetric flow rates obtained during the tests do not correspond with these reference conditions, and have therefore to be corrected to bring them to the values that would have been obtained had the reference conditions existed during the tests[4)].

When the determination is made by mass (third family gas), the corrected mass flow rate is calculated from the formula:

$$M_o = M \sqrt{\frac{1\,013{,}25 + p}{p_a + p} \times \frac{273{,}15 + t_g}{288{,}15} \times \frac{d_r}{d}} \qquad (6)$$

When the determination is made from the volumetric flow rate the following correction formula is used:

$$V_o = V \sqrt{\frac{1\,013{,}25 + p}{1\,013{,}25} \times \frac{p_a + p}{1\,013{,}25} \times \frac{288{,}15}{273{,}15 + t_g} \times \frac{d}{d_r}} \qquad (7)$$

The corrected mass flow rate is calculated from the formula:

$$M_o = 1{,}226\ V_o \cdot d \qquad (8)$$

where:

M_o is the mass flow rate under reference conditions (kg/h);

M is the mass flow rate obtained under test conditions (kg/h);

V_o is the volumetric flow rate under reference conditions at the appliance inlet (m^3/h);

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4) Special precautions should be taken when the measurement of volumes of dry gases is made with a wet (water filled) meter. For third family gases, if the rate is measured by volume, a dry meter should be used.

V is the volumetric flow rate obtained under test conditions (measured at, or corrected to, pressure p and temperature t_g) (m^3/h);

p_a is the atmospheric pressure (mbar);

p is the gas supply pressure (mbar);

t_g is the temperature of the gas at the appliance inlet (°C);

d is the density of dry test gas relative to that of dry air (dimensionless);

d_r is the density of reference gas relative to that of dry air (dimensionless).

These are the formulae that are used to calculate from the mass flow (M) or volumetric (V) flow rates, measured under test conditions, the corresponding M_o or V_o flow rates that would have been obtained under reference conditions, and it is these values, M_o and V_o, that are compared with the values M_n and V_n, calculated from the nominal heat input, using the formulae (2) to (5).

These formulae are applicable if the test gas used is dry.

If a wet (water filled) meter is used or if the gas is saturated, the value d (density of dry gas in relation to dry air) is replaced by the value of the density of the wet gas d_h given by the following formula:

$$d_h = \frac{d(p_a + p - p_w) + 0{,}622\ p_w}{p_a + p} \qquad (9)$$

where p_w is the saturation vapour pressure of the test gas expressed in millibar at the temperature t_g.

For all the tests described in 7.3, the measurements are taken with the appliance at thermal equilibrium, and with any thermostat put out of action, except where applicable as given in 7.3.5.

Type C_{11} appliances are connected to the maximum duct length specified by the manufacturer.

7.3.2 *Calibrated injector rate of appliance without gas rate adjusters or where these adjusters are put out of action*

To check the rate of the injectors, each reference gas for the appliance category is used successively.

The appliance is fitted successively with each of the prescribed injectors and the rate is measured for each reference gas by supplying the appliance at the appropriate normal test pressure in accordance with 7.1.4.

7.3.3 *Performance of gas rate adjusters for ungoverned appliances*

The tests are carried out with each reference gas pertaining to the appliance category but not with those for which the adjuster is put out of action.

Test No. 1

With the adjuster fully open, the supply pressure is brought to the minimum value given in 7.1.4 corresponding to the particular reference gas.

Test No. 2

With the adjuster fully closed, the supply pressure is brought to the maximum value given in 7.1.4 corresponding to the particular reference gas.

7.3.4 Start gas heat input

The heat input is calculated as described in 7.3.1 with each reference gas at normal test pressure. If the ignition burner has an adjuster, the heat input is measured at minimum test pressure with the adjuster fully open.

7.3.5 Reduced rate

The reduced rate is calculated as described in 7.3.1 by supplying the burner successively with each reference gas pertaining to the appliance category, after adjusting the burner to its nominal heat input and after turning the tap handle to the reduced rate position, or after letting the thermostat operate in its minimum position if it is of the 'modulating' type.

7.4 Temperature of various parts of the appliance

7.4.1 Temperature of external parts of the appliance

▌A1⟩ The test is carried out with reference gas at the nominal heat input with the appliance installed as described in 7.4.3. ⟨A1▐

Initially, establish the zone that has the highest temperature. Temperature measurements are carried out when the difference between the surface temperature and the ambient temperature is constant for this zone.

The temperatures are measured by contact thermocouples, the appliance thermostat, if any, being in the fully open position.

Check the location of the working surface declared by the manufacturer.

The test is repeated with the appliance convection fan, if any, inoperative.

7.4.2 Temperature of components

The temperatures of the component are measured during the tests for external temperature (see 7.4.1). At the end of this test check that the taps are easy to turn.

7.4.3 Temperature of floor, shelf and walls

7.4.3.1 *General*

The appliance is installed on a test rig (see Figure 2). This may be a test corner or test box. The test rig consists of hardwood panels of thickness (25 ± 1) mm with their surfaces coated with matt black paint. Thermocouples are incorporated into each panel at the centre of squares of side 100 mm; these thermocouples penetrate the panels from the outside so that the junctions are situated 3 mm from the surface of the test panels facing the appliance.

〈A1〉 *Text deleted.* 〈A1〉

For an appliance where the manufacturer specifies installation underneath a shelf, the manufacturer's user instructions should state any limitations on the height of the shelf above the appliance and shelf depth. An appropriate shelf of maximum recommended depth is placed at the minimum height above the appliance with the appropriate insulating material, if necessary, which shall be supplied by the manufacturer.

For an appliance which is intended to be installed on a combustible surface, the manufacturer should indicate in the installation instructions the nature of the effective protection to be applied between the appliance and the floor, shelf or walls. This protection shall be supplied to the test laboratory by the manufacturer.

If the manufacturer states in the instructions that it is necessary to use effective protection to limit temperature, a second test is carried out with the appliance fitted with the protection.

The appliance is installed and tested as described in 7.4.3.2 or 7.4.3.3 as appropriate, with the burner adjusted to its nominal heat input using reference gas.

The test is repeated with the appliance convection fan, if any, inoperative.

7.4.3.2 *Built-in appliances*

The appliance is installed in a test box, which is to be supplied by the manufacturer if requested by the test house. The test box comprises three walls, a floor and a ceiling, the internal dimensions being those of the minimum space specified in the installation instructions.

The test box shall:

a) be made of wood;

b) have sufficient mechanical resistance;

c) have sufficient tightness between its walls;

d) allow the appliance to be installed according to the manufacturer's instructions;

e) accommodate any recess ventilation specified in the installation instructions.

Initially, on the external face of each wall of the test box, establish the zone that has the highest temperature. When the difference in the surface temperature and the ambient temperature for each zone is constant, thermocouples are placed from the outside of the walls in recessed holes in such a way that their hot junctions are in contact with the wood at 3 mm from the inner faces of the test box. Measure the difference between the surface temperature of the inner face and the ambient temperature for each zone.

The test is repeated with the appliance fan, if any, inoperative.

7.4.3.3 *All other appliances*

The appliance is installed in a test corner. The distance between the back and side surfaces and test panels are the minimum distances specified by the manufacturer or, where appropriate, that distance created by fixing to the wall. The side panel is placed at the side of the appliance where the temperatures are the highest.

Initially, for each surface of the test rig, establish the zone that has the highest temperature. All measurements are taken when the difference between the surface temperature and the ambient temperature for each zone is constant, i.e. ±2 K.

It is recommended that for this test the appliance should be placed in a room where the ambient temperature is approximately 20 °C. This is measured at a height of 1,50 m and at least 3 m from the appliance, using a thermometer which is protected from the influence of stray heat.

The test is repeated with the appliance fan, if any, inoperative.

7.5 Ignition, cross-lighting and flame stability

7.5.1 Ignition and cross-lighting

7.5.1.1 *All appliances*

The following tests are carried out with the appliance at ambient temperature and thermal equilibrium.

Type C_{11} appliances are connected to the minimum duct length specified by the manufacturer.

Test No. 1

[A1] For this test the burner and ignition burner are adjusted in accordance with 7.1.3.2.1. The appliance is operated in accordance with the manufacturer's instructions using the appropriate reference, light back and lift gases, according to the appliance category (see Table 5), at the normal pressure (see 7.1.4). [A1]

The test is repeated either at the minimum rate given by the thermostat, where this exists, or at the rate obtained when the tap is in the reduced rate position if ignition is possible under these conditions in normal use according to the manufacturer's recommended procedure.

For piezo ignition devices, short out the electrodes after each ignition attempt.

Test No. 2

For this test the initial adjustments of the burner and of the ignition burner are not altered and the appliance is supplied with reference gas under the following conditions:

a) If the appliance has no pressure governor, the pressure at the appliance inlet is reduced to 70 % of the normal pressure (see 7.1.4) or a pressure to give 80 % of the ignition rate, whichever is the lowest for first and second family gases, and to the minimum pressure for third family gases (see 7.1.4);

b) If the appliance has a pressure governor, the pressure is also lowered to a value equal to 70 % of the normal pressure, but the pressure downstream of the pressure governor is lowered, if necessary, to obtain a heat input equal to 90 % of the nominal heat input for first family gases or 92,5 % of the nominal heat input for second family gases, [A1] or 95 % for the third family gases. [A1]

Under these supply conditions ignite the burner by the ignition burner.

The test is repeated either at the minimum rate given by the thermostat, where this exists, or at the rate obtained when the tap is in the reduced rate position if ignition is possible under these conditions in normal use according to the manufacturer's recommended procedure.

Test No. 3

a) For this test the initial burner or ignition burner adjustment are not altered and the appliance is supplied with reference gas. The pressure is reduced at the appliance inlet to the minimum pressure (see 7.1.4). For an appliance with a pressure governor, the pressure downstream of the pressure governor is reduced, if necessary, to obtain a heat input equal to 90 % of the nominal heat input for first family gases, or 92,5 % of the nominal heat input for second family gases (for the reference gases); ▌A1⟩ or 95 % for the third family gases (for the reference gases). ⟨A1▐

b) The ignition burner gas rate is reduced to the minimum required to keep the gasway to the burner open.

The necessary reduction in the ignition burner gas rate may be achieved either:

- by the adjustment of the ignition burner rate adjuster, if this exists;

or, if this is not possible,

- by means of adjustment of an adjuster inserted into the ignition burner gas supply system for this purpose.

c) The correct ignition of the burner by the ignition burner is then checked.

The test is repeated either at the minimum rate given by the thermostat, where this exists, or at the rate obtained when the tap is in the reduced rate position, if ignition is possible under these conditions in normal use according to the manufacturer's recommended procedure.

7.5.1.2 Supplementary tests

The following test is carried out at ambient temperature and thermal equilibrium.

Type C_{11} appliances are connected to the minimum duct length specified by the manufacturer.

The appliance is initially adjusted as described in 7.1.3.2.1 and supplied with the appropriate reference gas(es) (see Table 5) at nominal heat input.

Ignition of the main burner is checked. The test is repeated progressively, delaying the ignition up to the end of the safety time declared by the manufacturer or 60 s for manual ignition.

In order to delay the ignition, it generally will be necessary to provide independent control of the main gas or start gas automatic shut-off valves and the operation of the ignition device. A suitable arrangement is to provide a voltage supply, independent of the automatic burner control system, to the relevant gas valve(s) and to the ignition device. The ignition delay should be increased in stages.

7.5.2 Flame stability

The following tests are carried out with the appliance at ambient temperature and thermal equilibrium.

Type C_{11} appliances are connected to the minimum duct length specified by the manufacturer.

Test No. 1

For this test the burner and ignition burner are adjusted in accordance with 7.1.3.2.1 and the appliance is supplied with the appropriate light-back limit gas (see Table 5) at the minimum pressure (see 7.1.4).

For an appliance with a pressure governor, the pressure downstream of the pressure governor is reduced, if necessary, to obtain a heat input equal to 90 % of the nominal heat input for first family gases or 92,5 % of the nominal heat input for second family gases (for the reference gases), ⟩A1⟨ or 95 % for the third family gases (for the reference gases). ⟩A1⟨

Under these supply conditions check that the flames are stable.

The test is repeated either at the minimum rate given by the thermostat, where this exists, or at the rate obtained when the tap is in the reduced rate position.

Test No. 2

For all appliances without a pressure governor, the initial burner and ignition burner adjustments are retained and the appliance is supplied at the maximum pressure (see 7.1.4) with the flame-lift limit gas. The absence of flame-lift in normal use is checked.

For an appliance with a pressure governor, the test is carried out by increasing the burner rate to a value corresponding to 107,5 % of the nominal heat input for first family gases or 105 % of the nominal heat input for second family gases (for the reference gases), ⟩A1⟨ input for second family gases and third family gases (for the flame lift gas). ⟩A1⟨

7.5.3 Effects of room draughts (for type B_1 appliances)

The appliance is supplied with the reference gas at normal pressure 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.

The axis of the wind stream is in a horizontal plane and is moved one or more (at the discretion of the laboratory) angles of incidence 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. A shield is placed between the fan and the appliance and, immediately after lighting the appliance, the shield is removed for periods of 3 s to produce gusts. This is repeated at each angle of incidence, applying 3 gusts in each position of 3 s intervals.

The test is carried out with the appliance at ambient temperature and in the hot condition with the main burner and any ignition burner alight together and, if appropriate, with only the ignition burner alight. Any lighting door remains closed during the test.

The test is repeated at the minimum input given by the controls, if such operation is intended by the manufacturer.

During the test take precautions to screen the draught diverter from the effects of the wind.

7.5.4 Wind tests (for type C_{11} appliances)

[A1] The appliance is installed, as indicated in the manufacturer's instructions, on the test apparatus described in Figure 3. For series 1 and 2, the appliance shall be fitted first with the shortest duct length specified by the manufacturer. The tests are then repeated with the appliance fitted with the longest duct length specified by the manufacturer. [A1]

The appliance is supplied with one of the reference gases appropriate to its category and adjusted to obtain the nominal heat input given in 7.1.3.2.

The following two tests, Series 1 and Series 2, are then carried out:

Series 1

These tests are carried out with the appliance hot.

The appliance terminal is subjected successively to winds of different speeds in the three planes (see Figure 3):

Horizontal ($\alpha = 0°$)
Ascending, at 30° to the horizontal ($\alpha = -30°$)
Plunging, at 30° to the horizontal ($\alpha = +30°$).

In each of these three planes, the incident angle of the wind is varied by 15° increments between 0° and 90° inclusive. If the terminal is not symmetrical about the vertical axis the tests are carried out at 15° increments between 0° and 180° inclusively.

[A1] The tests are carried out at wind speeds of 2,5 m/s and 12,5 m/s and the products of combustion are sampled (see 7.7). [A1]

Determine the nine positions which give the lowest CO_2 values (see 7.7.3.3).

Under each of these nine conditions a visual check is made of:

a) the stability of the ignition burner without the main burner alight;

b) the ignition of the main burner by the ignition burner;

c) the cross-lighting of the main burner;

d) the stability of the ignition burner and the main burner when operating simultaneously.

Series 2

For each of the nine conditions noted in the above series 1 tests, check that the ignition burner can be ignited from the cold condition using the ignition device provided.

7.6 Pressure governors

7.6.1 Operational pressure governor

If the appliance has a pressure governor an adjustment is made, if necessary, to give the nominal volumetric rate with reference gas at the normal pressure given in 7.1.4 appropriate to the gas. Keeping this initial adjustment, the supply pressure is varied between the corresponding minimum and maximum values (see 7.1.4).

The test is carried out for all reference gases for which the pressure governor is not put out of service.

7.6.2 Pressure governor out of service

The appliance is supplied with the reference gas at the minimum and then at the maximum pressure given in 7.1.4 and the volumetric flow rate is measured under the same conditions of temperature and pressure. It is then verified that:

$$\frac{V_{\min}}{\sqrt{p_{\min}}} \times \frac{\sqrt{p_{\max}}}{V_{\max}} = 1 \pm 0{,}05 \qquad (10)$$

where:

$V_{\min}$ is the volumetric flow rate at minimum pressure $p_{\min}$ (m^3/h);

$V_{\max}$ is the volumetric flow rate at maximum pressure $p_{\max}$ (m^3/h);

$p_{\min}$ is the appropriate minimum pressure for the gas family or gas group to which the reference gas belongs (see 7.1.4) (mbar);

$p_{\max}$ is the appropriate maximum pressure for the gas family or gas group to which the reference gas belongs (mbar).

The test is carried out for all reference gases for which the pressure governor is put out of service.

7.7 Combustion

7.7.1 General

[A1] The appliance is installed in accordance with 7.1.5. [A1]

Any bricks, radiants and imitation fuel not positively located with respect to the burner and to each other are to be arranged at the limit of their movement. Due note should be taken of the manufacturer's instructions and the ease with which refractories can be positioned.

The appliance is supplied with the appropriate reference gas and, if necessary, adjusted as specified in 7.1.3.2 to give the nominal heat input.

For high-low or modulating appliances, the tests are carried out at the nominal and the minimum heat input given by the control.

A sample of the products of combustion is taken when the appliance has reached thermal equilibrium.

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

$$V_{CO,N} = V_{CO_2,N}\left(\frac{V_{CO,M}}{V_{CO_2,M}}\right) \qquad (11)$$

where:

$V_{CO,N}$ is the percentage CO concentration of the dry, air-free products of combustion;

$V_{CO_2,N}$ is the calculated percentage of CO_2 in the dry, air-free products of combustion of the gas involved;

$V_{CO,M}$ and $V_{CO_2,M}$ are the carbon monoxide and carbon dioxide concentrations respectively measured in the sample during the combustion test, both expressed in percentage by volume;

The values of $V_{CO_2,N}$ (neutral combustion) for the test gases are given in Table 10.

Table 10 — $V_{CO_2,N}$ values

Designation of gas	G 110	G 20	G 21	G 23	G 25 G 231	G 26	G 30	G 31	G 120	G 130	G 150	G 271
$V_{CO_2,N}$	7,6	11,7	12,2	11,6	11,5	11,8	14,0	13,7	8,35	13,7	11,8	11,2

The CO concentration of the dry, air-free products of combustion may also be calculated from the formula:

$$V_{CO,N} = \left(\frac{21}{21 - V_{O_2,M}} \right) V_{CO,M} \qquad (12)$$

where:

$V_{O_2,M}$ and $V_{CO,M}$ are the oxygen and carbon monoxide concentrations respectively measured in the sample, both expressed as a percentage.

The use of this formula is recommended where CO_2 concentration is less than 2 %.

7.7.1.1 *Type B_1 appliances*

A type B_1 appliance is placed in a suitably ventilated room with the back of the appliance as near as possible to a wall, according to the manufacturer's instructions.

The products of combustion are sampled by means of the probe shown in Figure 4, placed 200 mm from the top of the test flue.

For appliances fitted with a convection fan, if the appliance is designed such that failure of the convection fan (i.e. stoppage) does not result in closure of the gas valve(s), then the tests are repeated with the convection fan inoperative.

7.7.1.2 *Type C_{11} appliances*

For appliances fitted with a convection fan, if the appliance is designed such that failure of the convection fan (i.e. stoppage) does not result in closure of the gas valve(s), then the tests are repeated with the convection fan inoperative.

A type C_{11} appliance is tested in still air when installed on a test wall according to 7.5.4.

If the appliance is intended to be used with a terminal guard, the tests are repeated with the terminal guard fitted in accordance with the manufacturer's instructions.

For these tests, a sampling probe fitted with a thermocouple as shown in Figure 5 is used to take a sample of the products of combustion and to measure their temperature. The sample of the products of combustion is drawn through the probe at a rate of approximately 100 l/h.

The sample is taken in the plane perpendicular to the direction of flow of the products of combustion one diameter in from the end of the products outlet duct (see Figure 6). If the duct is not circular in section the diameter of a circle of equivalent area is used.

The sampling probe is inserted vertically downwards into the upper half of the products outlet duct (see Figure 6).

7.7.2 Tests under limit conditions

7.7.2.1 *Reference gas*

With the appliance installed as described in 7.7.1, the following tests are carried out under still air conditions using the appropriate reference gas(es) (see Table 5).

a) For appliances without a gas rate adjuster or pressure governor, or for appliances fitted with these devices but where their function has been annulled, the test is carried out with the appliance supplied at the maximum pressure given in 7.1.4.

b) For an appliance with a gas rate adjuster but without a pressure governor, the test is carried out by adjusting the burner to a rate equal to 1,10 times the nominal heat input.

c) For an appliance with a pressure governor that has not been put out of action, the test is carried out by raising the burner rate to 1,07 times the nominal input for gases of the first family or 1,05 times the nominal input for gases of the second and third family.

7.7.2.2 *Incomplete combustion gas*.

After the test with the reference gas(es) in 7.7.2.1, the appliance is tested with the incomplete combustion limit gas for the appliance category (see Table 5).

For this test, in the three cases above [i.e. 7.7.2.1 a), b) and c)], using the reference gas, the heat input of the appliance is adjusted to 1,05 times the nominal heat input if a pressure governor is fitted or 1,075 times the nominal heat input if the appliance does not incorporate a pressure governor. If the appliance is intended to be installed solely on a gas installation with a pressure governed meter, the factor of 1,05 may be applied.

Without changing the adjustment of the appliance or supply pressure, the reference gas is replaced by the corresponding incomplete combustion gas.

7.7.3 Supplementary tests under special conditions

The appliance is installed as described in 7.7.1.

7.7.3.1 ▌A1⟩ *Safety in the event of fluctuation, interruption and restoration of the auxiliary energy*

a) *Interruption and subsequent restoration*

The electrical supply is interrupted and restored after a period of 10 s.

b) *Fluctuation* ⟨A1▐

With the mains electrical supply reduced to 85 % of the minimum voltage for which the appliance is designed, using the appropriate reference gas(es) and at the normal gas supply pressure, ignite the appliance. With the appliance at its maximum setting (tap or thermostat) and at thermal equilibrium, measure the CO concentration of the air-free dry products of combustion. Repeat the test with the mains electrical supply increased to 110 % of the maximum voltage for which the appliance is designed.

7.7.3.2 *Type B_1 appliances*

The appliance is installed as described in 7.7.1.

The tests are carried out with each reference gas at the nominal heat input.

A first test is carried out with the flue blocked.

▌A1⟩ A second test is carried out by applying a continuous down-draught giving a steady pressure of 5,4 Pa at the base of the test flue (see Figure 7). ⟨A1▐

For each test, the spillage monitoring system is put out of action.

The probe used is shown in Figure 4.

The products of combustion are sampled between the heat exchanger and the draught diverter.

7.7.3.3 *Type C_{11} appliances*

The appliance is installed and adjusted as described in 7.5.4.

▌A1⟩ The products of combustion are sampled under the conditions of 7.5.4 Test series 1. For each duct length, i.e. shortest and longest, the arithmetic mean values of the nine highest CO concentrations, determined in these tests, are calculated. ⟨A1▐

If the appliance is intended to be used with a terminal guard, the test is repeated with the terminal guard fitted in accordance with the manufacturer's instruction.

7.7.4 Measurement of oxides of nitrogen (all appliances)

The test is carried out under the test conditions described in 7.1.5 using the reference gas(es) only at normal pressure.

▌A1⟩ *Text deleted*. ⟨A1▐

The method of test is in accordance with CR 1404.

According to the function and use of the appliance, the measured NO_x values are weighted before checking under which level (given in Table 2) the appliance comes.

The weightings applied are as follows:

a) For modulating appliances (maximum - modulation - minimum rate)

$NO_{x(max)} + NO_{x(mod)} + NO_{x(min)}$ = Weighted NO_x value in mg/kWh. (13)

where:

$NO_{x(max)}$ = NO_x value measured at nominal heat input times 0,1;

$NO_{x(mod)}$ = NO_x value measured at 60 % of nominal heat input times 0,45;

$NO_{x(min)}$ = NO_x value measured at minimum heat input specified by the manufacturer times 0,45.

b) For appliances with one rating only (maximum - off)

NO_x value measured at nominal heat input = Weighted NO_x value in mg/kWh. (14)

c) For appliances with two ratings (maximum - minimum)

$NO_{x(max)} + NO_{x(min)}$ = Weighted NO_x value in mg/kWh. (15)

where:

$NO_{x(max)}$ = NO_x value measured at nominal heat input times 0,3;

$NO_{x(min)}$ = NO_x value measured at minimum heat input specified by the manufacturer times 0,7.

d) For appliances with more than two fixed ratings

$$NO_{x(max)} + \Sigma\frac{NO_{x(n)}}{n} = \text{Weighted } NO_x \text{ value in mg/kWh} \quad (16)$$

where:

n is the number of other fixed ratings;

$NO_{x(max)}$ = NO_x value measured at nominal heat input times 0,1;

$NO_{x(n)}$ = NO_x value measured at other (*n*) fixed ratings specified by the manufacturer times 0,9 .

Conversion of emission values to parts per million (ppm) is given in annex J.

7.8 Sooting (live fuel effect appliances only)

7.8.1 General

The apparatus is described in annex G.

7.8.2 Determination of the smoke number

Unscrew the paper fixing device, insert the filter in the slot provided on the pump and screw up the device.

Introduce the sampling tube horizontally into the middle of the flow of the combustion gases. Gas-tightness between the sampling tube and the wall of the measuring sleeve, where the sample is taken, should be ensured.

The sampling may be by either a hand pump or an electro-mechanical pump.

When a hand pump is used, ten suctions are to be carried out; each suction is to be regular and last 2 s to 3 s. The end of the suction is reached when the operator no longer feels the reactions of the piston.

Withdraw the tube from the flue, unscrew the fixing device, withdraw the filter paper with care.

Compare the test spot visually with the standard grey scale by holding the band of filter paper against the standard scale. Examine the spot through the central window of the scale. Note the grade number whose shade is closest to that of the test spot. For the range of the grey scale between 0 and 4, the intermediate grades are to be distinguished particularly carefully.

An equivalent optoelectronic method of determining the smoke number may be used.

7.8.3 Test conditions

7.8.3.1 *General*

The appliance is installed as described in 7.7.1.

If the appliance is fitted with a fan to assist in the distribution of convection air and the user is able to turn the fan ON and OFF, without the main burner being shut-off when the fan is off, under normal operating conditions, the fan is to be rendered inoperative for the following test(s).

7.8.3.2 *Cold condition*

The appliance is installed and ignited according to the manufacturer's instructions using the appropriate reference gas and adjusted to give the nominal heat input. Substitute the reference gas with the appropriate sooting limit gas (see Table 5). Turn the appliance off and allow to cool to ambient temperature.

Light the appliance from the cold condition in accordance with the manufacturer's instructions and immediately, using the apparatus described in 7.8.1, sample the flue gases as described in 7.8.2 applying 10 successive suctions. At the end of the tenth cycle verify compliance with 6.8.1.

7.8.3.3 *Hot condition*

At the end of the tenth suction in test 7.8.3.2, leave the appliance running for 1 h on the sooting limit gas. At the end of this period, using the apparatus described in 7.8.1, sample the flue gases as described in 7.8.2 applying 10 suctions and determine the smoke number. Verify compliance with 6.8.2.

7.8.3.4 *Long cycle condition (only if soot is found on the burner/fuel bed)*

With the appliance at room temperature, the appliance is cleaned in accordance with the manufacturer's instructions.

The following tests are then carried out with the appliance using reference gas and adjusted to give the nominal heat input.

a) cycle the appliance 16 h on and 8 h off for five cycles with the fuel bed, if any, arranged in accordance with the manufacturer's instructions;

b) measure the dry air-free CO concentration of the products of combustion after 1 h of the first cycle;

c) at the end of the final cycle, measure the dry air-free CO concentration of the products of combustion and compare the result with that obtained in b) above (see 6.8.3).

7.9 Spillage monitoring system

7.9.1 General

▌A1⟩ If the appliance is fitted with a fan to assist in the distribution of convection air and the user is able to turn the fan ON and OFF, without the main burner being shut-off when the fan is off, under normal operating conditions, the following test(s) are carried out with the fan both ON and OFF. ⟨A1▌

7.9.2 Atmosphere sensing device (type B_{11AS} appliances)

The appliance is installed on the narrowest wall of a sealed room and adjusted to the nominal heat input using the appropriate reference gas(es).

7.9.2.1 *Sealed room* (see Figure 8)

The room dimensions are as follows:

Length	3,5 m ± 0,1 m;
Width	2,0 m ± 0,1 m;
Height	2,5 m ± 0,1 m;
Volume	17,5 m^3 ± 1 m^3.

Other dimensions may be used provided that the test results are unaffected.

〚A1〉 The soundness of the room is to be such that after a homogeneous room concentration of (4 ± 0,2) % CO_2 has been established then it should not have decreased by more than 0,1 % at the end of a two hour period. 〈A1〛

NOTE: The source may be made homogeneous by means of a fan or a pump. The CO_2 may be derived from any source, except by heating.

The room is to be designed such that:

- the operator may, at any time, observe the appliance in operation;

- sampling of the room atmosphere for carbon monoxide may be carried out from the geometric centre of the room; it is important that the sampling line from the probe to the analyser is as short as possible;

- the atmosphere in the room is maintained as a homogeneous mixture;

- the temperature at the centre of the room is maintained between 20 °C and 40 °C.

7.9.2.2 *Test method*

The appliance is ignited at the normal setting pressure with the door of the room open and the flue functioning normally.

At the end of the 1 h warm up period the flue is capped and sealed and the room is also sealed.

The room air is continuously monitored for its dry air-free CO percentage.

7.9.3 Combustion products discharge safety device (type B_{11BS} appliances)

7.9.3.1 *General*

The appliance is installed in accordance with the manufacturer's instructions and in accordance with the following conditions:

- the tests are carried out with a reference gas for the appliance category at nominal heat input;

- spillage is determined with a spillage plate (dew point) plate (see annex C); however, in doubtful cases, the spillage point is sought by means of a sampling probe connected to a rapid-response CO_2 analyser enabling concentrations of the order of 0,1 % to be detected;

- built-in appliances are installed in the test box described in 7.4.3.2.

7.9.3.2 *Nuisance shutdown*

The appliance is installed as described in 7.9.3.1.

The appliance is kept in operation for 30 min with any thermostat put out of action. It is checked that the device does not cause shutdown. The main burner is then shut off.

The rise in temperature after the burner shutdown should not result in a signal from the device to initiate shutdown.

7.9.3.3 *Shutdown times*

7.9.3.3.1 *Tests with complete blockage*

The appliance is installed in accordance with 7.9.3.1 with a 1 m high test flue and is operated at nominal heat input. When the appliance is at thermal equilibrium, the flue is completely blocked (see Figure 9). The reaction time between the flue being blocked and shutdown is measured. For appliances without lockout, the obstruction is maintained and the time between shutdown and ignition of the main burner is measured.

This test is repeated at the minimum rate, if any.

7.9.3.3.2 *Tests with partial blockage*

The appliance is installed in accordance with 7.9.3.1 and fitted with a telescopic flue (see Figure 9) brought to thermal equilibrium at the nominal heat input in accordance with 7.9.3.3.1.

The length of the telescopic flue is reduced until spillage just does not occur. Should this condition not be obtainable at the minimum height of the telescopic flue, then a concentric annulus is fitted to the flue in order to reach this point.

If the device is actuated before this length is obtained then shutdown is deemed to comply with 6.9.2.2.

If not, the test flue is covered with a blocking plate which has a concentric circular orifice of which the diameter is equal to 0,6 times the diameter *D* (see Table 3) of the test flue at its upper extremity (see Figure 9).

If spillage is not achieved with the telescopic test flue, it is covered with a plate incorporating a circular hole of diameter *D*' (see Table 3) 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.

Check that the shutdown times comply with 6.9.2.2.

NOTE: If the manufacturer specifies a minimum flue height, the test is carried out using a flue of that height.

7.10 Flame supervision device

7.10.1 Thermoelectric device

7.10.1.1 *Cold condition*

The tests are carried out with the appropriate reference gas(es) with the appliance adjusted to its nominal heat input.

After this adjustment has been made, the appliance is allowed to cool to ambient temperature. The gas is turned on again and lit at the ignition burner, if any, or main burner, as appropriate. The opening time is that between the moment of lighting the ignition burner, or main burner, as appropriate, to that when the safety device is actuated.

7.10.1.2 *Hot condition*

The appliance is left to operate at its nominal heat input for 1 h.

The time measured is the interval between the moment when the ignition burner and main burner are intentionally extinguished by cutting off the gas supply and the moment when, after turning on again, the gas supply is shut off through the action of the flame supervision device. A gas meter or any other appropriate device may be used to detect the closure of the valve of the flame supervision device.

7.10.2 Automatic burner control systems

7.10.2.1 *Manually operated devices (e.g. push button)*

The appliance is installed as described in 7.1.5.2 and supplied with an appropriate reference gas (see Table 5) at the nominal heat input in accordance with 7.3.1. The start device is manually operated 10 times, i.e. once every 5 s.

7.10.2.2 *Safety time*

Isolate the gas supply to the appliance. Attempt to ignite the appliance in accordance with the manufacturer's instructions, and measure the time between the signals for valve opening and valve closure. Compare this time with the manufacturer's specified time.

7.10.2.3 *Extinction time*

With the appliance in the running condition, isolate the gas supply to the main burner. Measure the time between the moment when the main burner is extinguished and the signal of valve closure is given.

7.11 Efficiency

7.11.1 Installation and gas supply

7.11.1.1 *General*

The appliance is installed as described in 7.7.1.

The appliance is initially adjusted to obtain the nominal heat input given in 7.1.3.2 using reference gas and the efficiency is determined when thermal equilibrium has been reached. The temperature of the room shall be approximately 20 °C. This temperature is measured at a height of 1,5 m at least 3 m from the appliance and with a thermometer which is shielded from direct radiation from the appliance.

7.11.1.2 *Type B_1 appliances*

The products of combustion are sampled and the temperature is measured 200 mm from the upper end of the flue. The products are sampled with the probe described in 7.7.1.1 and shown in Figure 5.

7.11.1.3 *Type C_{11} appliances*

A1 A type C_{11} appliance is installed according to the manufacturer's instructions using a flue of 350 mm length, i.e. to simulate installation on a wall of 350 mm thickness. A sampling probe fitted with a thermocouple as shown in Figure 5 is used to take a sample of the products of combustion and to measure their temperature. The sample of the products of combustion is drawn through the probe at a rate of approximately 100 l/h. A1

A1 The sample is taken in the plane perpendicular to the direction of flow of the products of combustion one diameter in from the end of the products outlet duct (see Figure 6). If the duct is not circular in section the diameter of a circle of equivalent area is used.

'The sampling probe is inserted vertically downwards into the upper half of the products outlet duct (see Figure 6). A1

The positions of the probe and thermometric devices are shown in Figure 6.

7.11.2 Determination of efficiency

The efficiency η referred to the net calorific value, H_i, is given by the formula:

$$\eta = 100 - (q_1 + q_2) \qquad (17)$$

where:

q_1 is the heat of the dry products of combustion (% of heat released per unit volume of gas);

and;

q_2 is the heat of the water vapour contained in the products of combustion (% of heat released per unit volume of gas).

q_1 is given by the formula:

$$q_1 = C_1 V_p \left(\frac{t_2 - t_1}{H_i} \right) 100 \qquad (18)$$

where:

C_1 is the mean specific heat of the dry products of combustion in megajoules per cubic metre and Kelvin [MJ/(m^3·K)] (see Figure 10);

t_2 is the average temperature of the products of combustion (°C);

t_1 is the average combustion air temperature (°C);

H_i is the net CV of the gas at 1 013, 25 mbar and 15 °C, dry in megajoules per cubic metre (MJ/m^3);

V_p is the volume of dry products of combustion per unit volume of gas at 1 013, 25 mbar and 15 °C (m^3).

V_p is given by the formula:

$$V_p = \frac{V_{CO_2}}{V_{CO_2 M}} 100 \qquad (19)$$

where:

V_{CO_2} is the volume of CO_2 produced by the combustion of 1 m^3 of gas (m^3);

$V_{CO_2 M}$ is the CO_2 concentration of the products of combustion in percent (%).

q_2 is given by the formula:

$$q_2 = 0{,}077 \left(\frac{H_s - H_i}{H_i} \right) (t_2 - t_1) \qquad (20)$$

where H_s is the gross calorific value of the gas at 1 013,25 mbar and 15 °C, dry in megajoules per cubic metre (MJ/m^3).

The measurement is made with a tolerance of ±1 % (absolute value) on the CO_2 concentration (%) which is measured to an accuracy of ±5 %.

The efficiency is calculated when thermal equilibrium has been achieved.

8 Marking and instructions

The instructions and warning notices shall be in the official language(s) of the country(ies) of destination.

8.1 Marking

8.1.1 Marking of the appliance

The appliance shall carry one or more data plates and/or labels that are firmly and durably attached to the appliances such that the information given is visible to, and can be read by, the installer, possibly after removing the outer case. The data plate(s) and/or label(s) shall give the following information in indelible characters:

a) the manufacturer's[5)] name and/or identification symbol;

b) the trade name of the appliance;

c) the serial number;

[5)] "Manufacturer" means the organization or company which assumes responsibility for the product.

d) the type of gas in relation to the pressure and/or the pressure couple, for which the appliance has been adjusted; any pressure identified in relation to the corresponding category index; If an intervention is necessary on the appliance in order to change from one pressure to the other within a pressure couple of the third family, only the pressure corresponding to the current adjustment of the appliance shall be indicated;

e) the nominal heat input and, where necessary, the range of inputs for an appliance with an adjustable input, expressed in kW, stating whether it is based on net or gross calorific value;

f) the direct country or countries of destination of the appliances (see 8.1.4.4);

g) the appliance category or categories: if more than one appliance category is specified, each of these categories shall be identified in relation with the appropriate country or countries of destination;

h) ▌A1⟩ the class of efficiency of the appliance, i.e. Class 1 heater or Class 2 appliance, as appropriate;

i) the representation of voltage as 'v' shall be replaced by 'V'; ⟨A1▌

j) the setting pressure for governed appliances.

For an appliance with an adjustable nominal input, there shall be room for the installer to durably mark the input value for which it has been adjusted.

No other information shall be included on the appliance if this could lead to confusion with regard to the current state of adjustment of the appliances and the corresponding appliance category (or categories) and the direct country (or countries) of destination.

The indelibility of the marking shall be checked by a test carried out in accordance with 7.14 of EN 60335-1:1994.

8.1.2 Other marking

The appliance shall be marked with the following text:

"This appliance must be installed in accordance with the rules in force, and used only in a sufficiently ventilated space. Consult instructions before installation and use of this appliance."

8.1.3 Marking of the packaging

The packaging shall carry at least the following information:

- the type of gas in relation to the pressure and/or the pressure couple for which the appliance has been adjusted; any pressure indication shall be identified in relation to the corresponding category index; If an intervention is necessary on the appliance in order to change from one pressure to the other within a pressure couple of the third family, only the pressure corresponding to the current adjustment of the appliance shall be indicated;

- the direct country or countries of destination of the appliance;

[A1] - the class of efficiency of the appliance, i.e. Class 1 heater or Class 2 appliance, as appropriate; [A1]

- the appliance category or categories: if more than one appliance category is specified, each of these categories shall be identified in relation with the appropriate country or countries of destination.

The packaging shall be marked with the following text:

"This appliance must be installed in accordance with the rules in force, and used only in a sufficiently ventilated space. Consult instructions before installation and use of this appliance."

No other information shall be included on the packaging if this could lead to confusion with regard to the current state of adjustment of the appliance and the corresponding appliance category (or categories) and the direct country (or countries) of destination.

8.1.4 Utilization of symbols on the appliance and packaging

8.1.4.1 *Electrical supply*

The marking concerning electrical values shall comply with EN 60335-1:1994.

8.1.4.2 *Type of gas*

In order to represent all of the category indices corresponding to the adjustment of an appliance, the symbol of the reference gas shall be used which is common to all of these indices, in accordance with Table 11.

NOTE: In order to satisfy the needs expressed by CEN members it is permitted that their countries' declared means of identification may be included in addition to the symbol. These additional means are given in annex E.

Table 11 — Symbol of the type of gas

Symbol of the type of gas[a]	Corresponding category index
First family:[a]	
G 110	1a
G 120	1b
G 130	1c
G 150	1e
Second family:	
G 20	2H, 2E, 2E+
G 25	2L, 2LL
Third family:	
G 30	3B/P, 3+[b-d]
G 31	3+[c-d], 3P

[a] If, in its current state of adjustment, the appliance may use gases from different groups, all the reference gases corresponding to these groups shall be indicated.

[b] Only applies to appliances which do not need any adjustment between G 30 and G 31, or to appliances which need an adjustment and which are adjusted for G 30.

[c] Only applies to appliances which need an adjustment between G 30 and G 31, and which are adjusted for G 31.

[d] For the appliances which need an adjustment between G 30 and G 31, the label concerning the adjustment to the other gas and the other pressure of the pressure couple shall be supplied with the technical instructions.

8.1.4.3 *Gas supply pressure*

The gas supply pressure can be expressed uniquely by the numerical value using the unit (mbar). Nevertheless, if it is necessary to explain this value, the symbol "*p*" shall be used.

8.1.4.4 *Country of destination*

In accordance with [A1] EN ISO 3166-1:1997 [A1], the names of countries shall be represented by the following codes:

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

8.1.4.5 *Category*

The category can be expressed uniquely by its designation in accordance with EN 437:1993. Nevertheless, if it is necessary to explain it, the term "category" shall be symbolized by "cat".

8.1.4.6 *Other information*

The symbol for nominal heat-input of a burner, represented by Q_n, is not obligatory, but is recommended under the title "preferential", and to the exclusion of any other symbol, to avoid the use of many and different markings.

8.2 Instructions

8.2.1 General

Instructions shall be written in the official language(s) of the country or countries of destination stated on the appliance and shall be valid for that country or countries.

If the instructions are written in an official language that is used by more than one country, the country or countries for which they are valid shall be identified using the codes given in 8.1.4.4.

Instructions for countries other than those stated on the appliance may be supplied with the appliance, on condition that each set of instructions has the following initial statement: "These instructions are only valid if the following country code is on the appliance .... If this code is not present on the appliance, it is necessary to refer to the technical instructions which will provide the necessary information concerning the modification of the appliance to the conditions of use for the country."

8.2.2 Technical instructions for installation and adjustment

8.2.2.1 *All appliances*

The following statement shall be included:

"Before installation, ensure that the local distribution conditions (identification of the type of gas and pressure) and the adjustment of the appliance are compatible."

In addition to the information specified in 8.1.1, the technical instructions may include information indicating, where appropriate, that the appliance has been certified for use in countries other than those stated on the appliance[6)]. If such information is given, the instructions shall include a warning that modification of the appliance and its method of installation are essential to use the appliance safely and correctly in any of these additional countries. This warning shall be repeated in the official language(s) of each of these countries. The instructions shall indicate how to obtain the information, instructions and parts necessary for safe and correct use in the countries concerned.

The technical instructions for installation and adjustment, intended for the installer, shall be available with the appliance and shall cover the following:

- the method of connection and the installation regulations in the country where the appliance is to be installed (if such regulations exist); also the flue and ventilation dimensions shall be given for the purposes of installation in those countries where there are no appropriate regulations;

- the fixing of the appliance;

- the gas rate in m^3/h in relation to the gas used;

- for an appliance with an adjustable pressure governor, the setting pressure as measured upstream of the burner but downstream of any adjuster, in relation to the gas family or group used;

- the adjusters;

- a declaration by the manufacturer of area(s) to be considered as a working surface;

- minimum distances between the appliance and any walls and/or shelves, if applicable;

- any necessary precautions to be taken to avoid over-heating of the floor, shelf, walls, or else a statement to use non-combustible materials for the floor, shelf or wall close to the appliance.

[6)] Indirect countries of destination.

The instructions shall provide the following:

- all information on the operations and adjustments to be carried out when converting from one gas to another, and the injector markings for each gas that may be used;

- necessary instructions for inspecting the flue;

- description of the performance and installation characteristics particular to the appliance, and information necessary for commissioning and maintenance.

For appliances which can only be installed on a gas installation with a governed meter, the instructions shall state the following:

"This appliance is intended for use on a gas installation with a governed meter."

8.2.2.2 *For type B_1 appliances*

The instructions for the spillage monitoring system shall:

a) warn that the system shall not be adjusted by the installer;

b) warn that the spillage monitoring system shall not be put out of operation;

c) warn that, when the spillage monitoring system or any of its parts is exchanged, only original manufacturer's parts shall be used.

8.2.2.3 *Built-in appliances*

In addition to the requirements given in 8.2.2.1 and 8.2.2.2 the instructions shall include:

a) the minimum dimensions of the space in which the appliance is to be recessed, and the nature of the materials from which that space is formed;

b) ventilation requirements for the recess;

c) performance and installation characteristics particular to the appliance, including, where applicable, minimum clearances around the appliance;

d) for type B_1, full details for the assembly of the draught diverter if it is not fitted to the appliance;

e) for type C_{11}, full details for the assembly of the flue ducts and terminal.

8.2.3 Instructions for use and maintenance

Instructions for use and maintenance shall be supplied with the appliance.

These instructions, which are intended for the user, shall provide all the necessary information for the safe and sensible use and maintenance of the appliance in clear and simple terms. They shall be separate or easily separable from the installation instructions. Wherever necessary, diagrams and/or photographs shall augment the text.

The instructions for use and maintenance shall stress that a qualified installer is required to install the appliance, and, where applicable, to convert it for use with other gases. The instructions shall deal briefly with the installation regulations (connection, ventilation) in the country where the appliance is to be installed.

The instructions for use and maintenance shall state the recommended frequency of periodic servicing and draw particular attention to the need for periodic sweeping of the flue of type B_1 appliances, according to the regulations in the country where the appliance is to be installed.

The instructions for use and maintenance shall include:

- the manufacturer's or distributors name and address;

- the type name or number (commercial designation);

- the operations of ignition, cleaning and maintenance of the appliance;

- a declaration by the manufacturer of area(s) to be considered as a working surface;

- recommendation for any additional guard that may be required to take account of the special hazards that exist in nurseries and other places where there are young children or aged or infirm persons;

- a warning that curtains should not be positioned above the appliance at a distance less than the minimum specified for shelves in accordance with 6.4.3;

- a minimum distance between the appliance and shelf, if applicable;

- where appropriate, a statement indicating that the gas controls require manual resetting following interruption and subsequent restoration of the electricity supply;

- lighting instructions which state clearly that if any flame supervision device actuating flame is extinguished either intentionally or unintentionally, no attempt should be made to relight the gas until at least 3 min have elapsed;

- explicit instructions, if applicable, for the correct replacement of artificial solid fuel components or any parts of the fuel bed intended to be removed by the user, and a warning against changing the fuel bed layout or the quantity of material contained therein;

- where appropriate, a statement warning the user not to use the appliance if the glass front door or panel has been broken, removed or is open;

- where appropriate, information regarding the safe use of removable handles or of any special tool supplied by the manufacturer;

- a statement that any special removable tool is to be removed after use.

For type B_1 appliances the instructions for use and maintenance shall:

- point out the spillage monitoring system operates if evacuation of the combustion products is interrupted;

- describe the restart procedures;

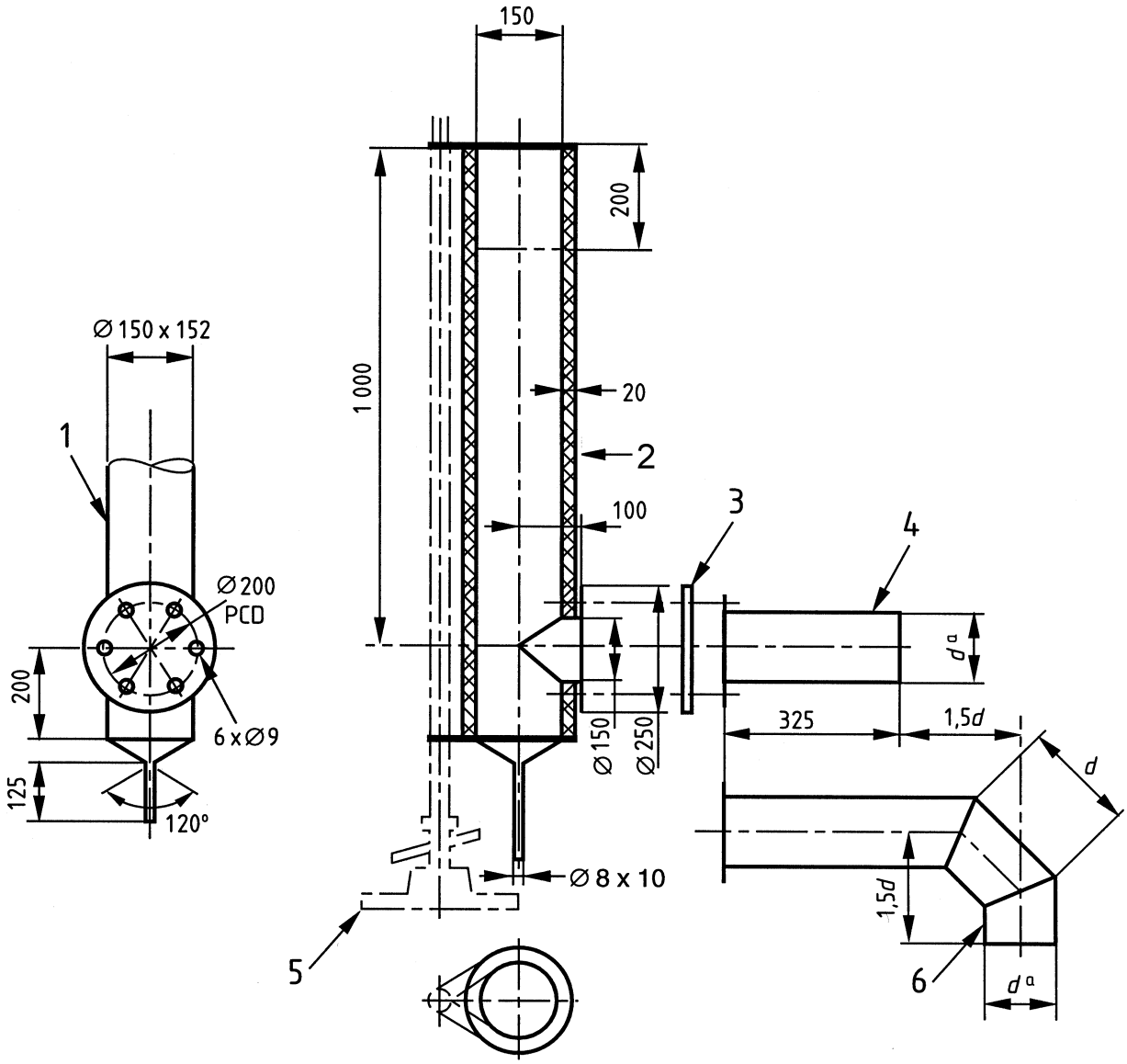
- point out that, on repeated operation of the spillage monitoring system, a specialist should be informed.

8.2.4 Additional information

The manufacturer shall specify the NO_x level of the appliance (see 6.7.2).

If the appliance is designed for use on more than one gas and the NO_x levels are different when changing from one gas to the other, the manufacturer shall specify the lowest level (i.e. the level that gives the highest NO_x limit).

Dimensions in millimetres



Key

d [a] : External diameter of the flue spigot = internal diameter of the socket

1 Stainless steel flue duct

2 Insulation
(glass wool – density 64 kg/m^3)

3 Gasket

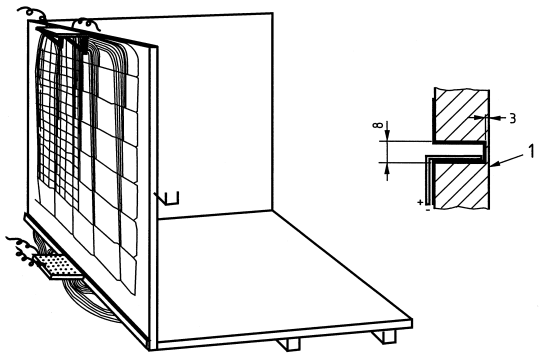
4 Stainless steel connecting pipe
(horizontal spigot)

5 Support
(height adjustable)

6 Stainless steel connecting pipe
(Vertical spigot)

Figure 1 — Test flue

Dimensions are in millimetres

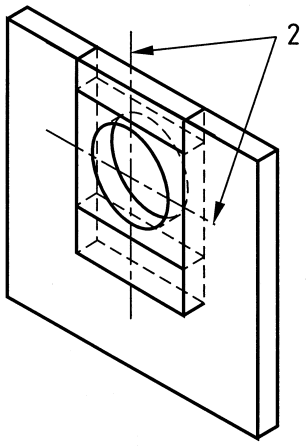


Key

1 Face of wall

3 Insulation in accordance with manufacturer's installation instructions

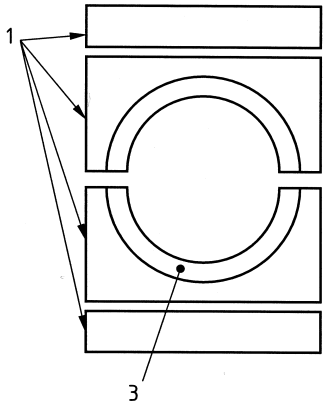
a) thermocouple arrangement



Key

2 Centrelines of flue outlet

b) filling piece assembly



Key

1 25 mm thick hardwood (or a material with similar thermal conductivity) with thermocouples inserted from outside to within 3 mm of surface facing the appliance.

The thermocouples are spaced at the centre of squares of side 100 mm.

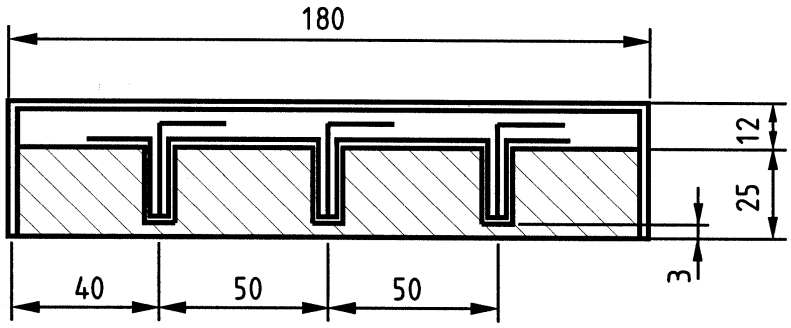
For filling pieces 2 and 3 additional thermocouples are located so as to measure the highest temperatures in the vicinity of the flue outlet duct.

3 Insulation in accordance with manufacturer's installation instructions

c) filling pieces

Figure 2 — Test corner for measuring floor, wall and shelf temperatures (*continued*)

Dimensions are in millimetres



d) spacing of thermocouples

Material for test shelf: hardwood. Oak is preferred, but any other wood or board having a thermal conductivity of approximately 0,16 W/(m·K) is acceptable.

Backing sheet: 0,9 mm aluminium.

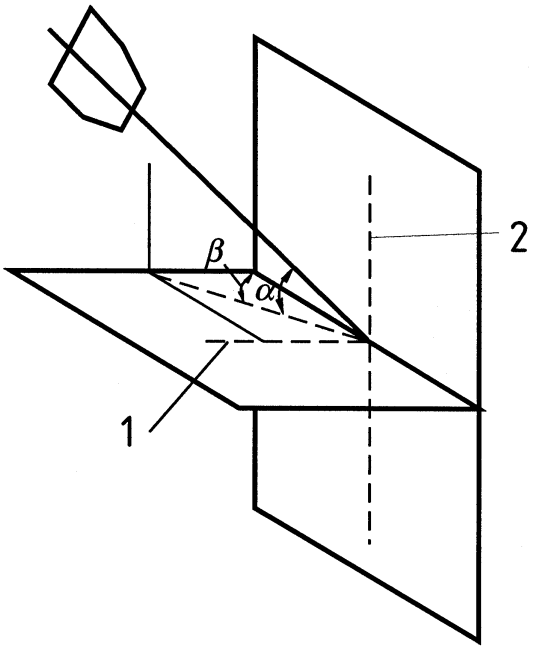
Figure 2 — Test corner for measuring floor, wall and shelf temperatures (*concluded*)

$\alpha = 0°$ (horizontal winds),
+30° and -30°

$\beta = 0°$
15°, 30°, 45°, 60°, 75°, 90°
(perpendicular to the test wall)

When the terminal is not symmetrical, the tests are continued with the following incident angles: 105°, 120°, 135°, 150°, 165°, 180°.

Angle β may be varied either by changing the position of the wind generator (fixed test 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 m square with a removable panel at its centre. The terminal of the appliance 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.

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

a) the wind front is either 900 mm × 900 mm or of circular cross-section with a diameter of at least 600 cm;

b) wind speeds of [A1] 2,5 m/s [A1] and 12,5 m/s are obtained, with an accuracy of 10 %, over the whole of the wind front;

c) the wind stream is essentially parallel and with no residual rotary movement.

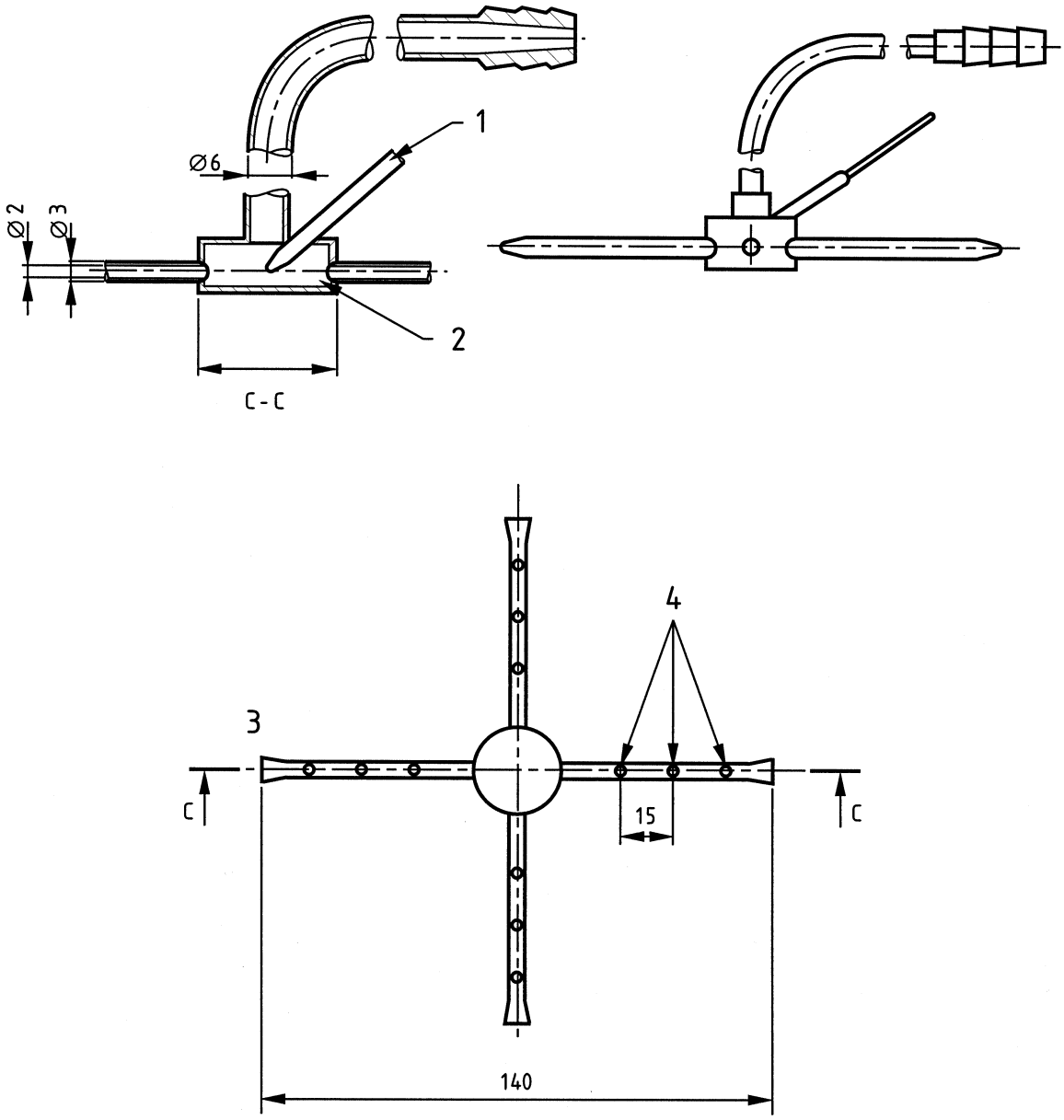
When the central removable panel is not large enough to allow these criteria to be checked, they are checked without the test wall and measured at a distance corresponding to the distance which is to exist between the test wall and the wind generator discharge nozzle in the test.

Key

1 Horizontal 2 Vertical

Figure 3 — Disposition of test apparatus for type C_1 appliances

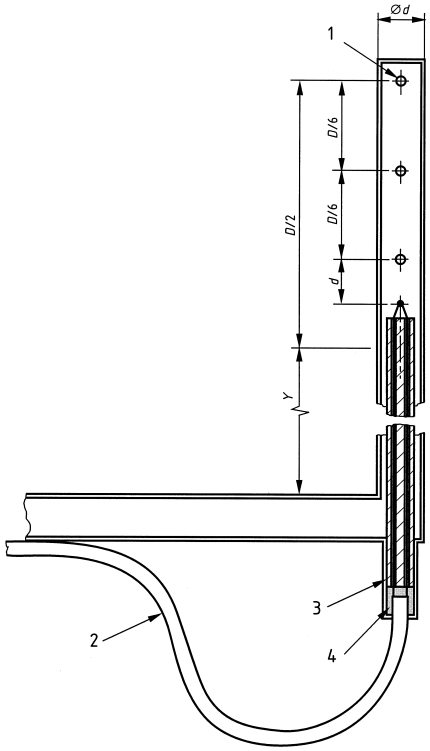
Dimensions are in millimetres



Key material - stainless steel

1 Steatite tube with two holes into which thermocouple wires are sealed
2 Measuring point
3 Pipe ends closed
4 3 holes Ø 1 per branch

Figure 4 — Sampling probe — type B appliances



Key
1 3 sampling holes Ø mm
2 Chromel/alumel thermocouple wire
3 Twin bore ceramic sleeve
4 Insulating cement

NOTE 1: Dimensions for 6 mm diameter probe (suitable for products outlet ducts of diameter (*D*) over 75 mm):

outside diameter of probe (*d*)	6 mm;
wall thickness	0,6 mm;
diameter of sampling hole (*x*)	1,0 mm;
twin bore ceramic sleeve	3 mm diameter × 0,5 mm bore;
thermocouple wire	0,2 mm diameter.

For products outlet ducts less than 75 mm diameter a smaller probe should be used with *d* and *x* chosen such that:

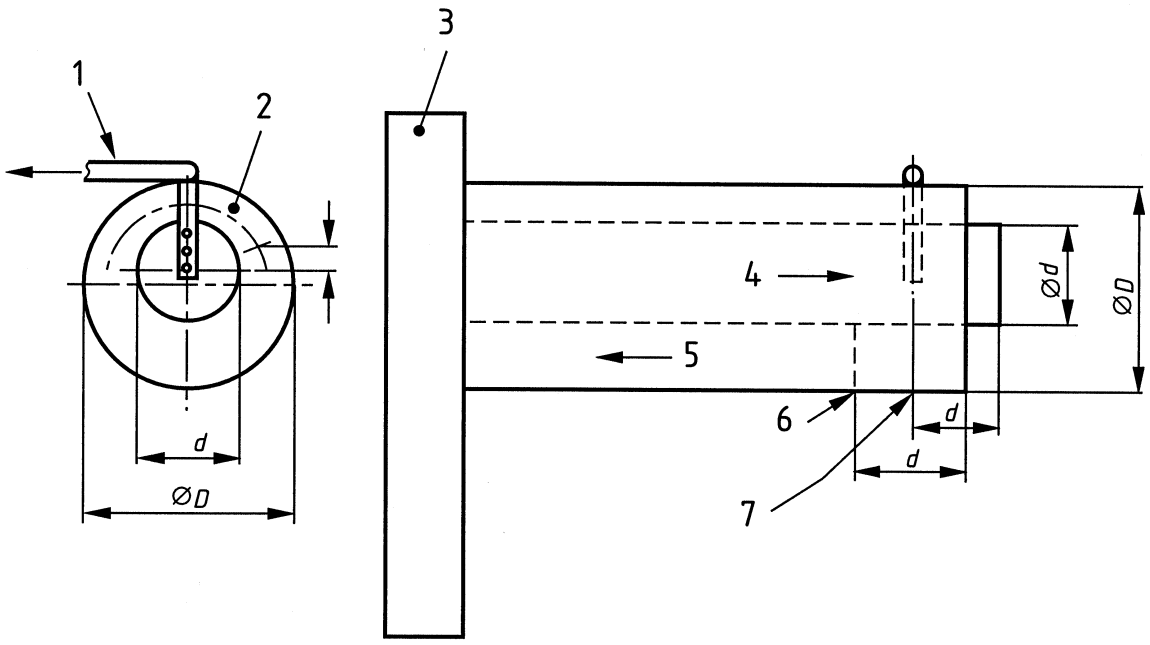
a) the area obstructed by the probe is less than 5 % of the cross-section of the duct;

b) the total area of the sampling holes is less than ¾ of the cross-section of the probe.

NOTE 2: Dimension *Y* should be chosen according to the diameter of the air inlet duct and its insulation.

material: stainless steel

Figure 5 — Sampling probe — type C appliances



Key

1 Sampling probe

2 Combustion air temperature

3 Combustion chamber

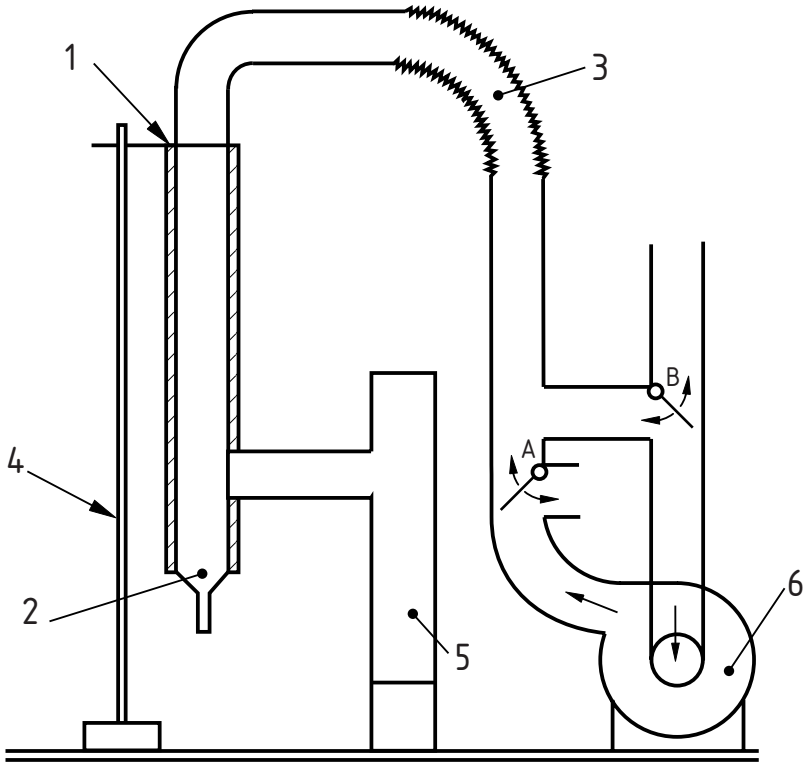
4 Flue gas

5 Air

6 Plane for combustion air temperature measurement

7 Plane for flue gas and flue temperature measurement

Figure 6 — Sampling probe and thermocouple positions — type C_{11} appliances



Key

1 Test flue (see Figure 1)

2 Speed of draught measuring point

3 Flexible ducting

4 Support

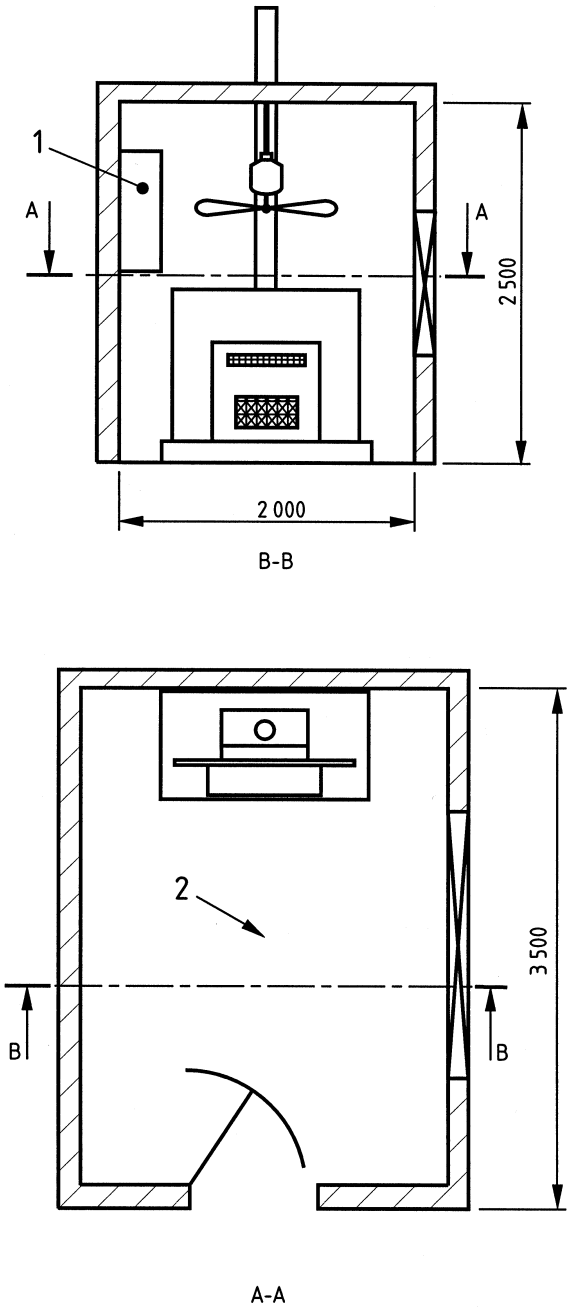
5 Appliance under test

6 Fan

A and B are flap valves for obtaining down draught.

Figure 7 — Apparatus for abnormal draught conditions — type B appliances

Dimensions are in millimetres

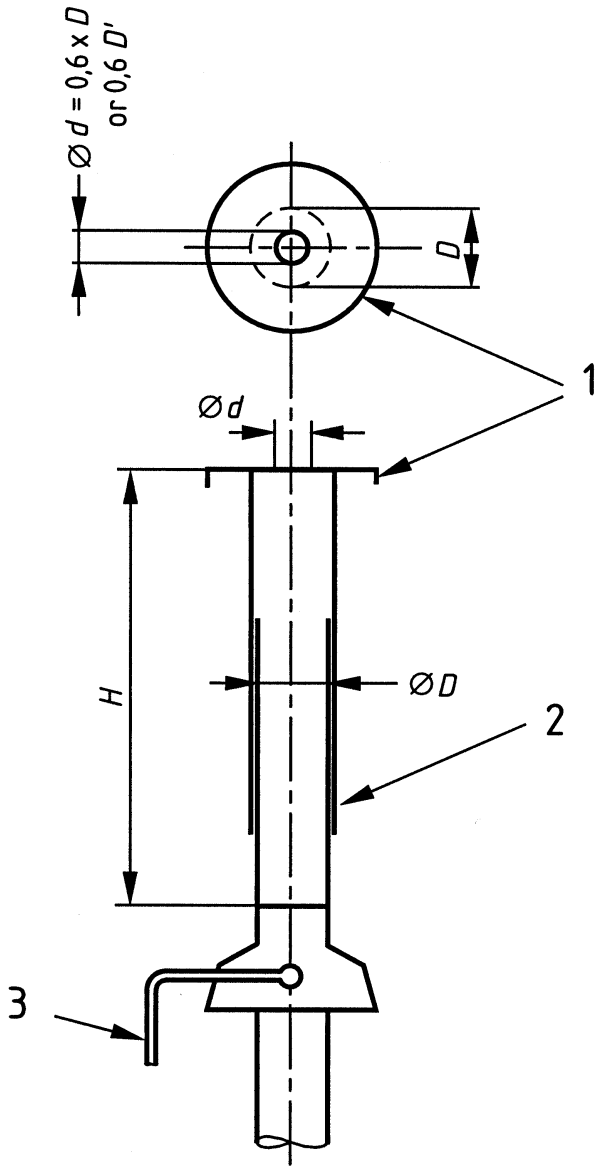


Key

1 Chiller

2 Sampling point at geometric centre of room

Figure 8 — Oxygen depletion test room



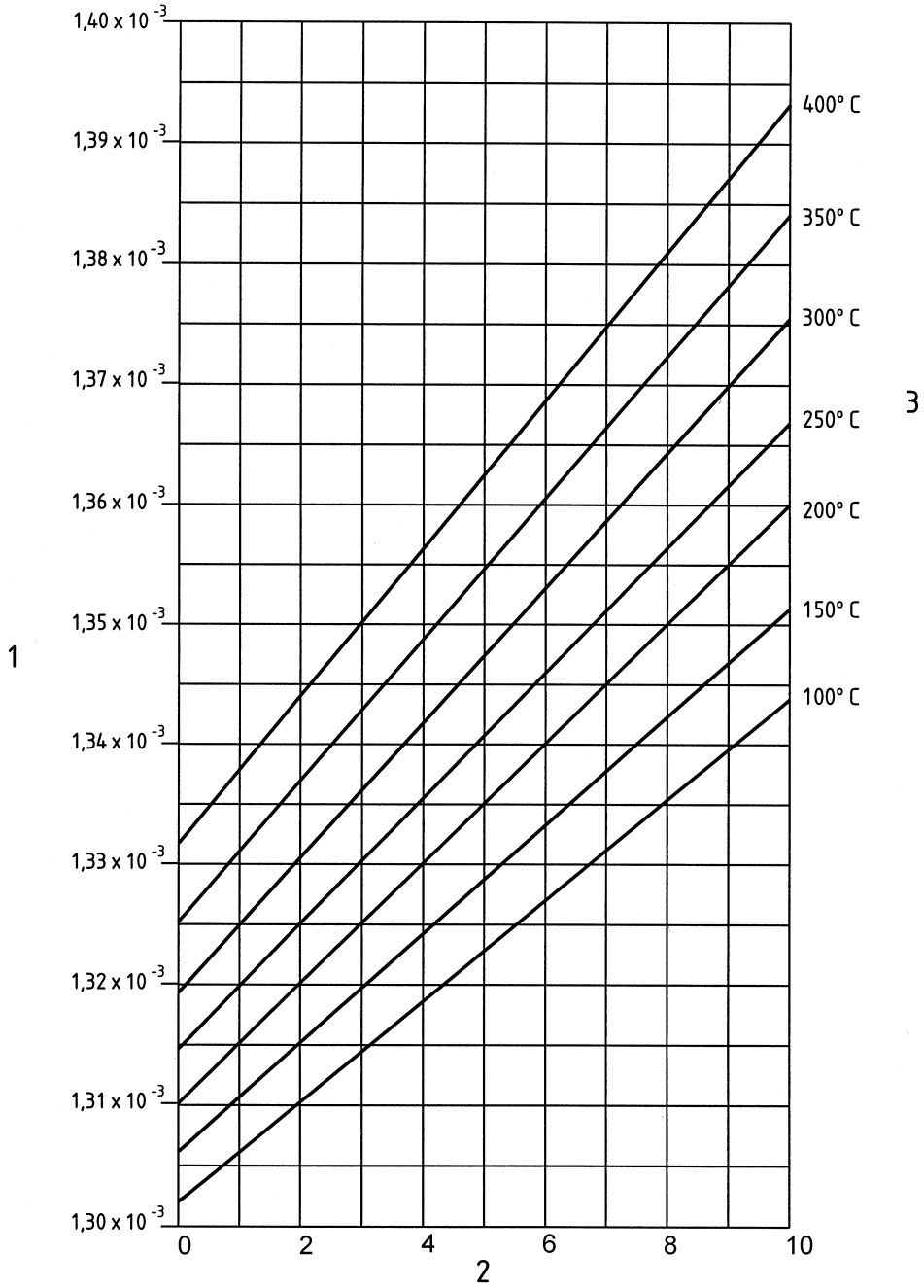
Key

1 Plate

2 Telescopic test flue

3 Detector

Figure 9 — Combustion products safety device — Test apparatus (see 7.9.2.3.2)



Key

1 Mean specific heat of dry combustion products ($MJ/m^3 \cdot K$)

2 % CO_2 in combustion products

3 Temperature of the combustion products (°C)

Figure 10 — Nomogram — Mean specific heat of dry products

Annex A (informative)

National situations

In each country in which this standard applies, appliances may be marketed only if they comply with the particular national supply conditions of that country.

In order to assist in making the correct choice from all the situations covered, both at the same time of testing the appliance and at the time of its sale, the various national situations are summarized in Tables A.1, A.2, A.3, A.4, A.5 and A.6.

A.1 Categories listed in the body of the standard marketed in the different countries

Tables A.1.1 and A.1.2 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 table indicates only that these categories may be sold throughout the whole of the country concerned and A.3 should 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.1.1 — Single categories marketed

Country	I_{2H}	I_{2L}	I_{2E}	I_{2E+}	$I_{3B/P}$	I_{3+}	I_{3P}
AT	X				X		
BE				X		X	X
CH	X				X	X	X
DE			X		X		X
DK	X				X		
ES	X					X	X
FI	X				X		
FR				X		X	X
GB	X					X	X
GR	X				X	X	X
IE	X					X	X
IS							
IT	X					X	X
LU			X				
NL		X			X		X
NO					X		
PT	X					X	X
SE	X				X		

Table A.1.2 — 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								X	
CH	X	X	X	X					
DE							X		
DK	X	X							
ES	X		X	X					
FI		X							
FR								X	X
GB			X	X					
GR		X	X	X					
IE			X	X					
IS									
IT	X		X						
LU									
NL					X	X			
NO									
PT			X	X					
SE	X	X							

A.2 Appliance supply pressures

Table A.2 gives the conditions in the various countries concerning the supply pressures to appliances in the categories given in A.1.

Table A.2 — Normal supply pressures

Gas	**G 110**	**G 20**	**G 25**		**G 20 + G 25**	**G 30**		**G 31**			**G 30 + G 31**	
Pressure (mbar)	**8**	**20**	**20**	**25**	**couple 20/25**	**30 28-30**	**50**	**30**	**37**	**50**	**couple 28-30/37**	**couple 50/67**
Country												
AT		X					X			X		
BE					X						X	X
CH	X	X							X		X	
DE		X	X				X			X		
DK	X	X				X		X				
ES	X	X				X			X		X	
FI		X				X		X				
FR					X	X			X		X	
GB		X				X			X		X	
GR		X				X		X	X	X		
IE		X				X			X		X	
IS												
IT	X	X							X		X	
LU		X										
NL				X		X		X		X		
NO						X		X				
PT		X				X			X		X	X
SE	X	X				X		X				

A.3 Special categories marketed nationally or locally

A.3.1 The national or local conditions of gas distribution (gas composition and supply pressures) lead to the definition of special categories that are marketed nationally or locally in certain countries, according to Table A.3.

Table A.3 — Categories marketed nationally or locally

Category	Reference gas	Incomplete combustion limit gas	Light back limit gas	Lift limit gas	Sooting limit gas	Country
I_{2ELL}	G 20, G 25	G 21	G 222	G 231, G 271	G 21	DE
II_{1c2E+}	G 130, G 20	G 21	G 132, G 222	G 231	G 21	FR
$II_{2ELL3B/P}$	G 20, G 25, G 30	G 21, G 30	G 222, G 32	G 231, G 271	G 30	DE
$III_{1a2H3B/P}$	G 110, G 20, G 30	G 21	G 112, G 222, G 32	G 23, G 31	G 30	DK
$III_{1c2E+3+}$	G 130, G 20, G 30	G 21	G 132, G 222, G 32	G 231, G 31	G 30	FR
$III_{1c2E+3P}$	G 130, G 20, G 31	G 21	G 132, G 222, G 32	G 231, G 31	G 32	FR
$III_{1ab2H3B/P}$	G 110, G 120, G 20, G 30	G 21	G 112, G 222, G 32	G 23, G 31	G 30	SE
$III_{1ce2H3+}$	G 130, G 150, G 20, G 30	G 21	G 132, G 152, G 222, G 32	G 23, G 31	G 30	ES
$III_{1ace2H3+}$	G 110, G 130, G 150, G 20, G 30	G 21	G 112, G 222, G 32	G 23, G 31	G 30	ES

A.3.2 The definitions of the categories in Table A.3 are derived in the same way as those categories listed in 4.1.2. The characteristics of the gases distributed regionally are given in Table A.4.

A.3.2.1 *Category I*

A.3.2.1.1 *Appliances designed for the use of gases linked to the first family*

Category I_{1b}: Appliances using only gases of Group B linked to the first family at a fixed supply pressure (this category is not used).

Category I_{1c}: Appliances using only gases of Group c linked to the first family at a fixed supply pressure (this category is not used).

Category I_{1e}: Appliances using only gases of Group E linked to the first family (this category is not used).

Adjustment of the gas rate is optional for the replacement of a gas of one group to a gas of another group within the first family and of the gases which are linked to it.

A.3.2.1.2 *Appliances designed for the use of gases of the second family and the gases linked to it*

Category I_{2LL}: Appliances using only gases of Group LL linked to the second family, at a fixed supply pressure. On condition that the gross Wobbe index of the second family gas distributed does not exceed the upper limit of 43,7 MJ/m^3, the appliance may be adjusted according to a lower nominal value (this category is not used).

Category I_{2ELL}: Appliances capable of using gases of Group E of the second family, and gases of Group LL linked to the second family. The gases of Group E of the second family are used under the same conditions as for category I_{2E}. The gases of Group LL of the second family are used under the same conditions as for category I_{2LL}.

A.3.2.2 *Category II*

A.3.2.2.1 *Appliances designed to use gases of the first family or that are linked to it and gases of the second family or that are linked to it*

Category II_{1c2E+}: Appliances capable of using gases of Group c linked to the first family and gases of Group E of the second family. The gases linked to the first family are used under the same conditions as for category I_{1c}. The second family gases are used under the same conditions as for category I_{2E+}.

A.3.2.2.2 *Appliances designed to use gases of the second family or that are linked to it and gases of the third family*

Category $II_{2ELL3B/P}$: Appliances capable of using gases of Group E of the second family, gases of Group LL linked to the second family and gases of the third family. The second family gases or the gases that are linked to it are used under the same conditions as for category I_{2ELL}. Gases of the third family are used under the same conditions as for category $I_{3B/P}$.

A.3.2.3 *Category III*

Category $III_{1a2H3B/P}$: Appliances capable of using gases of Group a of the first family, gases of Group H of the second family and gases of the third family. The first family gases are used under the same conditions as for category I_{1a}. The second family gases are used under the same conditions as for category I_{2H}. The third family gases are used under the same conditions as for category $I_{3B/P}$.

Category $III_{1c2E+3+}$: Appliances capable of using gases of Group c linked to the first family, gases of Group E of the second family and gases of the third family. The gases linked to the first family are used under the same conditions as for category I_{1c}. The second family gases are used under the same conditions as for category I_{2E+}. The third family gases are used under the same conditions as for category I_{3+}.

Category $III_{1c2E+3P}$: Appliances capable of using gases of Group c linked to the first family, gases of Group E of the second family and gases of Group P of the third family. The gases linked to the first family are used under the same conditions as for category I_{1c}. The second family gases are used under the same conditions as for category I_{2E+}. The third family gases are used under the same conditions as for category I_{3P}.

Category $III_{1ab2H3B/P}$: Appliances capable of using gases of Group a of the first family, gases of Group b linked to the first family, gases of Group H of the second family and gases of the third family. The first family gases or the gases linked to it are used under the same conditions as for categories I_{1a} and I_{1b}. The second family gases are used under the same conditions as for category I_{2H}. The third family gases are used under the same conditions as for category $I_{3B/P}$.

Category $III_{1ce2H3+}$: Appliances capable of using gases of Groups c and e linked to the first family, gases of Group H of the second family and gases of the third family. The gases linked to the first family are used under the same conditions as for categories I_{1c} and I_{1e}. The second family gases are used under the same conditions as for category I_{2H}. The third family gases are used under the same conditions as for category I_{3+}.

Category $III_{1ace2H3+}$: Appliances capable of using gases of Group a of the first family, gases of Groups c and e linked to the first family, gases of Group H of the second family and gases of the third family. The first family gases or the gases that are linked to it are used under the same conditions as for categories I_{1a}, I_{1c} and I_{1e}. The second family gases are used under the same conditions as for category I_{2H}. The third family gases are used under the same conditions as for category I_{3+}.

A.3.3 Gas rate adjusters, aeration adjusters and governors

This clause has been included to enable certain member states to provide information equivalent to that given in 5.2.2 and 5.2.6 in relation to the special categories they have requested, detailed in A.3.1.

A.3.4 Conversion to different gases

This clause has been included to enable certain member states to provide information equivalent to that given in 5.1.1 in relation to the special categories they have requested, detailed in A.3.1.

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

The characteristics of the gases distributed nationally or locally and the corresponding test gases are given in Table A.4 at 15 °C and 1 013,25 mbar.

Table A.4 — Test gases corresponding to local situations

Gas family and group		Nature of gas	Designation	Composition by volume %	W_i MJ/m^3	H_i MJ/m^3	W_s MJ/m^3	H_s MJ/m^3	d	Test pressure mbar	Country
Gases linked to the first family	Group b	Reference		$H_2 = 47$						$p_n = 8$	
										$p_{min} = 6$	
										$p_{max} = 15$	
		Incomplete Combustion Sooting	G 120	$CH_4 = 32$ $N_2 = 21$	24,40	15,68	27,64	17,77	0,413		SE
		Light back	G 112	$H_2 = 59$ $CH_4 = 17$ $N_2 = 24$	19,48	11,81	22,36	13,56	0,367		
	Group c	Reference (Propane-air)	G 130	$C_3H_8 = 26,9$ Air[1)] = 73,1	22,14	23,66	24,07	25,72	1,142	$p_n = 8$ $p_{min} = 6$	FR
		Light back	G 132	$C_3H_8 = 13,8$ $C_3H_6 = 13,8$ Air[1)] = 72,4	22,10	23,56	23,84	25,41	1,136	$p_{max} = 15$	ES
Gas linked to first family	Group e	Reference (methane-air)	G 150	$CH_4 = 53$ Air[1)] = 47	20,65	18,03	22,93	20,02	0,762	$p_n = 8$	
		Light back	G 152	$CH_4 = 40$ Air[1)] = 54 $C_3H_8 = 6$	20,09	18,49	22,09	22,33	0,847	$p_{min} = 6$ $p_{max} = 15$	ES

(*continued*)

Table A.4 — Test gases corresponding to local situations (*concluded*)

Gas family and group		Nature of gas	Designation	Composition by volume %	W_i MJ/m^3	H_i MJ/m^3	W_s MJ/m^3	H_s MJ/m^3	d	Test pressure mbar	Country
Gases linked to the second family	Group LL	Reference	G 25[2)]	CH_4 = 86 N_2 = 14	37,38	29,25	41,52	32,49	0,612	p_n = 20	DE
		Incomplete Combustion Sooting	G 26	CH_4 = 80 C_3H_8 = 7 N_2 = 13	40,52	33,36	44,83	36,91	0,678		
		Flame lift	G 271	CH_4 = 74 N_2 = 26`	30,94	25,17	34,36	27,96	0,662	p_{min} = 18 p_{max} = 25	

[1)] Composition of the air (%): O_2 = 20,95; N_2 = 79,05.

[2)] For the characteristics of the reference gases G 20 and G 25, see Table 6.

Mixtures of gases of Group a with gases of Groups c or e, where the Wobbe index is between 21,1 MJ/m^3 and 24,8 MJ/m^3, are also linked to Group a of the first family.

These mixtures may only be used without supplementary tests in appliances in multiple categories including Group a of the first family.

A.5 Gas connections in the various countries

Table A.5 lists the situations concerning types of connection specified in 5.1.4.

Table A.5 — Types of connection used in different countries

Countries	Categories I3B/P, I3+, I3P				Other categories		
	Without thread	With thread		Position connector	Thread		Position connector
		ISO 7-1:1994	ISO 228-1:1994		ISO 7-1:1994	ISO 228-1:1994	
AT	yes	yes[2)]	yes	no	yes[2)]	yes	no
BE	yes	yes	yes	yes	yes[2)]	no	no
CH	no	yes	yes	yes	yes	yes	no
DE	yes	yes[2)]	no	no	yes[2)]	no	no
DK	yes	yes	no	no	yes	no	no
ES	no	yes[1) 2)]	yes	yes	yes[1) 2)]	yes	yes
FI	no	yes	yes	yes	yes	yes	no
FR	no	no	yes	yes	no	yes	yes
GB	yes	yes[1) 2)]	no	no	yes[1) 2)]	no	no
GR	yes	yes[2)]	no	no	yes[2)]	no	no
IE	yes	yes[1) 2)]	no	no	yes[1) 2)]	no	no
IS							
IT	yes	yes	no	yes	yes[2)]	no	yes
LU							
NL	no	yes[2)]	no	yes	yes[2)]	no	no
NO	yes	yes		no			no
PT	yes	yes	yes	no	yes	yes	no
SE	no	yes	yes	yes	yes	yes	no

[1)] Taper - taper threads.

[2)] Taper - parallel threads.

A.6 Flue connections (see 5.1.7)

Table A.6 shows the diameters of flue pipes used in various countries.

Table A.6 — Flue connection practices

Country	Commercial flue pipe diameters (external) in mm
AT	60 70 80 90 100 110 120 130 140 150 160 180 200
BE	All diameters acceptable
CH	60 70 80 90 100 110 120 130 140 150 160 180
DE (Int)	60 70 80 90 110 120 130 150 160 200
DK	Diameters not standardized
ES	
FI	90 100 110 130 150 180 200
FR	66 83 97 111 125 139 153 167 180
GB	76 102 127 153 metal pipes (all –1 tolerance)
	84 109 137 162 fibre cement pipes (all ±3 tolerances)
GR (Int)	60 70 80 90 110 120 130 150 160 200
IE	As GB
IS	
IT	60 80 100 110 120 150
LU	
NL	60 70 80 90 100 110 130 150 180 200
NO	Diameters not standardized
PT	60 85 90 95 105 110 115 120 125 130 135 145 155 205 255 305 355
SE	

Annex B (informative)

Equivalence rules

B.1 Conversion to categories within a restricted Wobbe index range

Any appliance belonging to one category may be categorized as an appliance belonging to another category covering a more restricted range of **Wobbe index** provided that the requirements of 5.1.1, 5.2.2 and 5.2.6 are satisfied, that its state of conversion corresponds to that of the country (or countries) of destination and that the information provided on the appliance corresponds to its adjustment.

In principle, this equivalence is recognized without the appliance having to be submitted to new tests.

However, supplementary tests may be necessary using the pressures and the test gases currently in force in the intended country (or countries) of destination:

a) when the supply pressures are different in the country (or countries) for which the appliance has been tested from those in the intended country of destination; or

b) when an appliance fitted with adjusters[7)], even though sealed, has been tested under the conditions of the original category with test gases different from those of the country where it is to be sold; or

c) when the requirements for governors (see 5.2.6) with respect to the existing category differ from those of the new category.

In all cases these supplementary tests are at most those stated in 7.1.3.1.

Examples:

1) An appliance in category I_{2E} for G 20 at 20 mbar may be categorized as an appliance in category I_{2H} for G 20 at 20 mbar without additional tests.

If, however, the pressures are different, the tests specified in 7.1.3.1 shall be carried out, after changing the injectors, if necessary.

2) An appliance in category I_{2E+} for G 20 at 20 mbar may be categorized as an appliance in category I_{2H} for G 20 at 20 mbar provided that it satisfies the corresponding tests specified in 7.1.3.1 after changing the injectors, if necessary, and after adjusting the governor in accordance with 5.2.6.

[7)] Throughout annex B the word “adjuster” refers to gas rate adjusters and to fixed primary aeration adjusters as appropriate.

B.2 Conversion to categories within an identical Wobbe index range

Any appliance belonging to one category may be categorized as an appliance belonging to another category covering a more restricted range of Wobbe index provided that the requirements of 5.1.1, 5.2.2 and 5.2.6 are satisfied, that its state of conversion corresponds to that of the country (or countries) of destination and that the information provided on the appliance corresponds to its adjustment.

In principle, this equivalence is recognized without the appliance having to be submitted to new tests. However, supplementary tests may be necessary using the pressures and the test gases currently in force in the intended country (or countries) of destination:

a) when the supply pressures are different in the country (or countries) for which the appliance has been tested from those in the intended country of destination; or

b) when an appliance fitted with adjusters[7)], even though sealed, has been tested under the conditions of the original category with test gases different from those of the country where it is to be sold; or

c) when the requirements for governors (see 5.2.6) with respect to the existing category differ from those of the new category.

In all cases these supplementary tests are at most those stated in 7.1.3.1.

Examples:

1) An appliance in category I_{2E+} may be categorized as an appliance in category I_{2Esi} or I_{2Er}, provided that it satisfies the tests specified in 7.1.3.1 for the test pressures and the test gases relating to category I_{2Esi} or I_{2Er}[8)] and with the corresponding injectors and adjustments. These adjustments shall take into account the requirements of 5.2.6.

2) An appliance in category I_{2Esi} or I_{2Er} may be categorized as an appliance in category I_{2E+} provided that it satisfies the test specified in 7.1.3.1 for the test pressures corresponding to category I_{2E+}[8)]. In addition, any adjusters shall be locked and sealed in the appropriate positions, taking account of the requirements of 5.2.6.

[8)] Where the intended country of destination is Belgium, account is to be taken of the special conditions given in annex K.

B.3 Conversion of categories within a wider Wobbe index range

An appliance belonging to one category may be categorized as an appliance in another category covering a wider range of **Wobbe index** if it complies with all the constructional requirements of the proposed new category.

In addition, the appliance shall be submitted to the tests specified in 7.1.3.1 using the test gases and test pressures for the proposed new category. Where appropriate, account shall be taken of the special national categories given in annex K.

Annex C (normative)

Spillage test methods

C.1 Spillage plate test method

C.1.1 Apparatus

The following two forms of apparatus are suitable:

a) a chromium or rhodium plated, water cooled plate of rectangular cross section (see Figure C.1). The overall length of the plate is dependent upon the appliance design; or

b) a chromium or rhodium plated, water cooled tube of circular or other suitable cross section, approximately 12 mm in diameter.

An essential characteristic of the detector is that it is not to affect the appliance in any way so as to cause leakage when it is in position; it may, therefore have to be formed to match the shape of the area under consideration. It is not to be placed so that it effectively extends the surface under test.

The detector is polished, but not with polishes containing anti-mist substances, and its surface is chemically degreased.

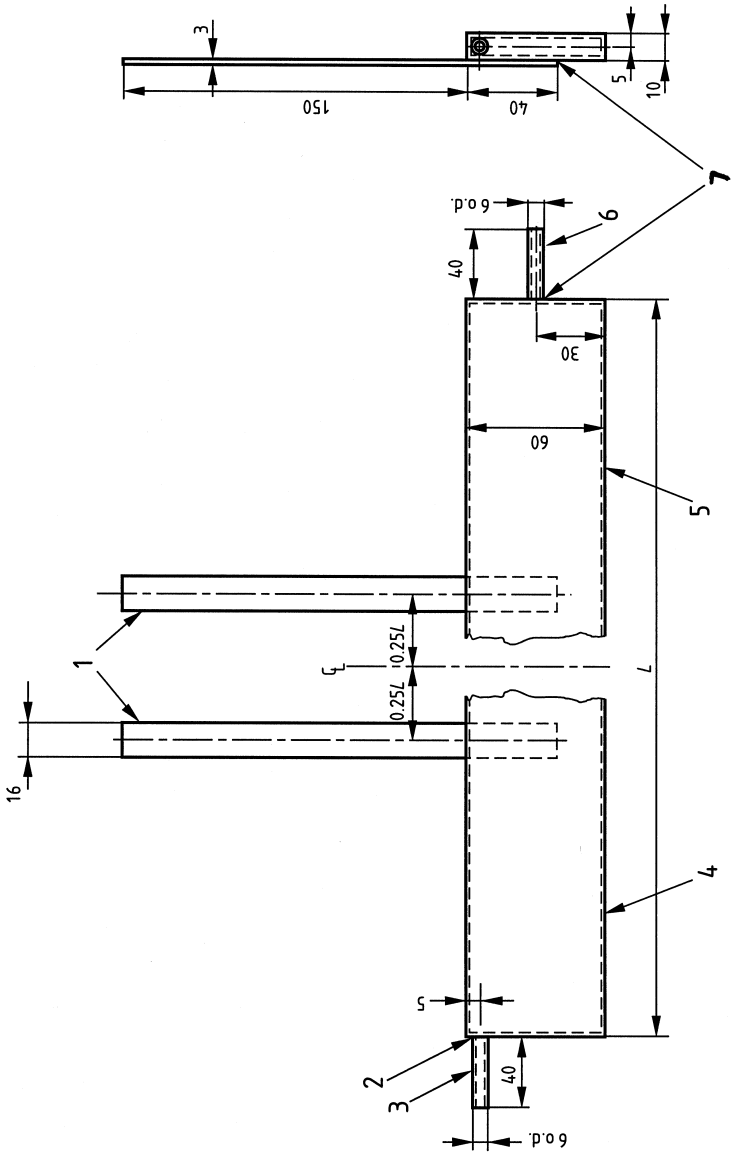
C.1.2 Method

Position the detector such that it will detect any leakage from the surface under test, and fix it in position.

Allow water to flow from a constant head device through the spillage detector at approximately 90 1/h and adjust the inlet temperature of the water to (11 ± 0,5) °C above the dew point of the surrounding air. Turn the appliance on under the conditions specified in 7.2.2.1. After operating the appliance for 15 minutes, starting from the cold condition, check the surface of the detector for condensation. Condensation on the detector indicates leakage of products. Short duration ‘puffs’ of condensation, provided that there is at least 5 s intervals between each ‘puff’, are to be ignored.

Condensation is best seen by illuminating the underside of the detector with a bright lamp and making observations along the length of the detector. It is advantageous to position a black surface so that it is reflected in the polished surface of the detector.

Dimensions in millimeters



Key

1 Brass, dull nickel plate

2 Braze

3 Water outlet

4 1 mm thick hard brass rhodium plate

5 This surface to be highly polished and free from wrinkles

6 Water inlet

7 Brass

Figure C.1 — Leakage indicator

C.2 Hood test method

C.2.1 Installation

The appliance is installed in accordance with 7.1.5.3.

Any bricks, radiants and imitation fuel not positively located with respect to the burner and to each other are to be arranged at the limit of their movement.

Due note should be taken of the manufacturer's instructions, and the ease with which refractories can be positioned. If it is obvious that any particular arrangement is not in accordance with the manufacturer's instructions for assembly of the fuel bed, this arrangement is not used for testing purposes.

The test is carried out after the appliance has been operating for 1 hour at the nominal heat input using the reference gas or any other gas of suitable quality, any thermostat remaining fully open.

The method for measuring the amount of leakage involves collecting, in a hood placed over the appliance, the convected air output from the appliance together with any escaping products. Figure C.2 a) gives details of a hood suitable for the majority of appliances. Where this hood is unsuitable a special hood is used for this purpose.

The arrangement of the hood for testing purposes is illustrated by Figure C.2 b). The back panel may be adapted to fit around the fireplace opening and should be sealed to the face of the test box. The front lower edge of the hood is positioned above the likely source of leakage such that:

a) the hood is positioned as low as possible without affecting the performance of the appliance under test;

b) there is no loss of products from the bottom of the hood.

Instrumentation is necessary capable of measuring the CO_2 concentration of gas to an accuracy of 0,002 %.

C.2.2 Preliminary adjustment

It is an advantage in this test method to minimize the flow through the collecting hood, thus increasing the CO_2 fraction of the sample. This is done by adjusting the hood damper. Care should be taken to ensure that the hood does not spill. This is checked by sampling along the front bottom edge of the hood and comparing the CO_2 concentration with that of ambient air in the same plane as the horizontal edge of the hood [see Figure C.2 a)]. When the adjustment of the hood damper is completed, a period of not less than 30 minutes is to be allowed for the hood to stabilize to its new condition before starting the test.

Take samples of the laboratory air passing into the appliance from:

a) the hood without the injection of CO_2;

b) the hood with the injection of CO_2;

c) the laboratory.

During the test ensure that the CO_2 concentration of the laboratory air passing into the appliance does not exceed 0,1 % and does not vary by more than ±0,02 % during any one test.

NOTE 1: Rates of injection of CO_2 of 0,02 m^3/h and 0,04 m^3/h have been found suitable for the majority of appliances.

NOTE 2: It has been found that the laboratory air can fluctuate quite rapidly and therefore a fast response analyser or alternatively simultaneous sampling into bags is recommended.

Calculation of results:

$$V = \frac{r\,(b - a_1)}{(c - a_2) - (b - a_1)\,Q} \times \frac{100}{V_{CO_2,N}}$$

where:

V is the leakage of dry undiluted products of combustion, in cubic metres per hour (m^3/h) per kilowatt (kW) of heat input;

a_1 is the CO_2 concentration in laboratory air when CO_2 is not injected, in percent, (%);

a_2 is the CO_2 concentration in laboratory air when CO_2 is injected, in percent, (%);

b is the CO_2 concentration in hood when CO_2 is not injected, in percent, (%);

c is the CO_2 concentration in hood when CO_2 is injected, in percent, (%);

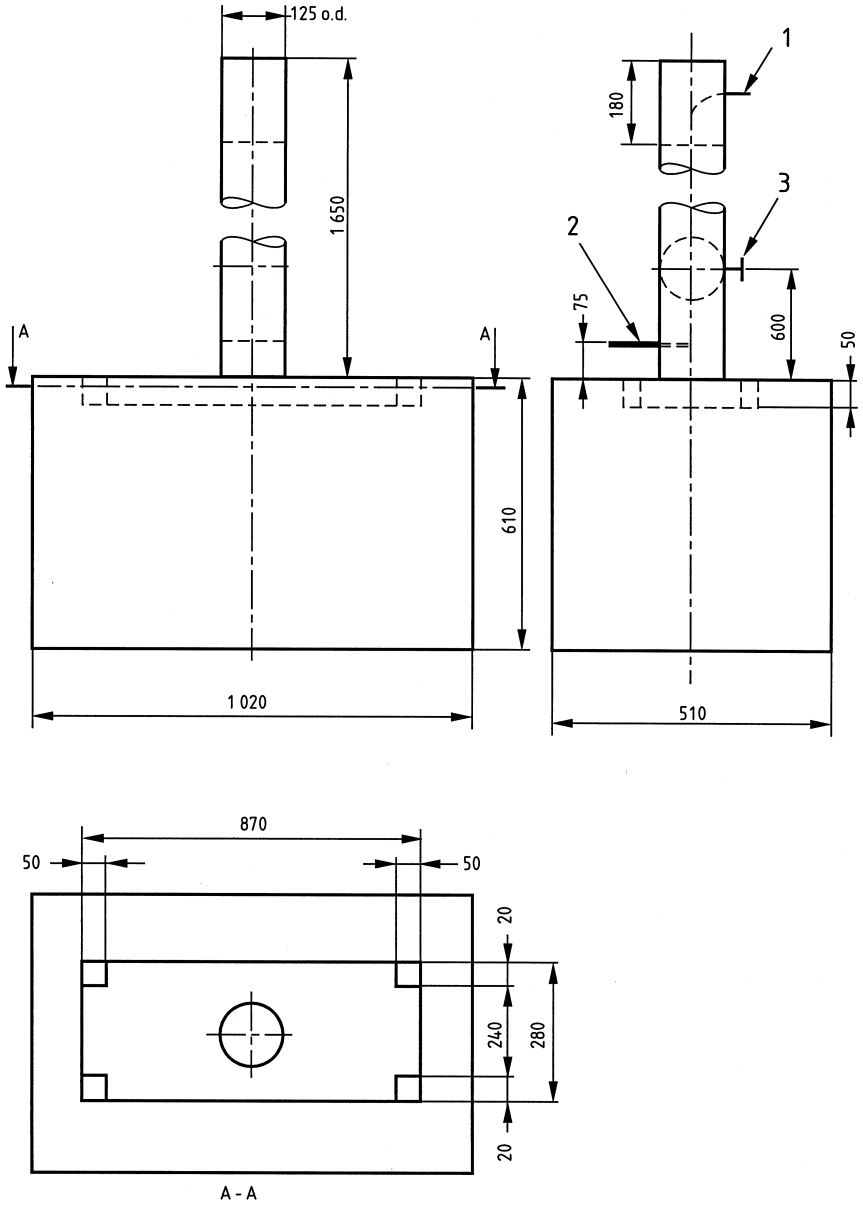
r is the injection rate, in cubic metres per hour, (m^3/h);

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

$V_{CO_2,N}1$ is the percentage of CO_2 concentration calculated for dry, air-free products of combustion of the gas involved (neutral combustion).

The values of $V_{CO_2,N}2$ (neutral combustion) for the test gases are given in Table 10.

Two pairs of results are used to calculate two values for the rate of leakage. Check that the two values are within ±0,004 m^3/h per kW of heat input.



Key

1 Sampling probe
(Ø copper tube)

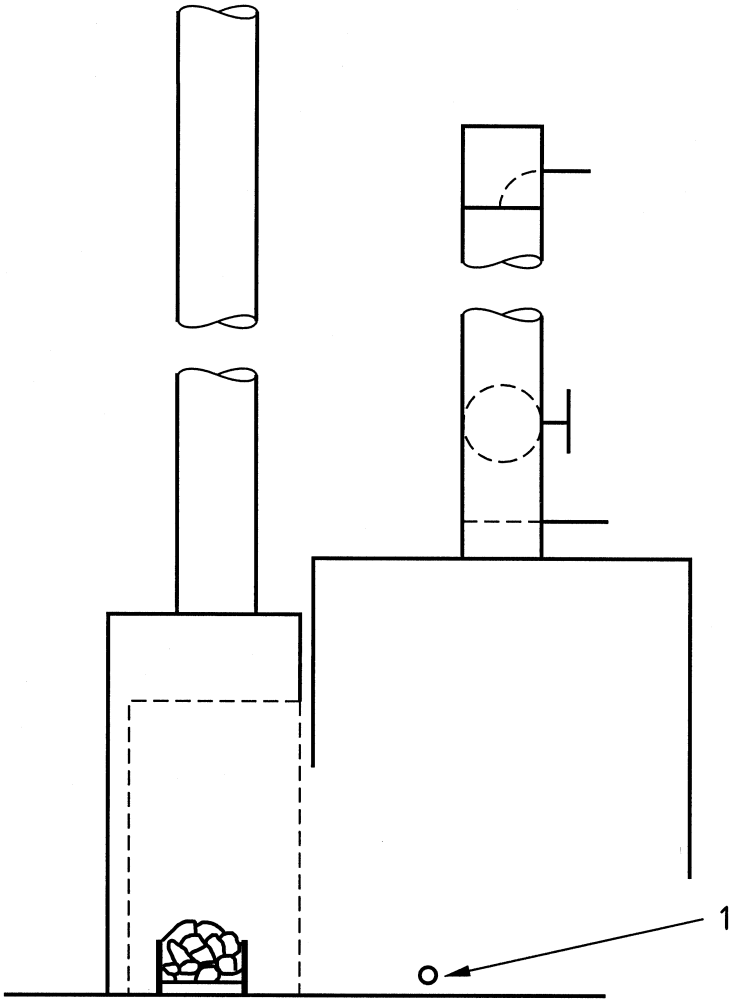
2 CO_2 injection probe

3 Flow restrictor

All dimensions are in millimetres

a) Hood

Figure C.2 — Collecting hood (*continued*)



Key

1 Sampling tube for laboratory air

b) Positioning

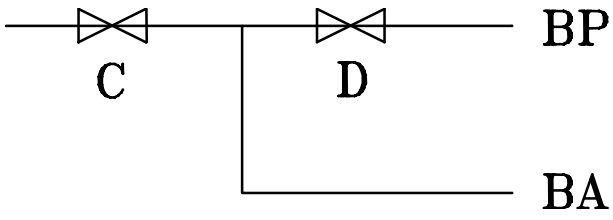
Figure C.2 — Collecting hood (*concluded*)

Annex D (informative)

Gas valve arrangements

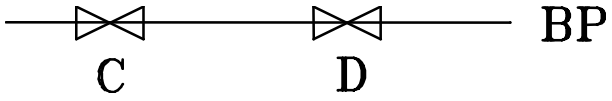
Legend: BA = ignition burner
BP = main burner

a) Appliances with permanent ignition burner:



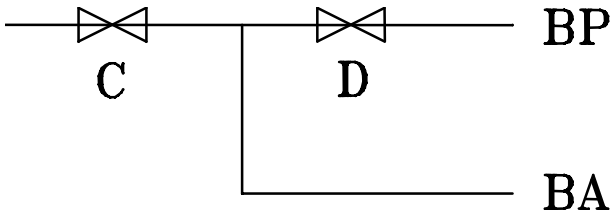
b) Appliances with automatic ignition:

1) Direct ignition of the main burner:

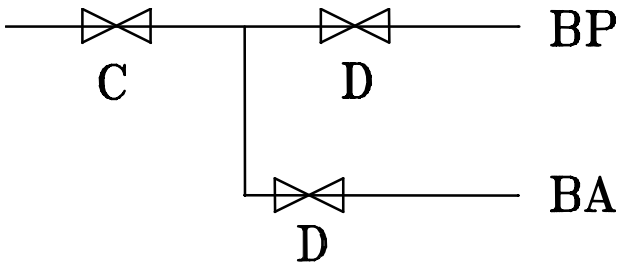


2) Appliances with an intermittent ignition burner:

i)



ii)



Annex E (informative)

Means of identification of the types of gas in force in the various countries

Table E.1 — Means of identification of the types of gas in use in the various countries

Gas type	G 110	G 120	G 130	G 150	G 20	G 25	G 30	G 31
AT					Erdgas		Flüssiggas	
BE					Aardgas, Gaz naturel	Aardgas, Gaz naturel	Butaan, Butane	Propaan, propane
CH			Propan-Luft Butan-Luft		Erdgas H		Butan	Propan
DE		Gruppe b			Erdgas E $Ws \cdot n = 15,0\ kWh/m^3$	Erdgas LL $Ws \cdot n = 12,4 kWh/m^3$	Flüssiggas B	Flüssiggas P
DK	By gas				Naturgas		F-Gas	F-Gas
ES	Gas manufacturado		Aire propando	Aire Metando	Gas natural		Butano	Propano
FI					Maakaasu Naturgas		Butaani Butan	Propaani/propan
FR			Air propané/ Air butanè		Gaz naturel Lacq	Gaz naturel Groningue	Butane	Propane
GB					Natural gas		Butane	Propane
GR								
IE					Natural gas		Butane	Propane
IS								
IT	Gas di Città				Gas naturale/ Gas metano		GPL	
LU								
NL						Aardgas	Butaan	Propaan
NO							Butan	Propan
PT	Gás de cidade				Gás naturel		Butano	Propano
SE								

A1 *Annex F deleted.* A1

Annex G (normative)

Apparatus for the determination of the smoke number

G.1 Pump

A (hand) pump, by means of which (160 ± 8) cm^3 may be sucked in a single operation through an effective filtering surface 6 mm in diameter (i.e. approximately (570 ± 27,5) cm^3 per cm^2 of effective filtering surface); the piston stroke of the pump should be approximately 200 mm.

The tensioning of the paper fixing device, which is set in the specified position before the paper is inserted, is to ensure satisfactory air-tightness for the re-heating operation which is intended to eliminate condensation.

The distance travelled by the gases from the sampling point to the filtering surface is not to exceed 40 cm, except in special chimney conditions.

G.2 Sampling tube

A tube with an external diameter of 6 mm, suitable for use with the pump described in G.1.

G.3 Filter paper

Use a filter paper with a reflection factor of (85 ± 2,5) % determined photometrically. For this measurement, place the filter paper on a white surface having a reflection factor of 75 % or more.

The passage of clean air through the new filter paper, at a flow rate of 3 dm^3 per min cm^2 of effective filtering surface, to give a pressure drop of between 20 mbar and 100 mbar.

G.4 Grey scale

The grey scale consists of ten numbered grades from 0 to 9, scaled in equal intervals from white to dark grey. These grades comprise samples printed, or made by other means on a support made of paper or plastic, with a reflection factor of (85 ± 2,5) % determined photometrically.

The identification number of each grade is equal to one tenth of the reduction rate. This is expressed as a percentage of the incident light reflected on the corresponding sample. The number 0 corresponds to the support paper and the number 6, for example, to a reduction rate of 60 %.

The tolerance of the deviations of the reflection factor for each of the points on the scale should not exceed 3 % of its value.

If the scale is protected by a transparent plastic cover, it should be made in such a way that the test spot and the standard grades are observed through the same thickness of protection material. The grades of the scale range have a diameter of about 20 mm and a central circular window 6 mm in diameter.

Annex H (informative)

Symbols and abbreviations

Calorific value - Net	H_i	MJ/m^3 or
Caloric value - Gross	H_s	MJ/kg
Heat input	Q	kW
Nominal heat input	Q_n	kW
Relative density - Dry test gas	d	
Relative density - Dry reference gas	d_r	
Relative density - Wet gas	d_h	
Wobbe index - Net	W_i	MJ/m^3 or
Wobbe index - Gross	W_s	MJ/kg
Pressure - Normal	p_n	mbar
Pressure - Maximum	p_{max}	mbar
Pressure - Minimum	p_{min}	mbar
Pressure - Atmospheric	p_a	mbar
Pressure - Saturation vapour	p_w	mbar
Mass flow rate	M	kg/h
Volumetric flow rate	V	
Volumetric flow rate - Reference conditions	V_o	m^3/h
Carbon monoxide concentration	$V_{CO,N}$	% by volume
Carbon monoxide measured	$V_{CO,M}$	% by volume
Carbon dioxide concentration	$V_{CO2,}$	% by volume
Carbon dioxide measured	$V_{CO2,M}$	% by volume

Annex J (normative)

Calculation of conversions of NO_x

Table J.1 — Conversion of the emission value of NO_x for first family gases

1 ppm = 2,054 mg/m^3 (1 ppm = 1 cm^3/m^3)		**G 110**	
		(mg/kWh)	(mg/MJ)
O_2 = 0 %	1 ppm =	1,714	0,476
	1 mg/m^3 =	0,834	0,232
O_2 = 3 %	1 ppm	2,000	0,556
	1 mg/m^3 =	0,974	0,270

Table J.2 — Conversion of the emission value of NO_x for second family gases

1 ppm = 2,054 mg/m^3 (1 ppm = 1 cm^3/m^3)		**G 20**		**G 25**	
		(mg/kWh)	(mg/MJ)	(mg/kWh)	(mg/MJ)
O_2 = 0 %	1 ppm =	1,764	0,490	1,797	0,499
	1 mg/m^3 =	0,859	0,239	0,875	0,243
O_2 = 3 %	1 ppm	2,059	0,572	2,098	0,583
	1 mg/m^3 =	1,002	0,278	1,021	0,284

Table J.3 — Conversion of the emission value of NO_x for third family gases

1 ppm = 2,054 mg/m^3 (1 ppm = 1 cm^3/m^3)		**G 30**		**G 31**	
		(mg/kWh)	(mg/MJ)	(mg/kWh)	(mg/MJ)
O_2 = 0 %	1 ppm =	1,792	0,498	1,778	0,494
	1 mg/m^3 =	0,872	0,242	0,866	0,240
O_2 = 3 %	1 ppm	2,091	0,581	2,075	0,576
	1 mg/m^3 =	1,018	0,283	1,010	0,281

Annex K (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 European Standard or Harmonization Document.

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

K.1 Belgium

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

Appliances in category I_{2Er} may also be marketed in Belgium, in which case the governor is required to be sealed. In addition the sealing of the governor shall be identified by the symbol (s).

Annex L (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 for gas appliances.

> NOTE: (from 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. C 59, 9.3.1982) that the effect of the decision of the Court of Justice in case 815/79 Cremonini/Vrankovich (European Court Report 1980, p3583) 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 safe-guard 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.

L.1 A-deviations

For **Switzerland** additional requirements to the following clauses are necessary:

6.7 Combustion
6.8 Sooting

Additional to the requirements given in this standard the limit of values for emissions of CO and sooting as laid down in the Swiss Clean-Air-Regulations[9)] (CAR) dated 1985-12-16 (state 1992-01-01) are authoritative.

[9)] LRV/OPair/CAR 81444.318.142.1
Bezugsquelle/Vente/Available from: EMDZ
PO Box
CH-3000 Berne
Switzerland

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 on The approximation of the laws of Member States concerning gas appliances.

> WARNING: Other requirements and other EU Directives may be applicable to the products falling within the scope of this standard.

The following clauses of this standard are likely to support requirements of EU Directive 90/396/EEC.

Compliance with these clauses of this standard provides one means of conforming with the specific essential requirements of the Directive concerned and associated EFTA regulations.

Table ZA.1 — Identification form on the compliance of EN 613 with the essential requirements of EU Directive 90/396 EEC on the approximation of the laws of member states concerning gas appliances

Essential requirement	Subject	Relevant clauses in EN 613
1.1	Safe design and construction	Whole standard
1.2	Instructions - installer	8.2.2.1
	- user	8.2.3
	Warning notices - appliance	8.1.1
	- packaging	8.1.3
	Official language	8
1.2.1	Type of gas used	8.2.2.1
	Gas supply pressure	8.2.2.1
	Fresh air - for combustion	8.2.2.1
	- products dispersal	8.2.2.1
	Forced draught burners	Not applicable
1.2.2	Instructions for use and servicing	8.2.1
		8.2.3
1.2.3	Warning notices on appliance and packaging	8.1.1
		8.1.3
1.3	Fittings - manual valves	5.2.4
	- governors	5.2.6
	- flame supervision device	5.2.5
	- automatic valves	5.2.4
	- automatic burner control systems	5.2.7
	- thermostats	5.2.8
	Instructions	Not applicable
2.1	Appropriate materials	5.1.2
		5.1.3
2.2	Properties	1
3.1.1	Durability	5.1.2
		5.1.3
3.1.2	Condensation	5.1.2
3.1.3	Explosion risk	5
3.1.4	Air/water penetration	Not applicable
3.1.5	Normal fluctuation of auxiliary energy	5.1.8
		6.5.3

continued

Table ZA.1 — Identification form on the compliance of EN 613 with the essential requirements of EU Directive 90/396 EEC on the approximation of the laws of member states concerning gas appliances (*concluded*)

Essential requirement	Subject	Relevant clauses in EN 613
3.1.6	Abnormal fluctuation of auxiliary energy	5.1.8 6.7.1
3.1.7	Electrical hazards	5.1.8
3.1.8	Deformation	Not applicable
3.1.9	Safety/control device failure	
	- gas circuit	5.2
	- automatic burner control system	5.2.7
	- flame supervision device	5.2.5 and 5.4
	- automatic shut off valves	5.2.4
	- governors	5.2.6
	- thermostatics	5.2.8
3.1.10	Overruling of safety devices	5.2.1
3.1.11	Pre-set adjuster protection	5.2.1 5.2.2
3.1.12	Marking of levers and setting devices	5.2.4.2 to 5.2.4.4
3.2.1	Gas leakage	5.1.5, 6.2.1
3.2.2	Gas release during ignition, re-ignition and extinction	5.4.1, 5.4.2 6.10.2.2 6.10.2.3
3.2.3	Unburned gas accumulation	5.2.4
3.3	Ignition - ignition, re-ignition and cross-lighting	6.5.1
3.4.1	Flame stability Harmful substance	6.5.2 6.7
3.4.2	Combustion products release	6.2.2
3.4.3	Combustion products release	6.9
3.4.4	Flueless domestic appliances	Not applicable
3.5	Rational use of energy	6.11
3.6.1	Floor etc. temperatures	6.4.3
3.6.2	Temperature of knobs/levers	6.4.1, 6.4.2
3.6.3	External parts	6.4.1
3.7	Foodstuffs and water	Not applicable
ANNEX II	Certification	1

Bibliography

EN 509:1999 *Decorative fuel-effect gas appliances*

prEN 13278:1998 *Open fronted gas-fired independent space heaters*

IEC 60479-1:1994 *Effects of current passing through the human body — Part 1: General aspects*

IEC 60479-2:1987 *Effects of current passing through the human body — Part 2: Special aspects*

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