

Independent gas-fired convection heaters incorporating a fan to assist transportation of combustion air and/or flue gases

ICS 97.100.20

National foreword

This British Standard is the UK implementation of EN 1266:2002, incorporating amendment A1:2005. Together with BS EN 613:2001 it supersedes BS 6332-4:1983 which is withdrawn, and it supersedes BS 5258-13:1986 which is withdrawn.

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

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

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Independent gas-fired convection heaters incorporating a fan to assist transportation of combustion air and/or flue gases

Appareils de chauffage indépendants à convection utilisant les combustibles gazeux et intégrant un ventilateur pour faciliter l'alimentation en air comburant et/ou l'évacuation des produits de combustion

Konvektions-Raumheizer für gasförmige Brennstoffe mit gebläseunterstützter Verbrennungsluftzu- und/oder Abgasabführung

This European Standard was approved by CEN on 11 January 2001.

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Foreword

This document (EN 1266:2002) 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 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2003, and conflicting national standards shall be withdrawn at the latest by April 2003.

This document has been prepared under a mandate given to CEN by the Commission and the European Free Trade Association, and supports the essential requirements of Directive 90/396/EEC.

For relationship with EU Directives, see informative annex ZA, which is an integral part of this document.

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, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Foreword to amendment A1

This European Standard (EN 1266:2002/A1:2004) 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 1266:2002 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2006, and conflicting national standards shall be withdrawn at the latest by February 2006.

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).

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and 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 that are fitted with fan-assisted atmospheric burners, or fully pre-mixed burners.

This standard is applicable to independent convection heaters, burning gas having a fan to assist the transportation of combustion air and/or flue gases, hereafter referred to as 'appliances':

- that are types B₁₂, B₁₃, B₁₄, B₂₂, B₂₃, C₁₂, C₁₃, C₃₂, C₃₃, C₄₂, C₄₃, C₅₂, C₅₃, C₆₂ and C₆₃ (see 4.2);
- 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:

- a) open fronted appliances to prEN 13278:1998;
- b) appliances fitted with automatic forced-draught burners to EN 676;
- c) ducted-air appliances;
- d) appliances installed by means of a closure plate (see 3.3.3.8). 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*

EN 161:2001, *Automatic shut-off valves for gas burners and gas appliances*

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

EN 298:2003, *Automatic gas burner control systems for gas burners and gas burning appliances with or without fans*

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

EN 50165:1997, *Electrical equipment of non-electric appliances for household and similar purposes — Safety requirements*

EN 12067-1:1998, *Gas/air ratio controls for gas burners and gas burning appliances — Part 1: Pneumatic types* prEN 13278:1998, *Open fronted gas-fired independent space heaters*

prEN 13278:1998, *Open fronted gas-fire independent space heaters*

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

EN 60529:1991, *Degrees of protection provided by enclosures (IP code) (IEC 529:1989)*

EN 60730-2-9:1995, *Automatic electrical controls for household and similar use — Part 2: Particular requirements for temperature sensing controls*

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

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

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

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

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

IEC 60479-1:1984, *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*

3 Terms and definitions

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

3.1 Independent gas-fired convection heaters

3.1.1

convection heater

convection 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 convection fan

device to assist in the distribution of heated air

3.1.4

live fuel effect convection heater

convection appliance which simulates the visual effect of a solid fuel appliance

3.1.5**open-fronted appliance**

appliance which has exposed flames or exposed incandescent areas

3.1.6**working surfaces**

those 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.

3.2 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/m³) of dry gas at the reference conditions; or
- megajoules per kilogram (MJ/kg) of dry gas;
- $\boxed{A_1}$ [EN 437:2003]. $\boxed{A_1}$

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 437:2003] 

3.2.5

test pressures

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

They are expressed in millibars (mbar).

NOTE 1 mbar = 100 Pa.

3.2.6

normal pressure

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

Symbol: p_n

3.2.7

limit pressures

pressures representative of the extreme variations in the appliance supply conditions

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 437:2003] 

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

Example:

$\frac{3}{4}$ cone seated joints

$\frac{3}{4}$ torroidal sealing rings ('O' rings)

$\frac{3}{4}$ flat joints

$\frac{3}{4}$ 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. It may also be used to adjust the gas rate of certain burners to a predetermined value, called the 'reduced rate'. This device 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. It 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. It is usually called simply 'burner'

3.3.2.2**fully premixed burner**

burner in which the gas and a quantity of air at least equal to that theoretically necessary for complete combustion are mixed before the combustion head

3.3.2.3

ignition burner

separate burner intended to light the main burner

3.3.2.3.1

permanent ignition burner

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

3.3.2.3.2

intermittent ignition burner

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

3.3.2.3.3

alternating ignition burner

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

3.3.2.4

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

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

3.3.3.4

atmosphere sensing device

device designed to shut off the gas supply before the combustion products of the surrounding atmosphere reaches a set value

3.3.3.5

terminal

device fitted at the end of the duct system to direct the flow of air and/or flue gases and to restrict the ingress of foreign matter

3.3.3.6

C₆ terminal

terminal which is specially approved for type C₆ appliances

3.3.3.7

adaption box

means of adapting the appliance for connection to different duct systems, e.g. from concentric to separate ducts

3.3.3.8

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 shall be considered as part of the appliance.

3.3.3.9

builders opening

enclosure constructed by the builder to accommodate fireplace components

3.3.3.10

fireplace opening

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

3.3.3.11

fireplace recess

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

3.3.3.12

fitting piece

device which allows for the fitting of the air supply and combustion products evacuation ducts to two ducts of a shared duct system for type C_4 appliances. The fitting piece may be part of the appliance or of the air supply and/or combustion products evacuation system

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

control knob

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

3.3.4.5

full sequence automatic control unit

control unit which can automatically bring an appliance into operation from a completely shut down condition in response to an external demand without the need for further intervention. This control unit comprises a programming unit and all the elements of a flame detector device

3.3.4.6

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.

3.3.4.7

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

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

3.3.4.9

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

3.3.4.10

purge

mechanical introduction of air into the combustion circuit in order to displace any fuel/air mixture which could remain there. A distinction is made between

pre-purge the purge that takes place between the start command and the ignition device being energized;

and

post-purge the purge that is carried out after burner shutdown.

3.3.4.1.1

air proving device

device intended to cause safety shut-down in the event of abnormal conditions of air admission or of combustion products evacuation

3.3.4.1.2

air/gas ratio device

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

3.4 Adjusters and controls

3.4.1

setting an adjuster

action of immobilizing an adjuster in the operating 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 437:2003] Ⓐ

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 437:2003] Ⓐ

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 437:2003] Ⓐ

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

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

3.5.6

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 the 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 also be accomplished by restoration of the electrical supply after its loss

3.5.11

equivalent resistance

resistance to flow in millibars, measured at the outlet of the appliance, which is equivalent to that of the actual flue

3.5.12

equivalent length

length of straight duct which has the same effect as the ducts to be used

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 from 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 Table A.3 the special categories marketed locally and nationally or corresponding to 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 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 I₃₊: 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 I₃₊.

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 I₃₊.

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 evacuating the products of combustion (types)¹⁾

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 B₁: A type B appliance incorporating a draught diverter.

For the purposes of this standard a type B₁ 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 B₁₂: A type B₁ appliance designed for a natural draught flue incorporating a fan downstream of the combustion chamber/heat exchanger and upstream of the draught diverter.

Type B_{12AS}: A type B₁₂ 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_{12BS}: A type B₁₂ 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 B₁₃: A type B₁ appliance designed for a natural draught flue incorporating a fan upstream of the combustion chamber/heat exchanger.

Type B_{13AS}: A type B₁₃ 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_{13BS}: A type B₁₃ 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.

1) Annex B gives examples of the various types.

Type B₁₄: A type B₁ appliance having an integral fan downstream of both the combustion chamber/heat exchanger and the draught diverter.

Type B_{14AS}: A type B₁₄ 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_{14BS}: A type B₁₄ 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 B₂: A type B appliance without a draught diverter.

Type B₂₂: A type B₂ appliance incorporating a fan downstream of the combustion chamber/heat exchanger.

Type B₂₃: A type B₂ appliance incorporating a fan upstream of the combustion chamber/heat exchanger.

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 C₁: 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 C₁₂: A type C₁ appliance incorporating a fan downstream of the combustion chamber/ heat exchanger.

Type C₁₃: A type C₁ appliance incorporating a fan upstream of the combustion chamber/heat exchanger.

Type C₃: A type C appliance which is designed for connection via ducts to a vertical 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 C₃₂: A type C₃ appliance incorporating a fan downstream of the combustion chamber/heat exchanger.

Type C₃₃: A type C₃ appliance incorporating a fan upstream of the combustion chamber/heat exchanger.

Type C₄: A type C appliance connected via two ducts to a common duct system serving more than one appliance. This common duct system consists of two ducts, one of which supplies the combustion air and the other evacuates the products of combustion.

Type C₄₂: A type C₄ appliance incorporating a fan downstream of the combustion chamber/heat exchanger.

Type C₄₃: A type C₄ appliance incorporating a fan upstream of the combustion chamber/heat exchanger.

Type C₅: A type C appliance connected to separate ducts for the supply of combustion air and the evacuation of combustion products. These ducts may terminate in zones of different pressure.

For appliances covered by this standard, the ducts may terminate in zones of different pressure provided the outlet duct terminates through the roof.

Type C₅₂: A type C₅ appliance incorporating a fan downstream of the combustion chamber/heat exchanger.

Type C₅₃: A type C₅ appliance incorporating a fan upstream of the combustion chamber/heat exchanger.

Type C₆: A type C appliance which is tested without the terminal and the combustion air supply and combustion products evacuation ducts.

In addition, after installation, the flue system is similar to a type C₁ or C₃ installation.

Type C₆₂: A type C₆ appliance incorporating a fan downstream of the combustion chamber/heat exchanger.

Type C₆₃: A type C₆ appliance incorporating a fan upstream of the combustion chamber/heat exchanger.

5 Constructional requirements

5.1 Conversion to different gases

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 adjustment 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 5.1.2 to 5.1.4 for each appliance category.

For type B_{12AS}, B_{13AS} and B_{14AS} appliances, when the operation of atmosphere 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.

5.1.2 Category I

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

Category I₃₊: 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.

5.1.3 Category II

5.1.3.1 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:

¾ adjustment of the gas rate with, if necessary, a change of injectors, restrictors or governor;

¾ replacement of a burner assembly;

- ¾ replacement of complete ignition burner or some of its parts;
- ¾ 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 mandatory to put the governor out of service in these circumstances (see 5.11.5).

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

5.1.3.2 Appliance 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:

- ¾ adjustment of the gas rate with, if necessary, a change of injectors, restrictors or governor;
- ¾ replacement of a burner assembly;
- ¾ replacement of complete ignition burner or some of its parts;
- ¾ exchange of fixed primary aeration restrictor.

The governor shall be put out of service where this is required in accordance with the requirements of 5.11.5.

Gas rate adjusters shall be put out of service in accordance with requirements of 5.11.2.

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

- ¾ 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 Û 50 mbar/67 mbar).
- ¾ 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.

5.1.4 Category III

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

5.2 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 service.

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.

5.3 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 dismantable for maintenance by a service engineer using ordinary tools, such as a screwdriver or a spanner.

For a type C 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 (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.

5.4 Connections

5.4.1 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. Moreover, 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 274:1975;
- 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.

5.4.2 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.

5.5 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.

5.6 Soundness of the combustion circuit

5.6.1 General

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

Those parts which do not require to be disconnected and/or 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.

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

5.6.2 Type B appliances

The soundness of an appliance up to the draught-diverter shall be effected by mechanical means only.

5.6.3 Type C appliances

The soundness of the heating body and of the connection of an appliance to the combustion air inlet and the products outlet ducts shall be effected by mechanical means only.

5.6.4 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.

5.7 Supply of combustion air and evacuation of combustion products

5.7.1 General

An appliance may be fitted with a means of adjustment in the combustion circuit intended to adapt the air flow through the appliance to the air resistance. This adjustment is effected either by restrictors or by fixing the means of adjustment to predetermined positions in accordance with detailed instructions from the manufacturer. The assembly of the various parts during installation shall be such that no work is necessary other than adjusting the length of the air supply and combustion products evacuation ducts (possibly by cutting them). Such adaption shall not impair the correct operation of the appliance.

It shall be possible to connect these ducts to the appliance using ordinary tools if necessary. The accessories and fitting instructions shall be supplied by the manufacturer.

For fully pre-mixed burners, automatic adjustment of the cross-section of the combustion air passageways to the appliance shall not be adjustable after installation.

Where the appliance is intended to be fitted to a duct system (i.e. combustion air inlet and/or combustion products outlet), the manufacturer shall provide the ducts and terminal(s).

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

The manufacturer shall state the minimum and maximum equivalent resistance. The manufacturer's instructions shall give details for calculating the equivalent resistance, for example the allowance to be made for bends etc.

For an appliance with a flue system that has a wall termination, the design of the flue system shall be such that any condensate formed when operating the appliance from cold shall either be retained and subsequently re-evaporated or discharged clear of the wall.

5.7.2 Type B appliances

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 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).

5.7.3 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.

5.7.4 Type C₄ appliances

The fitting piece, if required, shall be designed so that it is possible to obtain the distances specified by the manufacturer for the projection of the ends of the combustion air supply and combustion products discharge ducts into the common duct, whatever the total thickness (flue and cladding) of the common duct.

The manufacturer shall supply the appropriate fitting piece, if necessary.

5.7.5 Type C₆ appliances

The manufacturer shall make clear that the appliance shall only be installed with a terminal that complies with the requirements of annex C. Furthermore, he shall state the minimum and maximum pressure losses that can be generated in the air supply and combustion products evacuation ducts.

5.7.6 Terminal

The design of the terminal(s) shall be such that it will not allow entry of a ball of 16 mm diameter applied with a force of 5 N.

5.7.7 Terminal guard

A terminal guard shall be fitted in accordance with the national regulations applicable in the various member countries.

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

The guard shall be supplied by the manufacturer to the test house for the appropriate tests.

5.8 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 50165:1997 which covers such hazards.

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 **A1** EN 298:2003 **A1** 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.

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

A1 5.9.1 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 6.5.7.

5.9.2 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 6.5.7 and 6.7.1.

5.10 Air proving devices

5.10.1 General

Before the combustion air fan starts it shall be checked that there is no simulation of air flow, if air flow is simulated safety shut down shall occur; this requirement does not apply to appliances fitted with gas/air ratio controls which comply with 6.11.4.

This device shall operate on the valve which is not operated by the flame supervision device.

NOTE For type C appliances with a heat input less than or equal to 6 kW, an air proving device is not mandatory provided the requirements of 6.11.5 are met. **NOTE**

5.10.2 Gas/air ratio controls

Gas/air ratio controls shall be designed and constructed so that reasonably foreseeable damage does not give rise to a change capable of affecting safety.

Control tubes may be made of metal with suitable mechanical connections or of other materials with equivalent properties and in this case are considered immune to breakage, accidental disconnection and leakage after initial soundness checks. As such they are not subjected to the tests in 7.11.4.2.

When such control tubes are made of materials with non-equivalent properties their disconnection, breakage or leakage shall not lead to an unsafe situation. This implies either locking out or safe operation with no leakage of gas outside the appliance.

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

5.10.3 Other devices

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

- a) supervision of the combustion air rate or the combustion products rate;
- b) supervision of the minimum and maximum air rates with two rate supervision devices. This solution is only allowed for appliances with separate ducts when the leakage rates of the combustion products evacuation ducts do not exceed 0,006 dm³/(s·m²) under the conditions of 7.2.2.2.

5.11 Adjusting, control and safety devices

5.11.1 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.

5.11.2 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.

Appliances in categories I_{2H}, I_{2L}, I_{2E}, I_{2E+}, I_{3B/P}, I_{3P}, 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 category I_{2E+} and II_{2E+3+} may have a gas rate adjuster consisting of an adjusting screw on the gas governor.

Appliances in categories 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 5.11.5) 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.

5.11.3 Shut-off valves

5.11.3.1 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.

5.11.3.2 Manual valve system

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.

5.11.3.3 Automatic valve systems

Any electrically operated automatic shut-off valve shall comply with  EN 161:2001. 

Examples of gas valve arrangements for automatic controls are given in annex E. 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.

5.11.3.4 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. The markings for other positions are optional.

5.11.3.5 Room thermostat

For an appliance with a room thermostat, a reduced rate position is not mandatory.

5.11.4 Flame supervision devices

5.11.4.1 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.

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.

5.11.4.2 Appliances with automatic ignition 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.

5.11.5 Pressure governors

Pressure governors shall comply with EN 88:1991.

An appliance in category I₃₊ 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.

5.11.6 Automatic burner control system

If an appliance is fitted with an automatic burner control system, it shall comply with the requirements of  EN 298:2003. 

5.11.7 Thermostats

Any mechanical thermostat shall comply with EN 257:1992.

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

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

5.11.8 Spillage monitoring system

Type B₁ 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;
- Any safety device may operate on the same gas valve as the flame supervision device.

5.11.9 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.

5.12 Ignition devices

5.12.1 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. 

A1 5.12.2 Ignition burner A1

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.

An 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.

5.13 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.

5.14 Motors and fans

A1 *Text deleted* **A1**

5.14.2 Fan to assist transportation of combustion air and/or flue gases

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

5.15 Gas pressure test points

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.

5.16 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

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.

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 external leakage of air does not exceed $100 \text{ cm}^3/\text{h}$ 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 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.
- b) If a hood is used, when the appliance is tested as described in 7.2.2.1b), any leakage shall not exceed $0,04 \text{ m}^3/\text{h}$ per kW of heat input.

6.2.2.2 Type C 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:
 - $0,4 \text{ m}^3/\text{h}$ per kW of heat input for types C_{12} and C_{42} up to a maximum of $3 \text{ m}^3/\text{h}$;
 - $0,25 \text{ m}^3/\text{h}$ per kW of heat input up to a maximum of $3 \text{ m}^3/\text{h}$ for all other appliances.
- b) For appliances greater than 12 kW heat input, a maximum of $3 \text{ m}^3/\text{h}$.

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 maintenance and/or 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 - burner (type B 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 $\pm 5\%$ 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 specified in 7.3.3 test no. 1 and shall not exceed the nominal heat input when measured under the conditions specified in 7.3.3, test no. 2.

6.3.2 Ignition burner

Under the conditions of test described in 7.3.4 the heat input of any ignition burner shall not exceed $0,3 \text{ kW}^2$.

6.3.3 Reduced rate

When tested as described in 7.3.5, any reduced rate specified by the manufacturer shall be within $\pm 10\%$ 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 and 7.4.2, 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:

- $\frac{3}{4}$ 35 K for metals and equivalent materials;
- $\frac{3}{4}$ 45 K for porcelain and equivalent materials;
- $\frac{3}{4}$ 60 K for plastics and equivalent materials.

The temperature of those parts of the appliance other than working surfaces (see 3.1.6) shall not exceed the ambient temperature by more than:

- $\frac{3}{4}$ 80 K for base metal;
- $\frac{3}{4}$ 95 K for enamelled steel, coated or painted metals and equivalent materials;
- $\frac{3}{4}$ 100 K for plastics, rubber or wood.

2) The heat input based on net calorific value $Q(H_i)$ is related to the gross value $Q(H_s)$ for the five reference gases as follows:

G 110 $Q(H_i) = 0,880 \quad Q(H_s)$

G 120 $Q(H_i) = 0,882 \quad Q(H_s)$

G 20 $Q(H_i) = 0,900 \quad Q(H_s)$

G 25 $Q(H_i) = 0,901 \quad Q(H_s)$

G 30 $Q(H_i) = 0,923 \quad Q(H_s)$

6.4.2 Temperature of components

When the appliance is tested as described in 7.4.1 and 7.4.3, the temperature of any component (including taps) shall not exceed that declared by the component manufacturer.

In addition, at the end of the test any taps fitted shall be easy to turn.

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 7.4.4.1, 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 7.4.4.1, the temperature at any point of any floor on which an appliance is 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 7.4.4.1 and 7.4.4.2 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 7.5.1 and Test No. 1 to 3 of 7.5.2.1, smooth and correct ignition of the ignition burner, main burner and cross-lighting shall be assured, and the appliance shall continue to operate safely.

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

6.5.1.2 Supplementary tests

When tested as described in 7.5.1 and Test No. 1 of 7.5.2.2, 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.

For type B₁₄ appliances, when an appliance having a manually ignited ignition burner is tested under the conditions of 7.5.1 and Test No. 2 of 7.5.2.2, ignition of the ignition burner shall be correct even when the outlet of the flue system is completely blocked. Ignition and cross-lighting of the main burner shall be assured up until the gas supply to the main burner is shut off by the spillage monitoring system. If an appliance has an automatic ignition system, under the same test conditions, ignition of the ignition burner and cross-lighting of the main burner shall be assured up until the gas supply to the main burner, and ignition burner, is shut off by the spillage monitoring system.

6.5.2 Flame stability (all appliances)

When tested as described in 7.5.3 the flames shall be stable. A slight tendency to lift at the moment of ignition is acceptable, but the flames shall be stable in normal operation.

6.5.3 Effect of room draughts (for type B appliances)

The flames shall be stable when tested as described in 7.5.4.

6.5.4 Effect of down draughts (for type B appliances)

The flames shall be stable when tested as described in 7.5.5.

6.5.5 Restricted flue (for type B₁₄ appliances)

Under the conditions described in 7.5.6, the main burner and any ignition burner flames shall remain stable up until the gas supply to the main burner, and where appropriate the ignition burner, is shut off by the spillage monitoring system.

6.5.6 Wind tests (for type C appliances)

Under the conditions of test specified in 7.5.7, 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 permitted but there shall be no flame extinction.

6.5.7 Normal and abnormal voltage fluctuation

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

6.5.8 Pre-purge

Pre-purge is mandatory before each ignition attempt of the main burner (a single ignition attempt or before the first of several consecutive automatic ignition attempts) unless one of the following conditions is fulfilled:

- the appliance is fitted with a permanent or alternating ignition burner less than or equal to 0,3 kW;
- if the heat input of the ignition burner is greater than 0,3 kW and the gas circuit is fitted with two valves which are at least a class C, or, a class B and a class J which close simultaneously;
- when tested as described in Test No. 1 of 7.5.2.2, there shall be no hazard to the user or damage to the appliance which affects safety.

When tested as described in 7.5.8, the volume or the duration of the pre-purge shall be at least:

- for appliances where the pre-purge air is induced over the whole cross-section of the combustion chamber inlet, the volume of the combustion chamber or 5 s at the air rate corresponding to the nominal heat input;
- for other appliances, three times the volume of the combustion chamber or 15 s.

6.5.9 Additional requirements for the functioning of a permanent ignition burner when the combustion fan has stopped

When tested as described in 7.5.9, the ignition burner shall remain in a stable condition.

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, or by more than ± 5 % for second $\overline{A_1}$ and third $\overline{A_1}$ family gases, from the rate obtained at the normal test pressure, when the pressure upstream 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;
- A1** b) 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 7.7.3.4; **A1**
- c) For type C₄ and C₆ appliances, in addition to a) and b) above, 0,10 % when the appliance is supplied with reference gas under the test conditions described in 7.7.3.5.

In addition to the combustion requirement in c) above, when the appliance is supplied with reference gas under the test conditions described in 7.7.3.5.2, the pressure drop between the combustion air inlet duct and the combustion products evacuation duct shall be at least 0,2 mbar greater than the pressure drop specified by the manufacturer which corresponds to the maximum resistance of the duct system.

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 7.8.1, 7.8.2, 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 7.8.1, 7.8.2, 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 test

If, on completion of the tests in accordance with 7.8.1, 7.8.2, 7.8.3.1, 7.8.3.2 and 7.8.3.3 inclusive, soot is observed³⁾ 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 %.

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.

6.9 Spillage monitoring system (type B appliances only)

6.9.1 General

Type B₁ appliances shall incorporate a spillage monitoring device that meets the requirements of 6.9.2 or 6.9.3 or 6.9.4.

6.9.2 Atmosphere sensing device (Type B_{12AS}, B_{13AS} and B_{14AS} appliances)

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).

6.9.3 Combustion products discharge safety device (Type B_{12BS}, B_{13BS} and B_{14BS} appliances)

6.9.3.1 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.

6.9.3.2 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 (in s)	
		Q_n	Q_m
Complete blockage	0	200	$200 \cdot \frac{Q_n}{Q_m}$
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

3) Fine powdery deposits are ignored.

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.

6.10 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 5.11.4.2) 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 Air proving device

6.11.1 General

One of the following requirements, 6.11.2 to 6.11.4, shall be met, depending on the principle of air proving. However, for type C appliances with a heat input less than or equal to 6 kW, an air proving device is not mandatory (see 6.11.5) and 6.11.2 to 6.11.4 are not applicable.

6.11.2 Voltage reduction

- a) Under the conditions of 7.11.2, Test No. 1, when the fan supply voltage is progressively reduced, the gas supply shall be shut off before the CO concentration exceeds 0,2 %.
- b) Under the conditions of 7.11.2, Test No. 2, the CO concentration shall not exceed 0,1 %.

If in 6.11.2 a) the appliance shuts off, 6.11.2 b) is not applicable.

6.11.3 Restricted flue

- a) a) Under the conditions of 7.11.3, Test No. 1, when, by choice of the manufacturer, the air supply duct or the combustion products evacuation duct is progressively restricted, the gas supply shall be shut off before the CO concentration exceeds 0,2 %.
- b) b) Under the conditions of 7.11.3, Test No. 2, the CO concentration shall not exceed 0,1 %.

If in 6.11.3 a) the appliance shuts off, 6.11.3 b) is not applicable.

6.11.4 Gas/air ratio controls (only applicable to controls which have not been independently certified)

6.11.4.1 Endurance

The gas/air ratio control shall continue to operate correctly after 250 000 cycles with full diaphragm travel in each cycle, when tested in accordance with 7.11.4.1.

6.11.4.2 Leakage of non-metallic control tubes

When tested in accordance with 7.11.4.2, non-metallic control tubes shall be designed and constructed so that leakage does not give rise to a change in performance capable of affecting safety.

6.11.4.3 Safety of operation

- a) When tested in accordance with 7.11.4.3, Test No. 1, the gas supply shall be shut off before the CO concentration exceeds:

$\frac{3}{4}$ 0,2 % over the range of modulation provided by the manufacturer, or

$\frac{3}{4} \frac{Q_s}{Q_{KB}} \cdot CO_{mes}$ less than or equal to 0,2 %, below the minimum rate of the modulation range,

where:

Q_s is the heat input, at the point of shut off (kW);

Q_{KB} is the heat input at the minimum rate (kW);

CO_{mes} is the measured CO concentration.

- b) When tested in accordance with 7.11.4.3, Test No. 2, the CO concentration shall not exceed 0,1 %.

6.11.4.4 Adjustment of the air/gas or gas/air ratio

When the air/gas or gas/air ratio is adjustable, the device shall operate at the extreme limits and the range of adjustable pressures shall match the field of adjustment completely.

6.11.5 For type C appliances with a heat input less than or equal to 6 kW

An air proving device is not mandatory provided that the following requirements are met:

- $\frac{3}{4}$ when tested as described in 7.11.5.1, the CO concentration in the air-free, dry products of combustion shall not exceed 0,1 %;
- $\frac{3}{4}$ when tested as described in 7.11.5.2, the CO concentration in the air-free, dry products of combustion shall not exceed 0,2 %;

$\frac{3}{4}$ when tested as described in 7.11.5.3, the appliance shall go to safety shut down within 60 s.

6.12 Efficiency

Under the test conditions described in 7.12.1, the minimum net efficiency shall be at least 84 %.

For convection heaters only, with a heat input less than or equal to 5 kW, the minimum net efficiency shall be at least 80 %.

The efficiency value based on net calorific value, (H_i) , is related to the gross value, (H_s) , for the five reference gases as follows:

$$\text{G 110 } (H_i) = 1,136 \times (H_s)$$

$$\text{G 120 } (H_i) = 1,133 \times (H_s)$$

$$\text{G 20 } (H_i) = 1,111 \times (H_s)$$

$$\text{G 25 } (H_i) = 1,110 \times (H_s)$$

$$\text{G 30 } (H_i) = 1,083 \times (H_s)$$

The heat input based on net calorific value, $Q(H_i)$, is related to the gross value, $Q(H_s)$, for the five reference gases as follows:

$$\text{G 110 } Q(H_i) = 0,880 \times Q(H_s)$$

$$\text{G 120 } Q(H_i) = 0,882 \times Q(H_s)$$

$$\text{G 20 } Q(H_i) = 0,900 \times Q(H_s)$$

$$\text{G 25 } Q(H_i) = 0,901 \times Q(H_s)$$

$$\text{G 30 } Q(H_i) = 0,923 \times Q(H_s)$$

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 5 and 6. 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 5. For the preparation of the gases, the following rules shall be observed:

- a) the Wobbe index of the gas used shall be within $\pm 2\%$ of the value indicated in Table 5 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 ₃ H ₆	...95 %)	
— propane C ₃ H ₈	...95 %)	
— butane C ₄ H ₁₀ ⁴⁾	...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 mandatory 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.

However, for gases of the 2nd family:

³/₄ 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.

³/₄ for the preparation of the limit gases, another gas may be used as the base gas instead of methane:

³/₄ for limit gases G 21, G 222 and G 23, a natural gas of group H may be used;

³/₄ 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;

³/₄ 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 5 for the corresponding limit gas and, the hydrogen content of the final mixture shall be as given in Table 5.

4) Any mixture of iso-butane and n-butane can be used.