BRITISH STANDARD

BS EN 419-1:2009

Non-domestic gas-fired overhead luminous radiant heaters

Part 1: Safety

ICS 97.100.20

National foreword

This British Standard is the UK implementation of EN 419-1:2009. It supersedes BS EN 419-1:2000 which is withdrawn.

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Non-domestic gas-fired overhead luminous radiant heaters - Part 1: Safety

Appareils surélevés de chauffage à rayonnement lumineux au gaz, à usage non domestique - Partie 1 : Sécurité

Gasgeräte-Heizstrahler - Hellstrahler mit einem Brenner ohne Gebläse für gewerbliche und industrielle Anwendung - Teil 1: Sicherheit

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Foreword

This document (EN 419-1:2009) has been prepared by Technical Committee CEN/TC 180 “Domestic and non-domestic gas fired air heaters and non-domestic gas fired overhead radiant 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of an identical text or by endorsement, at the latest by July 2009, and conflicting national standards shall be withdrawn at the latest by July 2009.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 419-1:1999.

In particular, it should be noted that this standard no longer includes requirements for Type B_1 appliances.

The test gases, test pressures and appliance categories given in this European Standard are in accordance with those specified in EN 437:2003.

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 EC Directive(s).

For relationship with EC Directive(s), 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, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies the requirements and test methods for the construction, safety, classification and marking of non-domestic gas-fired overhead luminous radiant heaters for environmental comfort, incorporating an atmospheric burner system referred to in the body of the text as “appliances”.

This European Standard is applicable to Type A_1 appliances only (see 4.3).

This European Standard is not applicable to:

a) appliances designed for use in domestic dwellings;

b) outdoor appliances;

c) appliances of heat input in excess of 120 kW (based on the net calorific value of the appropriate reference gas);

d) appliances having fully pre-mixed gas and air burners in which:

1) either the gas and all the combustion air are brought together just before the level of the combustion zone; or

2) the pre-mixing of the gas and all combustion air is carried out in a part of the burner upstream of the combustion zone;

e) appliances in which the supply of combustion air and/or the removal of the products of combustion is achieved by integral mechanical means.

This standard is applicable to appliances which are intended to be type tested. Requirements for appliances which are not intended to be type tested would need to be subject to further consideration.

Requirements concerning the rational use of energy have not been included in this European Standard.

2 Normative references

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

EN 88-1:2007, *Pressure regulators and associated safety devices for gas appliances - Part 1: Pressure regulators for inlet pressures up to and including 500 mbar*

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

EN 126:2004, *Multifunctional controls for gas burning appliances*

EN 161:2007, *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 gas burners and gas burning appliances with or without fans*

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

EN 1057:2006, *Copper and copper alloys - Seamless, round copper tubes for water and gas in sanitary and heating applications*

EN 10226-1:2004, *Pipe threads where pressure-tight joints are made on the threads – Part 1: Taper external threads and parallel internal threads - Dimensions, tolerances and designation*

EN 10226-2:2005, *Pipe threads where pressure tight joints are made on the threads – Part 2: Taper external threads and taper internal threads. Dimensions, tolerances and designation*

EN 13410:2001, *Gas-fired overhead radiant heaters - Ventilation requirements for non-domestic premises*

EN 60335-1:2002, *Household and similar electrical appliances - Safety - Part 1: General requirements*

EN 60335-2-102:2006, *Household and similar electrical appliances - Safety - Part 2-102: Particular requirements for gas, oil and solid-fuel burning appliances having electrical connections*

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

EN ISO 228-1:2003, *Pipe threads where pressure-tight joints are not made on the threads - Part 1: Dimensions, tolerances and designation (ISO 228-1:2000)*

EN ISO 3166-1:2006, *Codes for the representation of names of countries and their subdivisions – Part 1: Country codes (ISO 3166-1:2006)*

EN ISO 6976:2005, *Natural gas - Calculation of the calorific value, density, relative density and Wobbe index from composition (ISO 6976:1995 including Corrigendum 1:1997, Corrigendum 2:1997 and Corrigendum 3:1999)*

ISO 7005-1:1992, *Metallic flanges - Part 1: Steel flanges*

ISO 7005-2:1988, *Metallic flanges - Part 2: Cast iron flanges*

ISO 7005-3:1988, *Metallic flanges - Part 3: Copper flanges and composite flanges*

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

3 Terms and definitions

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

3.1 Appliance and its constituent parts

3.1.1
overhead luminous radiant heater
gas-fired appliance intended for installation at a height above head level, which is designed to heat the space beneath by radiation and in which the heat is produced by means of burning the fuel at or near the outer surface of a material such as a ceramic plaque or gauze, or by means of an atmospheric burner heating a gauze or similar material

3.1.2
atmospheric burner
aerated burner in which the air for combustion is entrained at atmospheric pressure

3.1.3
inlet connection
the part of the appliance intended to be connected to the gas supply

3.1.4
mechanical joint
means of ensuring the soundness of an assembly of several (generally metallic) parts without the use of liquids, pastes, tapes, etc.

NOTE For example the following:

a) metal to metal joints;

b) conical joints;

c) toroidal sealing rings (“O” rings);

d) flat joints.

3.1.5
gas circuit
part of the appliance that conveys or contains the gas between the appliance gas inlet connection and the burner(s)

3.1.6
restrictor
device with an orifice, 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

3.1.7
gas rate adjuster
component allowing an authorized person to set the gas rate of the burner to a predetermined value according to the supply conditions

NOTE 1 Adjustment can be progressive (screw adjuster) or in discrete steps (by changing restrictors).

NOTE 2 The adjusting screw of an adjustable regulator is regarded as a gas rate adjuster.

NOTE 3 The action of adjusting this device is called “adjusting the gas rate”.

NOTE 4 A factory sealed gas rate adjuster is considered to be non-existent.

3.1.8
setting an adjuster
immobilizing a gas rate adjuster by such means as e.g. a screw, after the gas rate has been adjusted by the manufacturer or installer

3.1.9
sealing an adjuster
term applied to any arrangement in respect of the adjuster such that any attempt to change the adjustment breaks the sealing device or sealing material and makes this interference apparent

NOTE 1 A factory sealed adjuster is considered to be non-existent.

NOTE 2 A regulator is considered to be non-existent if it has been factory sealed in a position such that it is not operational in the range of supply pressures corresponding to the appliance category.

3.1.10
putting an adjuster or a control out of service
putting an adjuster or a control (of temperature, pressure, etc.) out of action and sealing it in this position.

NOTE The appliance functions as if the adjuster or control had been removed.

3.1.11
injector
component that admits the gas into a burner

3.1.12
main burner
burner that is intended to ensure the thermal function of the appliance and is generally called “the burner”

3.1.13
ignition burner
burner whose flame is intended to ignite another burner

3.1.14
ignition device
means (e.g. flame, electrical ignition device or other device) used to ignite the gas at the ignition burner or at the main burner

3.1.15
primary aeration adjuster
device enabling the primary air to be set at the necessary value according to the supply conditions

3.2 Adjusting, control and safety devices

3.2.1
automatic burner control system
system comprising at least a programming unit and all the elements of a flame detector device

The various functions of an automatic burner control system may be in one or more housings.

3.2.2
programming unit
device 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

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

3.2.3
programme
sequence of control operations determined by the programming unit involving switching on, starting up, supervising and switching off the burner

3.2.4
flame detector
device by which the presence of a flame is detected and signalled

NOTE The flame detector 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.

3.2.5
flame signal
signal given by the flame detector, normally when the flame sensor senses a flame

3.2.6
flame supervision device
device that, in response to a signal from the flame detector, keeps the gas supply open and shuts it off in the absence of the supervised flame

3.2.7
flame simulation
condition which occurs when the flame signal indicates the presence of a flame when in reality no flame is present

3.2.8
pressure regulator [1)]
device which maintains the outlet pressure constant independent of the variations in inlet pressure within defined limits

3.2.9
adjustable pressure regulator
regulator provided with means for changing the outlet pressure setting

3.2.10
volume regulator[1)]
device which maintains the gas rate constant within a given tolerance, independent of the upstream pressure

3.2.11
range-rating device
component on the appliance intended to be used by the installer to adjust the heat input of the appliance within a range of heat inputs stated by the manufacturer; to suit the actual heat requirements of the installation

This adjustment may be progressive (e.g. by use of a screw adjuster) or in discrete steps (e.g. by changing restrictors).

3.2.12
automatic shut-off valve
valve designed to open when energized and to close automatically when de-energized

3.3 Operation of the appliance

3.3.1
heat input
Q
quantity of energy used in unit time corresponding to the volumetric and mass flow rates, the calorific value to be used being the net or gross calorific value

NOTE The heat input is expressed in kilowatts (kW) [EN 437:2003].

3.3.2
nominal heat input
Q_n
value of the heat input (kW) declared by the manufacturer

[1)] The term “regulator” is used in both cases.

3.3.3
volume flow rate
V
volume of gas consumed by the appliance in unit time during continuous operation

NOTE The volume flow rate is expressed in m^3/h, l/min, dm^3/h or dm^3/s [EN 437:2003].

3.3.4
mass flow rate
M
mass of gas consumed by the appliance in unit time during continuous operation

NOTE The mass flow rate is expressed in kg/h or g/h [EN 437:2003].

3.3.5
start gas
gas that is supplied at the start gas rate either at the main burner or at a separate ignition burner

3.3.6
start gas rate
restricted gas flow rate admitted either to a separate ignition burner or to the main burner during start up

3.3.7
start gas flame
flame established at the start gas rate either at the main burner or at a separate ignition burner

3.3.8
flame stability
characteristic of flames which remain on the burner ports or in the flame reception zone intended by the construction

3.3.9
flame lift
total or partial lifting of the base of the flame away from the burner port or the flame reception zone provided by the design

Flame lift may cause the flame to blow out, i.e. extinction of the air-gas mixture.

3.3.10
light-back
entry of a flame into the body of the burner

3.3.11
light-back at the injector
ignition of the gas at the injector, either as a result of light-back into the burner or by the propagation of the flame outside the burner

3.3.12
sooting
phenomenon appearing during incomplete combustion and characterized by deposits of soot on the surfaces or parts in contact with the combustion products or with the flame

3.3.13
first safety time [2)]
interval between the ignition burner valve, start gas valve or main gas valve, as applicable, being energized and the ignition burner valve, start gas valve or main gas valve, as applicable, being de-energized if the flame detector signals the absence of a flame at the end of this interval

3.3.14
second safety time
where there is a first safety time applicable to either an ignition burner or to a start gas flame only, the second safety time is the interval between the main gas valve being energized and the main gas valve being de-energized if the flame detector signals the absence of a flame at the end of this interval

3.3.15
running condition of the system
condition in which the burner is in normal operation under the supervision of the programming unit and its flame detector

3.3.16
controlled shut-down
process by which the power to the automatic shut-off valve(s) is removed immediately as a result of the action of a controlling function

3.3.17
safety shut-down
process which is effected immediately following the response of a safety control or sensor or the detection of a fault in the burner control system and which puts the burner out of operation by immediately removing the power from the automatic shut-off valve(s) and the ignition device

3.3.18
non-volatile lock-out
safety shut-down condition of the system such that a restart can only be accomplished by a manual reset of the system and by no other means

3.3.19
volatile lock-out
safety shut-down condition of the system such that a restart can only be accomplished by either the manual reset of the system, or an interruption of the mains electrical supply and its subsequent restoration

3.3.20
spark restoration
process by which, following loss of the flame signal, the ignition device will be switched on again without total interruption of the gas supply

NOTE This process ends with the restoration of the running condition or, if there is no flame signal at the end of the safety time, with volatile or non-volatile lock-out.

3.3.21
automatic recycling
process by which, after loss of flame during the running condition or accidental interruption of the operation of the appliance, the gas supply is interrupted and the complete start sequence is automatically re-initiated

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[2)] Where there is no second safety time, this is called the safety time.

NOTE This process ends with the restoration of the running condition or, if there is no flame signal at the end of the safety time, or if the cause of the accidental interruption has not disappeared, with volatile or non-volatile lock-out.

3.3.22
ignition opening time
time interval between ignition of the supervised flame and the moment when the valve is held open

3.3.23
extinction safety time
time which elapses between the moment when the supervised flame is extinguished and the moment when:

a) for an appliance without an automatic burner control system, the gas supply is shut-off:

1) to the main burner;

2) and/or to the ignition burner;

b) or for an appliance with an automatic burner control system, the control system initiates shut-down of the burner by removing power to the automatic gas shut-off valves

3.4 Gases

3.4.1
calorific value
quantity of heat produced by the complete combustion, at a constant pressure equal to 1 013,25 mbar, of unit volume or mass of gas, the constituents of the combustible mixture being taken at reference conditions and the products of combustion being brought back to the same conditions

A distinction is made between:

a) the gross calorific value H_s in which the water produced by combustion is assumed to be condensed;

b) the net calorific value H_i in which the water produced by combustion is assumed to be in the vapour state

NOTE The calorific value is expressed either in MJ/m^3 of dry gas at the reference conditions or in MJ/kg of dry gas [EN 437:2003].

3.4.2
relative density
d
ratio of the masses of equal volumes of dry gas and dry air measured under the same conditions of temperature and pressure

3.4.3
Wobbe index
gross Wobbe index: W_s and net Wobbe index: W_i.
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

NOTE The Wobbe index is expressed in MJ/m^3 of dry gas at the reference conditions or in MJ/kg of dry gas [EN437:2003].

3.4.4
test pressures
gas pressures used to verify the operational characteristics of appliances using combustible gases; they consist of normal and limit pressures

NOTE Test pressures are expressed in mbar; 1 mbar = 10^2 Pa [EN 437:2003].

3.4.5
normal pressure
p_n
pressure under which the appliances operate in nominal conditions when they are supplied with the corresponding reference gas

[EN 437:2003]

3.4.6
limit pressures
(maximum limit pressure p_{max} and minimum limit pressure p_{min})
pressures representative of the extreme variations in the appliance supply conditions

[EN 437:2003]

3.4.7
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:

a) the higher pressure corresponds only to gases of low Wobbe index;

b) the lower pressure corresponds to gases of high Wobbe index

[EN 437:2003]

3.5 Conditions of operation and measurement

3.5.1
reference conditions
in this standard the following reference conditions apply:

a) for calorific values, temperature 15 °C

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

3.5.2
cold condition
condition of the appliance required for some tests and obtained by allowing the unlit appliance to attain thermal equilibrium at room temperature

3.5.3
hot condition
condition of the appliance required for some tests and obtained by heating to thermal equilibrium at the nominal heat input, any thermostat remaining fully open

3.5.4
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 % (in °C) over a period of 10 min

3.6 Country of destination

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 is essential in order that it can be utilized safely and correctly in this country

4 Classification of appliances

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

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 the gas used in this standard.

Table 1 — Classification of gases

Gas family	**Gas Group**	**Gross Wobbe index at 15 °C and 1 013,25 mbar** MJ/m³	
		Minimum	Maximum
First family	A	22,4	24,8
Second family		39,1	54,7
	H	45,7	54,7
	L	39,1	44,8
	E	40,9	54,7
Third family		72,9	87,3
	B/P	72,9	87,3
	P	72,9	76,8
	B	81,8	87,3

4.2 Classification according to the gases capable of being used

4.2.1 Category I

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

a) 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).

b) 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 pressures;

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

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

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

c) 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 the gases of third family gases (propane and butane) and operating with a pressure couple without adjustment of the appliance. However for certain types of appliance specified in the particular standards 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;

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

4.2.2 Category II

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

a) 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}.

b) 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 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 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 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}.

4.2.3 Category III

Appliances of category III are designed for use on gases of three families.

This category is not in general use.

Categories III appliances which are in use in certain countries are given in Annex A (see A.3).

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

4.3.1 General

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

4.3.2 Type A

An appliance not intended for connection to a flue or to a device for evacuation of the products of combustion to the outside of the room in which the appliance is installed.

This standard applies to:

a) Type A_1: a Type A appliance without a fan.

5 Constructional requirements

5.1 General

5.1.1 Conversion to different gases

The only acceptable operations when converting from a gas of one group or family to a gas of another group or family and/or to adapt to different gas distribution pressures are given below for each category.

It is recommended that these operations should be possible without disconnecting the appliance.

5.1.1.1 Category I

a) **Categories I_{2H}, I_{2L}, I_{2E}, I_{2E+}:** no modification to the appliance;

b) **Category $I_{3B/P}$:** no modification to the appliance;

c) **Category I_{3+}:** replacement of injectors or calibrated orifices and primary adjusters but only in order to convert from one pressure couple to another (e.g. 28 - 30/37 mbar to 50/67 mbar);

d) **Category I_{3P}:** no modification to the appliance relative to a change of gas. For a change of pressure, replacement of injectors and adjustment of gas rates.

5.1.1.2 Category II

5.1.1.2.1 Categories of appliance designed for use with gases of the first and second families

Adjustment of the gas rate with, if necessary, a change of injector, restrictor or regulator.

Adjustment of the gas rate of the ignition burner(s), either by using an adjuster or by a change of injector or restrictor and, if necessary, a change of the complete ignition burner(s) or of some of its/their parts.

A change, if necessary, of the automatic shut-off valves(s).

Putting the regulator out of service under the conditions of 5.2.5.

Putting the gas rate adjuster(s) out of service under the conditions of 5.2.2.

The adjustments or component changes are only acceptable when converting from a gas of the first family to a gas of the second family or vice versa.

5.1.1.2.2 Categories of appliance designed for use with gases of the second and third families

Adjustment of the gas rate with, if necessary, a change of injector, restrictor or regulator.

Adjustment of the gas rate of the ignition burner(s), either by using an adjuster or by a change of injector or restrictor and, if necessary, a change of the complete ignition burner(s) or of some of its/their parts.

A change, if necessary, of the automatic shut-off valves(s).

Adjustment of the low pressure cut-off, if any.

Putting the regulator out of service under the conditions of 5.2.5.

Putting the gas rate adjuster(s) out of service under the conditions given in 5.2.2.

The adjustments or component changes are only acceptable when:

a) converting from a gas of the second family to a gas of the third family or vice versa;

b) converting from one butane/propane pressure couple to another, e.g. 28 - 30 /37 mbar <=> 50/67 mbar.

5.1.1.3 Category III

Category III appliances that are permitted in certain countries are given in Annex A.

5.1.2 Materials and method of construction

The quality and thickness of materials used in the construction of an appliance shall be:

a) such that the construction and performance characteristics are not altered so as to affect the safe operation of the appliance in normal conditions of use and of maintenance by the user;

b) such as to ensure a reasonable operating life.

In particular, when the appliance is installed according to the manufacturer's instructions, all the components shall withstand the mechanical, chemical and thermal conditions to which they may be subjected when used in a manner which can be reasonably foreseen.

Copper shall not be used for gas-carrying parts where the temperature is likely to exceed 100 °C.

Asbestos or materials containing asbestos shall not be used.

Solder that has a melting point below 450 °C after application shall not be used for gas-carrying parts.

5.1.3 Accessibility for maintenance and use

Components and controls shall be arranged such that they are readily accessible for adjustment, maintenance or exchange. Where necessary, access doors or removable panels shall be provided.

Parts that are intended to be removed for maintenance or cleaning shall be readily accessible, shall be simple to assemble correctly and difficult to assemble incorrectly. Such parts shall be difficult to assemble incorrectly where incorrect assembly would create a hazardous condition or result in damage to the appliance and its controls.

Parts of the appliance which are not intended to be removed by the user and for which removal would affect safety shall be capable of removal only with the aid of tools.

5.1.4 Means of sealing the gas circuit

Holes for screws, studs, etc. intended for the assembly of components shall not open into the gasways. The wall thickness between holes (including threads) and gasways shall be not less than 1 mm.

The soundness of components and assemblies connected to the gas circuit and likely to be dismantled for routine maintenance at the consumer's premises shall be ensured by means of mechanical joints (e.g. metal to metal joints, O-ring joints or packing) but excluding the use of any sealing compound (e.g. tape, mastic or paste). The soundness shall be maintained after dismantling and re-assembly.

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

5.1.5 Supply of combustion air and evacuation of combustion products

5.1.5.1 Air inlets

The cross-sectional area of the inlet air passageway(s) shall not be adjustable.

5.1.5.2 Appliance outlet

The cross-sectional area of the combustion circuit shall not be adjustable. Any outlet for products of combustion shall be so designed and arranged that it is protected against inadvertent blockage.

5.1.6 Inlet connection

The inlet connection shall be one of the following types:

a) a thread conforming to EN ISO 228-1:2003 In this case the end of the gas inlet connection shall have a flat annular surface at least 3 mm wide for thread sizes ½ and ⅜ and at least 2,5 mm wide for thread size ¼, to allow the interposition of a sealing washer. Moreover, when the end of the gas inlet connection has a thread of nominal size ½, 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 EN 10226-1:2004 or EN 10226-2:2005;

c) a compression fitting suitable for copper tube conforming to EN 1057:2006;

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 flange to ISO 7005-1:1992, ISO 7005-2:1988 or ISO 7005-3:1988.

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

The gas inlet connection shall be so secured that connections to the gas supply can be made without disturbing any controls or gas-carrying components of the appliance.

Appliances shall be provided with adequate means of support or suspension other than the gas supply pipe.

5.1.7 Confirmation of operation

Means shall be provided to allow observation of any ignition burner flame during commissioning and servicing.

It shall at all times be possible for the user to ascertain visually whether the appliance is in operation or whether the main burner has been extinguished.

5.1.8 Electrical equipment

The electrical equipment of the appliance shall be so designed and constructed as to obviate hazards of electrical origin and shall comply with the requirements of EN 60335-2-102:2006 which cover such hazards.

If the appliance is fitted with electronic components or electronic systems providing a safety function, these shall comply with the relevant requirements of EN 298:2003 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:

a) to give the degree of personal protection against contact with dangerous electrical components inside the appliance case;

b) to give the degree of electrical protection, inside the appliance case, against harmful actions due to water penetration.

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

Interruption and subsequent restoration of the electricity supply at any time during the starting up or operation of the appliance shall result in:

a) continued safe operation; or

b) closure of the main burner gas valve; or

c) volatile or non-volatile lock-out where the appliance is fitted with an automatic burner control system; or

d) safety shut-down followed by automatic recycling.

Interruption and subsequent restoration of the electricity supply shall not override any “lock-out” condition except where the appliance is intended to be reset by means of switching off and on the electricity supply to the appliance, e.g. volatile lock-out. Such resetting shall only be possible if any interruption and subsequent restoration of the electricity supply cannot give rise to a hazardous appliance condition.

NOTE Requirements relating to the continued and safe operation of the appliance in the event of normal and abnormal fluctuation of auxiliary energy are specified in 6.7.2.

5.2 Requirements for adjusting, control and safety devices

5.2.1 General

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

The appliance shall not incorporate any controls which need to be manipulated by the user when the appliance is in normal operation.

5.2.2 Gas rate adjusters

Gas rate adjusters shall be pre-set and sealed by the manufacturer in the positions appropriate for the gas and pressure for which the appliance has been adjusted.

The instructions for conversion to different gases shall specify that all the sealing devices shall be restored after the gas conversion operations.

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

Appliances in category II_{1a2H} shall have a gas rate adjuster for the first family of gases.

For appliances in category II_{2H3+} having a gas rate adjuster, it shall be possible to put these devices out of service when these appliances are supplied with a third family gas. This also applies to 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 5.2.5) when these appliances are supplied with a second family gas.

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

5.2.3 Range-rating devices

A range-rating device on an appliance is optional.

For appliances on category II $_{1a2H}$ the gas rate adjuster and the range-rating device may be one and the same. However, if the gas rate adjuster has to be sealed, either completely or partially, when the appliance is supplied with a second family gas, the gas rate adjuster or its sealed part shall be no longer be used by the installer as a range-rating device.

5.2.4 Primary aeration adjusters

Primary aeration adjusters shall be pre-set and sealed by the manufacturer in the positions appropriate for the gas for which the appliance has been adjusted.

The instructions for conversion to different gases shall specify that all sealing devices shall be restored after the gas conversion operations.

5.2.5 Controls and safety devices

5.2.5.1 General

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

The appliance shall not incorporate any controls which need to be manipulated by the user when the main burner is in normal operation.

This requirement shall not apply to controls which have to be manipulated in order to ignite the ignition burner.

5.2.5.2 Manual controls

Manual valves, push buttons or electrical switches that are essential for normal operation and commissioning of the appliance shall either be provided with the appliance or be specified in the manufacturer's installation instructions.

Where the operation of the main burner is normally controlled by a manual valve, the means of operating the valve shall be readily accessible to the user from floor level.

If the appliance is intended for ON/OFF operation only the manual means of operation shall be clearly marked.

5.2.5.3 Manual valves

Any manual valve shall be of the 90^{o} turn type unless it is incorporated in a flame supervision device.

Manual valves shall be so designed or positioned as to prevent inadvertent operation but shall be easy to operate when required. They shall be so designed that in operation the OPEN and CLOSED positions are readily distinguishable.

When a manual valve is provided at the inlet of the appliance, it shall be capable of operating at a pressure equal to 1,5 times the maximum supply pressure and shall be readily accessible.

Manual valves used solely for OPEN/CLOSED operation shall be provided with positive stops at the OPEN and CLOSED positions.

5.2.6 Regulators

Regulators shall comply with EN 88-1:2007.

The gas supply to the burner and any ignition burner shall be under the control of a regulator fitted in the appliance gas circuit upstream of the automatic shut-off valve(s) unless the regulator is incorporated in a multifunctional control.

The design and accessibility of the regulator 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.

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

5.2.7 Flame supervision devices

The appliance shall incorporate a flame supervision device.

Thermo-electric flame supervision devices shall comply with EN 125:1991.

Electronic flame supervision devices shall comply with EN 298:2003 except that the device shall have a flame ionization current of at least $0{,}2 \times 10^{-6}$ amperes.

NOTE The amperage requirement would cater for those appliances which use first family gases.

5.2.8 Multifunctional controls

Multifunctional controls shall comply with EN 126:2004.

5.2.9 Automatic shut-off valves

Automatic shut-off valves shall comply with EN 161:2007.

Unless the appliance is fitted with a thermo-electric flame supervision device the gas supply to the main burner shall be under the control of at least one automatic shut-off valve connected in the gas circuit of either Class A or Class B capability.

The start gas supply shall be under the control of at least one automatic shut-off valve of either Class A, Class B, Class C or Class D capability.

5.2.10 Gas strainers

A strainer shall be fitted at the inlet of any gas circuit incorporating an automatic shut-off valve(s) to prevent the ingress of foreign matter. The strainer may be integral with the upstream automatic shut-off valve. The maximum strainer hole dimension shall not be greater than 1,5 mm and the mesh shall not permit a 1 mm pin gauge to pass through it.

In gas circuits incorporating more than one automatic shut-off valve only one strainer needs to be fitted, provided it gives adequate protection to all valves.

For valves incorporating a shearing action (self-cleaning) the strainer may be omitted.

Where a regulator is fitted upstream of the automatic shut-off valve(s) the strainer may be fitted upstream of the regulator.

5.2.11 Automatic burner control system

5.2.11.1 General

Where an appliance is fitted with an automatic burner control system it shall comply with EN 298:2003.

5.2.11.2 Manually operated devices

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

Under the test conditions described in 7.2.4.4 the rapid (on and off) operation of any start switch shall not set up a hazardous condition.

5.2.11.3 Flame detector

The flame detector shall incorporate a means to prevent the energization of any gas valve and of the ignition device if a flame or flame simulating condition is present during the start-up period.

Upon flame failure in the running condition the flame detector shall cause one of the following:

a) non-volatile lock-out; or

b) volatile lock-out; or

c) one of the following provided that such action cannot give rise to a hazardous condition

    1) safety shut-down followed by automatic recycling; or

    2) spark restoration.

Where a spark restoration system is used, the time allowed before the automatic shut-off valve(s) closes may be extended to permit the re-ignition attempt, but this extended time shall not exceed the first safety time.

5.2.11.4 Ignition burner flame establishment

The main gas automatic shut-off valve(s) shall not be energized to admit the main gas flow to the main burner until after the ignition burner flame has been detected.

5.2.11.5 Direct main burner flame establishment

The ignition spark (or other means of ignition e.g. hot surface igniter) shall be de-energized at or before the end of the safety time.

The main burner valve(s) shall not be energized before the ignition spark (or other means of ignition) is energized. If the main burner flame is not detected by the end of the second safety time, volatile or non-volatile lock-out shall result.

5.2.11.6 Safety shut-down

The flame detector shall affect closure of all automatic shut-off valves.

5.3 Ignition devices

5.3.1 General

5.3.1.1 Appliances with manually ignited ignition burners

There shall be ready access for lighting the ignition burner.

5.3.1.2 Appliances with automatic ignition

When the appliance is installed in accordance with the manufacturer's instructions it shall be possible to light the appliance from an easily accessible position by means of an electrical or other convenient ignition device incorporated in the appliance.

Ignition burners and ignition devices shall be protected by design and position against diminution or extinction resulting from e.g. draughts, products of combustion, overheating, condensation, corrosion or matter falling from above.

Ignition burners, ignition devices and their mountings shall be so designed that they can only be located rigidly and correctly in relation to every component and burner with which they are designed to operate.

5.3.2 Ignition device for the main burner

The main burner shall be fitted with an ignition burner or other automatic ignition device for direct ignition.

Where the heat input is 6 kW or less the main burner may be ignited directly by manual means, provided that the main flame is supervised.

5.3.3 Ignition burners

If different ignition burners are used when the appliance is converted from one gas to another, they shall be marked, easy to substitute for one another and easy to fit. The same applies to injectors where only they have to be changed. Injectors shall carry an indelible means of identification and shall only be removable with the aid of a tool.

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

5.4 Main burner

The cross-sectional area of the flame ports shall not be adjustable.

The burner shall be so located and arranged that misalignment cannot occur. It shall not be possible to remove the main burner assembly without the use of tools.

5.5 Pressure test points

The appliance shall be fitted with at least two pressure test points. One shall be fitted upstream of the first control and safety device and the other downstream of the last gas flow rate control and in a position carefully selected so as to permit measurements to be made.

For appliances burning only third family gases not fitted with a regulator a single test pressure point may be fitted.

The test points shall have an external diameter of ($9_{-0,5}^{0}$) mm and a useful length of at least 10 mm to permit ready connection to a pressure measuring device. The minimum diameter of the bore shall not exceed 1 mm.

5.6 Injectors

Injectors and removable restrictors shall carry an indelible means of identification. It shall be possible to change injectors and restrictors without having to move the appliance from its installed position. However, injectors shall only be removable with the aid of a tool.

6 Operational requirements

6.1 Soundness of the gas circuit

The gas circuit shall be sound. It is deemed to be sound if, under the conditions described in 7.2.1.1, 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 Heat inputs

6.2.1 Nominal heat input

When measured under the test conditions described in 7.2.2.2, the heat input obtained at the normal pressure shall be within ± 5 % of the nominal heat input.

6.2.2 Ignition burner heat input

When measured under the test conditions described in 7.2.2.3 the heat input obtained at normal pressure shall be within ± 5 % of the ignition burner heat input declared by the manufacturer.

However this tolerance is extended to ± 10 % where the injector has a diameter of 0,5 mm or less.

Where the ignition burner supply is under the control of a single automatic shut-off valve, the heat input at the time of ignition shall not exceed 0,25 kW for permanent ignition burners, and 0,5 kW for other types of ignition burner.

6.2.3 Effectiveness of the range-rating device

For appliances fitted with a range-rating device distinct from a gas rate adjuster, it is checked under the conditions described in 7.2.2.4 that:

a) with the range-rating device in the position giving the maximum rate, the nominal heat input is obtained to within ± 5 %; and

b) with the range-rating device in the position giving the minimum rate, the heat input is within ± 5 % of the minimum heat input stated by the manufacturer; and

c) for appliances burning third family gases, with the range-rating device in the position giving the maximum rate; the rate obtained shall be that with the device wide open and operative.

6.3 Limiting temperatures

6.3.1 Wall and ceiling temperatures

When the appliance is tested under the conditions described in 7.2.3.1, the wall and ceiling temperatures shall not exceed the ambient temperature by more than 50 K.

6.3.2 Component temperatures

When the appliance is tested under the test conditions described in 7.2.3.2, the maximum temperature of the specified appliance components shall not exceed the maximum temperature specified by the component manufacturer.

6.4 Ignition, cross-lighting and flame stability

6.4.1 Still air conditions

6.4.1.1 Ignition and cross-lighting

Under the test conditions described in 7.2.4.1.1, correct and smooth ignition and cross-lighting shall be assured.

When the gas rate of any ignition burner is reduced under the test conditions described in 7.2.4.1.2 to the minimum required to hold open the gas supply to the main burner, correct and smooth ignition of the main burner shall occur without undue noise.

Under the test conditions described in 7.2.4.1.3 ignition of any ignition burner, or the main burner where this is ignited directly, shall be safe and without undue noise when ignition is delayed by up to 50 % longer than the safety time declared by the manufacturer.

The appliance shall not sustain any damage likely to affect its safe operation.

6.4.1.2 Flame stability

Under the test conditions described in 7.2.4.2 the flames shall be stable. A slight tendency to lift at the moment of ignition is acceptable but the flame shall be stable in normal operation.

6.4.2 Effect of room draughts

6.4.2.1 Flame stability

The main burner and ignition burner flames shall be stable under the test conditions described in 7.2.4.3. The ignition burner shall remain stable at its nominal rate both on its own and with the main burner alight.

6.4.2.2 Ignition and cross-lighting

Under the test conditions described in 7.2.4.3 correct ignition and cross-lighting shall be ensured.

6.4.3 Manually operated devices

Under the test conditions described in 7.2.4.4 the operation of the appliance shall be safe.

6.5 Flame supervision devices

6.5.1 Thermo-electric devices

Under the test conditions described in 7.2.5.2 the ignition opening time shall not exceed 30 s. This time may be increased to 60 s in the case of automatic ignition.

The extinction safety time shall not exceed 60 s.

6.5.2 Electronic devices

Under the test conditions described in 7.2.5.3 the safety time shall not exceed 30 s.

Under the test conditions described in 7.2.5.4 the extinction safety time shall not exceed 2 s.

6.6 Pressure regulator

When tested in accordance with the conditions given in 7.2.6 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 initial rate obtained under those conditions.

6.7 Combustion

6.7.1 Still air conditions

When tested as described in 7.2.7.2:

a) Test No. 1: the carbon monoxide concentration of the dry, air-free products of combustion shall not exceed 0,1 %;

b) Test No. 2: the carbon monoxide concentration of the dry, air-free products of combustion shall not exceed 0,2 %;

c) Test No. 3: the carbon monoxide concentration of the dry, air-free products of combustion shall not exceed 0,2 %.

6.7.2 Auxiliary energy variations

When supplied with reference gas at normal pressure and the supply voltage is varied under the test conditions described in 7.2.7.3, the appliance shall continue to operate and the carbon monoxide concentration of the dry, air-free products of combustion shall not exceed 0,2 %.

Under these conditions, it shall be verified that the appliance ignites and continues to operate.

6.8 Prolonged performance

After the appliance has been tested under the conditions described in 7.2.8 it shall comply with the following:

a) there shall be no significant deposition of soot. Neither shall there be any appreciable distortion or disturbance of the flames when the appliance is tested in accordance with 6.7.1.1;

b) there shall be no breakdown or distortion in any part of the appliance that could affect its safety;

c) there shall be no significant deterioration in the external surface of the burner;

d) there shall be no signs of other corrosion caused by condensation or other factors that will adversely affect the life of the appliance;

e) there shall be no sign of leakage from the flue connections in the case of Type B_{11} appliance;

f) the heat input shall be within ± 5 % of the nominal heat input.

6.9 Measurement of oxides of Nitrogen, NO_x

The manufacturer shall declare the NO_x class in Table 2 that is applicable to the appliance.

When measured in accordance with the method of test given in 7.3.1, the NO_x concentration(s) in the dry, air free products of combustion shall be such that the weighted NO_x value, determined as appropriate in accordance with 7.3.2, does not exceed the maximum NO_x class declared by the manufacturer.

Table 2 — NO_x classes

NO_x classes	**Maximum NO_x concentration** mg/kWh
1	260
2	200
3	150
4	100

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 different 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 for which it is designed and for the pressure for which it is designed, if necessary using the adjusting devices.

The test gases, test pressures and appliance categories given in this standard are in accordance with those specified in EN 437:2003.

The characteristics of the reference and limit gases are given in Tables 4 and 5. The values in Table 4, measured and expressed at 15 °C, are derived from EN ISO 6976:2005.

7.1.2 Conditions for preparation of the test gases

The composition of the gases used for the tests shall be as close as possible to that given in Table 4. For the preparation of these gases, the following rules shall be observed:

a) the corresponding test the Wobbe index of the gas used shall be within ± 2 % of the value indicated in Table 4 for gas (this tolerance includes the error due to measuring instruments);

b) the constituents used for the preparation of the mixtures shall have at least the purity shown in Table 3.

Table 3 — Test gas purity

Gas	Purity %
Nitrogen (N_2)	99
Hydrogen (H_2)	99
Methane (CH_4)	95[a)]
Propene (C_3H_6)	95
Propane (C_3H_8)	95
Butane[3] (C_4H_{10})	95

a) With a total concentration of H_2, CO, and O_2 below 1 % and a total concentration of N_2 and CO_2 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 made from components satisfying the conditions of Table 3. 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 second family:

c) for the tests carried out with reference gases G 20 or G 25, a gas belonging respectively to either Group H or Group 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 Table 4 for the corresponding reference gas.

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

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

2) 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) 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 4 for the corresponding limit gas and the hydrogen content of the final mixture shall be as given in Table 4 .

[3] Any mixture of iso/n butane can be used.

Table 4 — Characteristics of the test gases [a] (gas dry at 15 °C and 1 013,25 mbar)

Gas family and group	Test gases	Designation	Composition volume %	W_i MJ/m³	H_i MJ/m³	W_s MJ/m³	H_s MJ/m³	d
Gases of the first family [b]								
Group A	Reference gas Incomplete Combustion flame lift and sooting limit gases	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 and light-back limit gas	G 25	CH_4 = 86 N_2 = 14	37,38	29,25	41,52	32,49	0,612
	Incomplete combustion and 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 and 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 231	CH_4 = 85 N_2 = 15	36,82	28,91	40,90	32,11	0,617
Gases of the third family [c]								
Third family and groups 3B/P and 3B	Reference gas, incomplete combustion and sooting limit gas	G 30	nC_4H_{10} = 50 iC_4H_{10} = 50	80,58	116,09	87,33	125,81	2,075
	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, incomplete combustion, sooting [d] and flame lift limit gas	G 31	C_3H_8 = 100	70,69	88,00	76,84	95,65	1,550
	Light-back and sooting limit gas [d]	G 32	C_3H_6 = 100	68,14	82,78	72,86	88,52	1,476

[a] For gases used nationally or locally, see A.4.
[b] For other groups, see A.4.
[c] See also Table 3.
[d] See 7.1.2 footnote 3).

Table 5 — Calorific values 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 7.2.2, 7.2.3, 7.2.4, and 7.2.7 shall be as specified in 7.1.1 and made up in accordance with 7.1.2.

For those 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 4 and in accordance with 7.1.5.1 are used. The selected gases, for each appliance category, are listed in Table 6.

Table 6 — 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
I_{3B}	G 30	G 30	G 32	G 31	G 30
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
$II_{2E3B/P}$ $II_{2E+3B/P}$ 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.					

7.1.3.2 Conditions of supply and adjustment of the appliance

7.1.3.2.1 Initial adjustment of appliance

Before all the required tests are carried out, the appliance shall be fitted with the appropriate equipment (injector(s)) corresponding to the gas family or gas group to which the specified test gas belongs (see Table 4). Any gas rate adjuster(s) are set in accordance with the manufacturer's instructions using the appropriate reference gas(es) (see 7.1.5.1) 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 shall not be altered.

7.1.3.2.3 Adjustment of heat inputs

For tests requiring adjustment of the burner to the nominal heat input and/or any other heat input specified by the manufacturer, it shall be ensured that the pressure upstream of the injector(s) is such that the heat input obtained is within ± 2 % of that specified (by altering the pre-set adjuster(s) or the appliance regulator, if adjustable, or the appliance supply pressure).

The specified heat input shall be determined in accordance with 7.2.2 and with the appliance supplied with the appropriate reference gas(es).

7.1.3.2.4 Corrected pressures

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

The corrected test pressures are calculated using Equation (1):

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

where:

p_n is the normal test pressure;

p_{min} is the minimum test pressure;

p_{max} is the maximum test pressure;

p is the appliance inlet pressure;

p'_{min} is the corrected minimum test pressure;

p'_{max} is the corrected maximum test pressure.

7.1.3.2.5 Test pressures

The test pressures, i.e. the pressures required at the gas inlet connection of the appliance, are given in Tables 7 and 8.

These pressures and the corresponding injectors are used in accordance with the national conditions given in Annex A, for the country in which the appliance is to be installed (see Annexes D and G).

In certain circumstances the appliance manufacturer may specify a normal pressure at the appliance inlet other than that given in Tables 7 and 8. In these cases the alternative pressure and corresponding injector(s) are used for testing the appliance and the values of p_{min} and p_{max} are determined in accordance with 7.1.3.2.4.

Table 7 — Test pressures where no pressure couple exists [a)]

Appliance categories having as index	Test gas	p_n mbar	p_{min} mbar	p_{max} mbar
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 [b)]	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
Third family: 3B [c)]	G 30, G 31 G 32	29 [b)]	20	35

[a)] For test pressures corresponding to gases distributed nationally or locally, refer to Table A.5
[b)] Appliances of this category may be used, without adjustment, at the specified supply pressures of 28 mbar to 30 mbar.
[c)] The tests with G 31 and G 32 are carried out at the normal pressure only (p_n = 29 mbar), these test gases being more severe than any gas of Group 3B. This condition covers the normal variations in the gas supply.

Table 8 — Test pressures where a pressure couple exists

Appliance categories having as index	Test gas	p_n mbar	p_{min} mbar	p_{max} mbar
Second family: 2E+	G 20, G 21 G 222	20	17 [b]	25
	G 231	(25) [a]	17 [b]	30
Third family: 3+ (28 - 30/37 couple)	G 30	29 [c]	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
Third family: 3+ (112/148 couple)	G 30	112	60	140
	G 31, G 32	148	100	180

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

[b] See Annex D.

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

7.1.4 Test procedures

7.1.4.1 Tests requiring the use of reference gas

The tests described in clauses 7.2.2, 7.2.4 and 7.2.7 shall be carried out with each of the reference gases appropriate to the country in which the appliance is to be installed, according to the information given in Annex A.

The other tests are carried out with only one of the reference gases of the appliance category (see 7.1.1) at one of the normal test pressures given in 7.1.4 for the selected reference gas, hereafter referred to as “the reference gas”.

However, the test pressure shall be one of those stated by the manufacturer and the appliance shall be fitted with the appropriate injector(s).

7.1.4.2 Tests requiring the use of the limit gases

These tests shall be carried out with the limit gases appropriate to the appliance category (see Table 6) and with the injector(s) and adjustment(s) corresponding to the reference gas of the group, or family, to which each limit gas belongs.

7.1.5 General test conditions

7.1.5.1 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 permitted provided that the test results are not affected.

7.1.5.2 Test installation

The appliance shall be installed in accordance with the manufacturer’s instructions, with particular reference to minimum declared clearances round the appliance.

However, 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.

7.1.5.3 Influence of thermostats

Precautions shall be taken to prevent thermostats or other controls from operating and affecting the gas rate, unless such operation is necessary for the test.

7.1.5.4 Electrical supply

The appliance is connected to an electrical supply at the nominal voltage, except where otherwise stated.

7.1.5.5 Range-rated appliances

For appliances that are designed to be range-rated, all tests are carried out at their maximum and minimum nominal heat inputs.

7.2 Safety of operation

7.2.1 Soundness of the gas circuit

For appliances using first and/or second family gases only, the tests are carried out with an air inlet pressure of 50 mbar except that 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. However, if the appliance is designed to use third family gases at the 112 mbar/148 mbar pressure couple, the tests are carried out at a pressure of 220 mbar. Any regulator may be locked in its maximum open position to avoid damage.

Verify compliance with 6.1 when:

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

b) all gas valves are open and the injector(s) for any ignition burner and the main burner are sealed.

If the gas outlet of the ignition burner cannot be sealed, the 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 when it is operating at its normal working pressure.

For the determination of the leakage rate a volumetric method is used which is of such accuracy that the error in its determination does not exceed 0,01 dm^3/h.

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

7.2.2 Heat inputs

7.2.2.1 General

For the purposes of this standard all heat inputs are determined from the volumetric flow rate (V_o) or mass flow rate (M_o) which relate to the rate obtained with reference gas under reference test

conditions (dry gas, 15 °C, 1 013,25 mbar). The heat input (Q_o), in kilowatts (kW), is based on the net and the gross calorific value [4)] and is given by Equation (2) or (3)

$$Q_o = 0{,}278 M_o H_i \text{ (or } H_s) \quad (2)$$

$$Q_o = 0{,}278 V_o H_i \text{ (or } H_s) \quad (3)$$

where:

M_o is the mass flow rate, in kilograms per hour, obtained at reference conditions;

V_o is the volumetric flow rate, in cubic metres per hour, obtained at reference conditions;

H_i is the net calorific value of the reference gas, in mj/kg in Equation (2) or mj/m^3 (dry gas, 15 °C, 1 013,25 mbar) in Equation (3);

H_s is the gross calorific value of the reference gas, in mj/kg in Equation (2), or mj/m^3 (dry gas, 15 °C, 1 013,25 mbar) in Equation (3).

The mass and volumetric flow rates correspond to a measurement and to a flow of reference gas, under reference conditions, in other words assuming the gas to be dry, at 15 °C and under a pressure of 1 013,25 mbar. In practice, the values obtained during the tests do not correspond to these reference conditions so they shall then be corrected so as to bring them to the values that would actually have been obtained if these reference conditions had existed at the injector outlet during the test.

If the corrected mass flow rate (M_o) is determined using the mass flow rate (M), Equation (4) is used:

$$M_0 = M\sqrt{\frac{1013{,}25 + p}{p_a + p} \times \frac{273 + t_g}{288} \times \frac{d_r}{d}} \quad (4)$$

where:

M_o is the corrected mass flow rate (kg/h), obtained under test conditions;

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

p_a is the atmospheric pressure (mbar);

p is the gas supply pressure (mbar);

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

G 110:	gross value =	1,14 × net value
G 120:	gross value =	1,13 × net value
G 20:	gross value =	1,11 × net value
G 25:	gross value =	1,11 × net value
G 30:	gross value =	1,08 × net value
G 31:	gross value =	1,09 × net value

t_g is the temperature of the gas at the measuring point (°C);

d is the density of dry gas relative to dry air;

d_r is the density of the reference gas relative to dry air.

If the corrected volumetric flow rate (V_o) is determined using the volumetric flow rate (V), Equation (5) is used:

$$V_0 = V\sqrt{\frac{1013,25+p}{1013,25}\times\frac{p_a+p}{1013,25}\times\frac{288}{273+t_g}\times\frac{d}{d_r}} \quad (5)$$

where:

V_o is the corrected volumetric flow rate (m^3/h), under reference conditions;

V is the volumetric flow rate (m^3/h), obtained under test conditions;

p_a is the atmospheric pressure (mbar);

p is the gas supply pressure (mbar);

t_g is the temperature of the gas at the measuring point (°C);

d is the density of dry gas relative to dry air;

d_r is the density of the reference gas relative to dry air.

The corrected mass flow rate (M_o), under reference conditions is calculated using Equation (6).

$$M_0 = 1,226\ V_0 \times d \quad (6)$$

where:

M_o is the corrected mass flow rate (kg/h), obtained under test conditions;

V_o is the corrected volumetric flow rate (m^3/h), under reference conditions;

d is the density of dry gas relative to dry air.

Equations (5) and (6) are used to calculate, from the mass flow rate (M) or volumetric flow rate (V) measured during the test, the corresponding corrected flow rates M_o or V_o which would have been obtained under the reference conditions.

Equations (5) and (6) are applicable if the test gas used is dry.

If a wet meter is used or if the gas used is saturated, the value d is replaced by the value of the density of the wet gas (d_h) and is given by Equation (7).

$$d_h = \frac{d(p_a+p-p_w)+0,622+p_w}{p_a+p} \quad (7)$$

where:

d_h is the density of the wet gas relative to dry air;

d is the density of dry gas relative to dry air;

p is the gas supply pressure (mbar);

p_a is the atmospheric pressure (mbar);

p_w is the saturation vapour pressure of the test gas (mbar) at temperature t_g.

7.2.2.2 Nominal heat input

The tests are carried out at the normal pressure p_n specified by the manufacturer in accordance with the requirements of 7.1.4.

The appliance is fitted successively with each of the prescribed injectors and adjusted in accordance with 7.1.3.2.1. The heat input is determined as described in 7.2.2.1 for each reference gas.

The measurements are taken with the appliance at thermal equilibrium and with any thermostat put out of action.

The heat input, Q_o, obtained is compared with the nominal heat input, Q_n, declared by the manufacturer in order to verify compliance with 6.2.1.

7.2.2.3 Ignition burner heat input

The tests are carried out at the pressure specified by the manufacturer in accordance with the test pressures given in 7.1.4, using an arrangement which allows operation of the ignition burner on its own.

The appliance is fitted successively with each of the prescribed injectors and adjusted in accordance with 7.1.3.2.1. The heat input is determined as described in 7.2.2.1 for each reference gas.

The measurements are taken immediately after ignition of the ignition burner flame.

The heat input obtained is compared with the ignition burner heat input declared by the manufacturer in order to verify compliance with 6.2.2.

7.2.2.4 Effectiveness of the range-rating device

The tests are carried out as described in 7.2.2.1 for the two extremes of the range-rating device.

7.2.3 Limiting temperatures

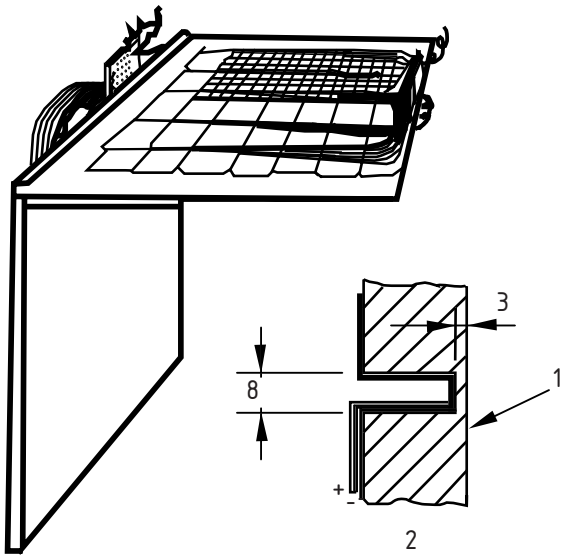
7.2.3.1 Wall and ceiling temperatures

7.2.3.1.1 Apparatus

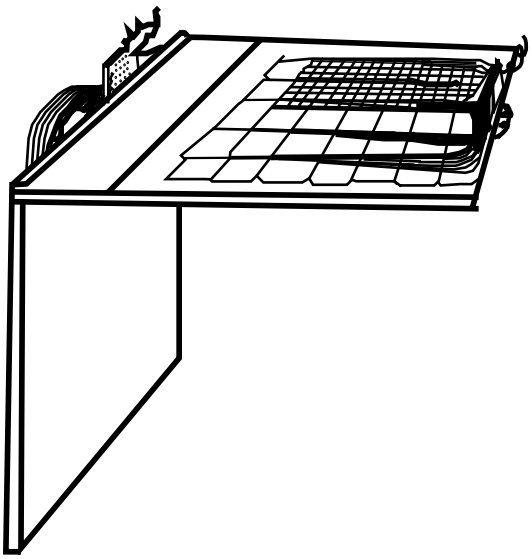
The apparatus consists of a vertical wooden wall and horizontal ceiling board. The vertical wall is at least 1 200 mm in height and at least 1 200 mm in width. The ceiling board is 1 200 mm in depth and of a similar width to that of the wall. The wall and ceiling are both 25 mm thick wood painted dull black.

For wall mounted appliances the ceiling board is arranged such that one edge is against the face of the wall (see Figure 1 a).

This arrangement may not be suitable for other installations (e.g. ceiling suspension) if a large horizontal clearance is specified by the manufacturer. In this case a 25 mm thick wooden panel may be required to fill the gap between the ceiling board and the wall (see Figure 1 b).



a) Arrangement for wall mounted appliances



b) Arrangement for installations with large horizontal clearances

Key
1 Face of wall
2 Section at thermocouple

Figure 1 — Arrangement for measuring wall and ceiling temperatures

Thermocouples are embedded in each board at 100 mm centres. The thermocouples enter the board on the side remote from the appliance, the junctions being fixed 3 mm from the surface of the wood adjacent to the appliance.

7.2.3.1.2 Procedure

Install the appliance on the apparatus in accordance with the manufacturer's instructions regarding clearances (see 8.2.2.1).

If the appliance is too long to allow the measurement of wall and ceiling temperatures for the appliance as a whole, the test is carried out with the apparatus positioned adjacent to the part(s) of the appliance producing the maximum heating effect.

If the manufacturer specifies a large horizontal clearance the ceiling board shall be positioned centrally over the part(s) of the appliance producing the maximum heating effect. Any gap between the ceiling board and the wall shall be filled in as shown in Figure 1 b).

Where the manufacturer's instructions specify alternative installation arrangements (e.g. wall mounting, ceiling suspension) repeat the test with the appliance fitted to the apparatus accordingly.

The appliance is supplied with one of the reference gases indicated in 7.1.1 according to its category and adjusted in accordance with 7.1.3.2.1.

The test is carried out with the appliance operating at its nominal heat input. All the measurements are taken when thermal equilibrium has been reached. It is recommended that for this test the appliance should be placed in a room where the ambient temperature is approximately 20 °C.

7.2.3.2 Component temperatures

Component temperatures are measured when thermal equilibrium has been reached in the test described in 7.2.3.1.2.

The component temperatures are measured by a method which is accurate to within ± 2 °C.

However, if an electrical component is itself likely to cause a rise in temperature (e.g. automatic shut-off valves) the temperature of the component is not measured.

In this case, thermocouples are placed so as to measure the air temperature around the device.

The temperature measurements of the components are deemed to be satisfactory if the requirements of Equation (8) are met:

$$t_{measured} \leq (t_{max} + t_{ambient}) - 25\ °C \qquad (8)$$

where:

$t_{measured}$ is the maximum temperature (°C) measured in the test;

t_{max} is the maximum temperature (°C) specified by the component manufacturer;

$t_{ambient}$ is the ambient room temperature (°C).

7.2.4 Ignition, cross-lighting and flame stability

7.2.4.1 Ignition and cross-lighting

7.2.4.1.1 Tests with all gases

These tests are carried out both with the installation cold and with the installation at thermal equilibrium under still air conditions in accordance with 7.1.6.2.

The appliance is initially adjusted in accordance with 7.1.3.2.1 and the tests shown in 7.2.4.1.1a) to c) are carried out:

a) Test 1

The appliance is supplied with the appropriate reference and limit gases (see Table 4) at the normal pressure given in 7.1.4.

Under these conditions it is checked that ignition of the main burner or the ignition burner (if fitted) occurs correctly and that ignition of the main burner by the ignition burner as well as cross-lighting of the various parts of the burner occurs correctly.

b) Test 2

For this test the initial adjustments of the main burner and the ignition burner are not altered and the appliance is supplied with reference gas with the pressure at the appliance inlet reduced to 70 % of the normal pressure or the minimum pressure given in 7.1.4, whichever is the lower.

Under these conditions it is checked that ignition of the main burner or the ignition burner (if fitted) occurs correctly and that ignition of the main burner by the ignition burner as well as cross-lighting of the various parts of the burner occurs correctly.

c) Test 3

Without altering the initial adjustments of the main burner or the ignition burner, the appropriate flame lift and light-back limit gases are substituted successively for the reference gas and the pressure at the appliance inlet is reduced to the minimum pressure given in 7.1.4.

Under these conditions it is checked that ignition of the main burner or the ignition burner (if fitted) occurs correctly and that ignition of the main burner by the ignition burner as well as cross-lighting of the various parts of the burner occurs correctly.

7.2.4.1.2 Ignition burner flame reduction

This test is carried out both with the installation cold and with the installation at thermal equilibrium under still air conditions in accordance with 7.1.6.3.

The appliance is initially adjusted in accordance with 7.1.3.2.1 and supplied with the appropriate reference gases (see Table 4) at nominal heat input.

The ignition burner gas rate is then reduced to the minimum required to hold open the gas supply to the main burner.

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

a) by the adjustment of the ignition burner rate adjuster, if this exists, or, if this is not possible;

b) by means of an adjuster inserted into the ignition burner gas supply for this purpose.

The correct ignition of the main burner by the ignition burner is then checked.

Where an ignition burner has several ports that are likely to become blocked, the test is carried out with all the ignition burner orifices blocked except for the one that is producing the flame which is to be detected by the flame detector.

7.2.4.1.3 Delayed ignition test

The test is carried out both with the installation cold and with the installation at thermal equilibrium under still air conditions in accordance with 7.1.6.3.

The appliance is initially adjusted in accordance with 7.1.3.2.1 and supplied with the appropriate reference gases (see Table 4) at the nominal heat input.

Ignition of the ignition burner or the main burner, if this is ignited directly, is then checked. The test is carried out, progressively delaying the ignition by up to a maximum of 50 % longer than the safety time declared by the manufacturer.

In order to delay the ignition it will generally be necessary to provide independent control of the main burner or ignition burner 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. For safety reasons the ignition delay should be increased in stages.

7.2.4.2 Flame stability

These tests are carried out with the appliance installed in accordance with 7.1.6.2.

The appliance is initially adjusted in accordance with 7.1.3.2.1 and the tests shown in 7.2.4.2 a) and b) are carried out:

a) Test 1

Without altering the initial main burner or ignition burner adjustment, the appropriate light-back limit gases are substituted successively for the reference gas and the pressure at the appliance inlet reduced to the minimum pressure given in 7.1.4.

b) Test 2

Without altering the initial main burner or ignition burner adjustment, the appropriate flame lift limit gases are substituted successively for the reference gas and the pressure at the appliance inlet is increased to the maximum value given in 7.1.4.

7.2.4.3 Effect of room draughts

The tests are carried out with the appliance installed in accordance with 7.1.6.3.

The appliance is initially adjusted in accordance with 7.1.3.2.1 and supplied with the appropriate reference gases (see Table 4) according to its category and at the normal pressure given in 7.1.4.

An air stream of 2 m/s is directed at the appliance. A vane anemometer, or similar device, is used to determine the distance from the fan at which the required wind speed is obtained.

The fan is placed at this distance from the appliance and the air stream directed horizontally at the appliance. 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. The tests are repeated at steps of 30° around the appliance in a horizontal plane, applying at least three gusts at 3 s intervals in each position.

The tests are carried out with the appliance at ambient temperature and at thermal equilibrium. The tests are then repeated with the appliance inlet pressure adjusted to the maximum value given in 7.1.4 for flame stability, and to the minimum value given in 7.1.4 for ignition and cross-lighting.

7.2.4.4 Manually operated devices

The appliance is turned on and off 10 times with 5 s intervals between each on/off and each off/on operation.

7.2.5 Flame supervision devices

7.2.5.1 General

The tests are carried out with each reference gas and with the appliance adjusted to its nominal heat input.

7.2.5.2 Ignition opening time

After this adjustment has been made, the appliance is turned off until it has cooled to ambient temperature. The gas is turned on again and lit at the ignition burner. The ignition opening time is measured between the moment of lighting the ignition burner and that when the safety device is actuated.

7.2.5.3 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 closure. Compare this time with the manufacturer's specified safety time.

7.2.5.4 Extinction safety time

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

The extinction safety time is measured 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 cut off through the action of the flame supervision device.

A gas meter or any other appropriate device may be used to detect that the gas supply is cut off.

7.2.6 Pressure regulator

If the appliance has an adjustable regulator, this is adjusted, if necessary to give the nominal heat input with reference gas at the normal pressure given in 7.1.4. Keeping the initial adjustment, the appliance inlet pressure is varied between the corresponding maximum and minimum values. This test is carried out for all the reference gases for which the regulator is not put out of action.

7.2.7 Combustion

7.2.7.1 General

These tests are carried out with the appliance installed in accordance with 7.1.6.3.

The appliance is initially adjusted to the nominal heat input in accordance with 7.1.3.2.

The products of combustion are collected in such a manner as to ensure a representative sample and the carbon monoxide and carbon dioxide concentrations are determined. A sample is considered to be representative if it contains at least 2 % carbon dioxide.

The carbon monoxide, CO, concentration is measured by an instrument capable of determining carbon monoxide concentrations between 5×10^{-5} and 100×10^{-5} parts by volume.

The carbon monoxide, CO, and carbon dioxide, CO_2, concentrations are measured by a method accurate to within ± 6 %.

For all tests the sample is taken when the appliance has reached thermal equilibrium whilst operating under the specified conditions.

The carbon monoxide concentration of the dry, air-free products of combustion (neutral combustion) is given by Equation (9).

$$V_{CO,N} = V_{CO_2,N} \times \frac{V_{CO,M}}{V_{CO_2,M}} \quad (9)$$

where:

$V_{CO,N}$ is the carbon monoxide concentration of the dry, air-free products of combustion expressed as a percentage;

$V_{CO_2,N}$ is the calculated carbon dioxide content of the dry, air-free products of combustion expressed as a percentage;

$V_{CO,M}$ and $V_{CO_2,M}$ are the carbon monoxide and carbon dioxide concentrations measured in the sample during the combustion test, both expressed as a percentage.

The values of $V_{CO_2,N}$ (neutral combustion) are given for the test gases in Table 9:

Table 9 — $V_{CO_2,N}$ values

Gas designation	G 110	G 20	G 21	G 25	G 26	G 30	G 31
$V_{CO_2,N}$	7,6	11,7	12,2	11,5	11,8	14,0	13,7

The carbon monoxide concentration of the dry, air-free products of combustion may also be calculated using Equation (10).

$$V_{CO,N} = \frac{21}{21 - V_{O_2,M}} \times V_{CO,M} \quad (10)$$

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 Equation (10) is recommended where it gives greater accuracy than the formula based on the CO_2 concentration.

7.2.7.2 Still air conditions

With the appliance installed and the combustion measured as described in 7.2.7.1, the tests described in 7.2.7.2 a) to c) are to be carried out under still air conditions.

a) Test No. 1

Without altering the initial burner adjustment given in 7.1.3.2 the appliance is supplied with the appropriate reference gases (see Table 4) according to its category and operated with the pressure at the appliance inlet increased to the maximum value given in 7.1.4.

b) Test No. 2

Without altering the initial burner adjustment given in 7.1.3.2, the appliance is supplied with the appropriate reference gases (see Table 4) according to its category with the pressure at the

appliance inlet reduced to 70 % of the normal pressure or to the minimum pressure given in 7.1.4, whichever is the lower.

c) Test No. 3

Without altering the initial burner adjustment given in 7.1.3.2, the appropriate incomplete combustion limit gases are substituted successively for the reference gas, and the pressure at the appliance inlet increased to the maximum pressure given in 7.1.4.

7.2.7.3 Auxiliary energy variations

Without altering the initial burner adjustment, given in 7.1.3.2, the appliance is supplied with the appropriate reference gas(es) (see Table 4) according to its category and operated at the nominal heat input.

The test is carried out with the appliance supplied with electricity at a voltage of 85 % of the minimum and then at a voltage of 110 % of the maximum of the voltage range stated by the manufacturer.

7.2.8 Prolonged performance

The test is carried out after all the other tests given in 7.2 have been completed.

The appliance is installed in accordance with 7.1.6.3 and initially adjusted as described in 7.1.3.2.1.

The test is carried out with the appliance supplied with one of the appropriate reference gases (see Table 4) according to its category and at the corresponding normal pressure given in 7.1.4.

The appliance is operated for 100 cycles of 1 h “ON” / 0,5 h “OFF” under these adjustment conditions.

7.3 Other pollutants

7.3.1 General

The appliance is installed as specified in 7.1.6.

For appliances intended to use second family gases, the tests are carried out using test gas G 20, if the appliance category is such that this test gas is used as a reference gas. If G 20 is not used as a reference gas, the tests are carried out using G 25 exclusively.

For appliances intended to use all gases of the third family, the tests are carried out with reference gas G 30 and the maximum NO_x concentration (see Table 9) is multiplied by a factor of 1,30.

For appliances intended to use propane only, the tests are carried out with reference gas G 31 and the maximum NO_x concentration is multiplied by a factor of 1,20.

The appliance is adjusted to its nominal heat input.

The NO_x measurements are carried out when the appliance is at thermal equilibrium, conforming to details given in CR 1404:1994.

No wet meters are used.

The reference conditions for the combustion air are:

temperature: 20 ^{o}C;

relative humidity H_o: 10 g(H_2O) /kg(air).

If the test conditions are different to these reference conditions, it is necessary to correct the NO_x values using Equation (11)

$$NO_{x,reference} = NO_{x,m} + \frac{0,02\,NO_{x,m} - 0,34}{1 - 0,02\,(h_m - 10)}(h_m - 10) + 0,85(20 - T_m) \qquad (11)$$

where:

$NO_{x,reference}$ is the value of NO_x corrected to the reference conditions (mg/kWh);

$NO_{x,m}$ is the NO_x measured at h_m and T_m (mg/kWh) in the range 50 mg/kWh to 300 mg/kwh;

NOTE Where NO_x is measured in ppm, convert it to mg/kWh in accordance with Annex F.

h_m is the humidity during the measurement of $NO_{x,m}$ (g/kg) in the range 5 g/kg to 15 g/kg;

T_m is the ambient temperature during the measurement of $NO_{x,m}$ (°C) in the range 15 °C to 25 °C.

The measured NO_x values are weighted in accordance with 7.3.2.

It is checked that the weighted NO_x values comply with the values of Table 9, depending on the NO_x class chosen.

7.3.2 Weighting

7.3.2.1 General

The weighting of the NO_x measured values shall be calculated as described in 7.3.2.2 to 7.3.2.5, on the basis of the values in Table 10.

Table 10 — Weighting factors

Partial heat input $Q_{pi,\%}$ as % of Q_n	70	60	40	20
Weighting factor F_{pi}	0,15	0,25	0,30	0,30

For range rated appliances Q_n is replaced by Q_a, the arithmetic mean of the maximum and the minimum heat input of the range, as stated by the manufacturer.

7.3.2.2 On/off appliances

The NO_x concentration is measured (and possibly corrected as specified in 7.3.1) at the nominal heat input, Q_n.

7.3.2.3 Appliances with several rates

The NO_x concentration is measured (and possibly corrected as specified in 7.3.1) at the partial heat input corresponding to each of the rates and weighted in accordance with Table 10.

If necessary, the weighting factor specified in Table 10 is recalculated for each rate as specified below.

If the heat inputs of two rates are between the partial heat inputs specified in Table 10, it is necessary to apportion the weighting factor between the heat inputs of the higher rate as shown in Equations (12).

$$F_{\text{p,high rate}} = F_{\text{pi}} \times \frac{Q_{\text{pi,\%}} - Q_{\text{low rate,\%}}}{Q_{\text{high rate,\%}} - Q_{\text{low rate,\%}}} \times \frac{Q_{\text{high rate,\%}}}{Q_{\text{pi,\%}}} \quad (12)$$

where:

$F_{\text{p,high rate}}$ is the apportioned weighting factor, high rate;

F_{pi} is the weighting factor corresponding to the partial heat input $Q_{\text{pi,\%}}$;

$Q_{\text{pi,\%}}$ is the partial heat input for weighting, expressed in percent of Q_n;

$Q_{\text{low rate,\%}}$ is the heat input rate less than $Q_{\text{pi,\%}}$;

$Q_{\text{high rate,\%}}$ is the heat input rate greater than $Q_{\text{pi,\%}}$;

and the lower rate using Equation (13).

$$F_{\text{p,low rate}} = F_{\text{pi}} - F_{\text{p,high rate}} \quad (13)$$

where:

F_{pi} is the weighting factor corresponding to the partial heat input $Q_{\text{pi,\%}}$;

$F_{\text{p,low rate}}$ is the apportioned weighting factor, low rate;

$F_{\text{p,high rate}}$ is the apportioned weighting factor, high rate.

If the heat inputs of two rates cover more than one partial heat input specified in Table 10, then it is necessary to apportion each weighting factor between the heat inputs of the higher and lower rate as indicated above.

The weighted NO_x value, $NO_{x,pond,}$ is then equal to the sum of the products of the measured NO_x values at the different rates, multiplied by their weighting factor, as given by Equation (14).

$$NO_{x,pond} = \Sigma(NO_{x,mes\ high} \times F_{p,high\ rate}) \quad (14)$$

(See calculation examples in Annex E and Annex F.)

7.3.2.4 Modulating appliances in which the minimum modulating heat input is no greater than 0,20 Q_n

The NO_x concentration is measured (and possibly corrected as specified in 7.3.1) at the partial heat inputs specified in Table 10.

The weighted NO_x value, $NO_{x,pond}$ is determined as given by Equation (15).

$$NO_{\text{x,pond}} = 0{,}15 \times NO_{\text{x,mes(70)}} + 0{,}25 \times NO_{\text{x,mes(60)}} + 0{,}3 \times NO_{\text{x,mes(40)}} + 0{,}3 \times NO_{\text{x,mes(20)}} \quad (15)$$

where:

$NO_{x,pond}$ is the weighted NO_X value (mg/kWh);

$NO_{x,mes(70)}$ the measured (and possibly corrected) NO_X value (mg/kWh), 70 % heat input;

$NO_{x,mes(60)}$ the measured (and possibly corrected) NO_X value (mg/kWh), 60 % heat input;

$NO_{x,mes(40)}$ the measured (and possibly corrected) NO_X value (mg/kWh), 40 % heat input;

$NO_{x,mes(20)}$ the measured (and possibly corrected) NO_X value (mg/kWh), 20 % heat input.

7.3.2.5 Modulating appliances in which the minimum modulating heat input is greater than 0,20 Q_n

The NO_x concentration is measured (and possibly corrected as specified in 7.3.1) at the minimum modulating rate and at the partial heat inputs $Q_{pi,\%}$, specified in Table 10, which are greater than the minimum modulation rate.

The weighting factors for the partial heat inputs in Table 10, which are no greater than the minimum modulation rate are added and multiplied by $NO_{x,mes,Qmin}$.

The weighted NO_x value, $NO_{x,pond}$, is determined using Equation (16).

$$\mathrm{NO}_{x,\mathrm{pond}} = \mathrm{NO}_{x,\mathrm{mes,Qmin}} \sum F_{\mathrm{pi}} \left(Q_{pi\%} \le Q_{\min\%} \right) + \sum \left(\mathrm{NO}_{x,\mathrm{mes}} \times F_{\mathrm{pi}} \left[Q_{pi\%} > Q_{\min\%} \right] \right) \qquad (16)$$

where:

$NO_{x,pond}$ is the weighted NO_X value (mg/kWh);

$NO_{x,mes}$ is the measured (and possibly corrected) NO_X value (mg/kWh) at the partial heat input(s), $Q_{pi,\%}$, greater than the minimum modulating rate, $Q_{min\%}$;

$NO_{x,mes,Qmin}$ is the measured (and possibly corrected) NO_X value (mg/kWh) at the minimum heat input (modulating appliances) :

$Q_{min\%}$ is the minimum modulating rate, expressed as a percentage of Q_n;

F_{pi} is the weighting factor corresponding to the partial heat input $Q_{pi,\%}$.

8 Marking and instructions

8.1 Marking of the appliance and the packaging

8.1.1 Data plate

The appliance burner housing shall carry one or more data plates and/or labels that are firmly and durably attached to the appliance such that the information given is visible to, and can be read by, the installer. The data plate(s) and/or label(s) shall provide at least the following information in indelible characters:

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

NOTE The PIN number is acceptable as identification symbol of the manufacturer.

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

c) the trade name of the appliance;

d) the serial number;

e) the commercial identification symbol of the appliance;

f) the type of gas in relation to the pressure and/or the pressure couple, for which the appliance has been adjusted, and pressure indication 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;

g) the direct country or countries of destination of the appliance;

h) the appliance category or categories. If more than one appliance category is specified, each of these categories shall be identified in relation to the appropriate direct country or countries of destination;

i) the setting pressure for regulated appliances;

j) the nature and voltage of the current used and the maximum electrical power used, in volts, amperes, frequency and kilowatts for all intended electrical supply conditions;

k) the burner supply pressure in mb for each gas family or group for which the appliance is intended;

l) the NO_x class of the appliance.

No other information shall be included on the appliance burner housing if this could lead to confusion with regard to the current state of adjustment of the appliance, 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 60335-1:2002.

8.1.2 Other marking

On delivery the appliance shall carry in a prominent position, possibly near the data plate, a firmly fixed badge stating the nature and pressure of the gas family or group for which the appliance has been adjusted. This information may be put on the plate.

In addition, the appliance shall carry a suitable plate or durable label indelibly marked with the following text:

"This appliance must be installed in accordance with the rules in force. It shall be used in a space ventilated in accordance with the requirements of EN 13410. Consult the instructions before installation and use of this appliance".

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

The appliance shall also carry all useful information relating to any electrical equipment, particularly the voltage and the current to be used and the appropriate insulation code in accordance with EN 60529:1991.

The manufacturer shall also provide a suitable plate or durable label for attachment on, or adjacent to, a low level user control. This plate or label shall be indelibly marked with the instructions for the safe operation of the appliance including its lighting and shut-down procedures.

Permanent warning notices shall be provided in a readily visible position on the appliance, requiring the appliance to be switched off and the gas isolated before carrying out any service operation.

Provision shall be made on the appliance or the data plate for fixing the CE mark.

8.1.3 Marking on the packaging

The packaging shall carry at least the following information:

a) the type of gas, in relation to the pressure and/or pressure couple for which the appliance has been adjusted; any pressure indication identified in relation to the corresponding appliance 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;

b) the direct country or countries of destination of the appliance;

c) the appliance category or categories. If more than one appliance category is specified, each of these categories shall be identified in relation to the appropriate direct country or countries of destination.

In addition, the appliance package shall carry a label indelibly marked with the following text:

“This appliance must be installed in accordance with the rules in force. It shall be used in a space ventilated in accordance with the requirements of EN 13410. Consult the instructions before installation and use of this appliance”.

No other information shall be included on the package if this could lead to confusion with regard to the current state of adjustment of the appliance, 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 be in conformity with EN 60335-1:2002.

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.

Table 11 — Gas type symbol

Gas type symbol	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+, 2Esi[b], 2Er[b], 2ELL[b]
G 25	2L, 2Esi[c], 2Er[c], 2ELL[c]
Third family:	
G 30	3B/P, 3+[d] [f] , 3B
G 31	3+[e] [f], 3P

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

[b] When the appliance is adjusted for G 20.

[c] When the appliance is adjusted for G 25.

[d] 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.

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

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

In order to satisfy the needs expressed by CEN members it is permitted that their country's declared means of identification may be included, in addition to the symbol. These additional means are given in Annex C.

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 EN ISO 3166-1:2006, the names of countries shall be represented by the codes shown in Table 12:

Table 12 – Country codes

AT	Austria	IE	Ireland
BE	Belgium	IS	Iceland
BG	Bulgaria	IT	Italy
CH	Switzerland	LT	Lithuania
CY	Cyprus	LU	Luxembourg
CZ	Czech Republic	LV	Latvia
DE	Germany	MT	Malta
DK	Denmark	NL	Netherlands
EE	Estonia	NO	Norway
ES	Spain	PL	Poland
FI	Finland	PT	Portugal
FR	France	RO	Romania
GB	United Kingdom	SE	Sweden
GR	Greece	SK	Slovakia
HU	Hungary	SI	Slovenia

8.1.4.5 Category

The category can be expressed uniquely by its designation in accordance with EN 437:2003. Nevertheless, if it is necessary to explain it, the term “category” shall be symbolized by “cat”.

8.1.4.6 Other information

The symbols for "Nominal heat input of a burner Q_n" and "Nominal heat input of all appliance burners ΣQ_n" are not obligatory, but are 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

They 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 or those 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 by 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

8.2.2.1 Technical instructions for installation and adjustment

In addition to the information given 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 in order 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. Furthermore, 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 supplied with the appliance. The instructions shall be clear and simple and the terms shall be those in common usage. Wherever necessary, diagrams and/or photographs shall augment the text.

The technical instructions shall include the following statement:

> "Before installation, check that the local distribution conditions, nature of gas and pressure, and adjustment of the appliance are compatible."

The instructions shall refer to:

a) the construction of the flue, where applicable;

b) the method assembly;

c) the use and siting of thermostats and other controls;

d) the siting of the appliance, including the minimum clearances around the appliance, the minimum fixing height(s) above the floor and the method of fixing;

e) the combustion and ventilation air requirements;

f) the gas and electricity supply and connections;

g) the procedure to be followed for commissioning the appliance;

h) the procedure to be followed where multiple appliances are installed and supplied from a common gas supply.

[6)] Indirect country of destination.

In particular, the manufacturer shall state the ventilation requirements necessary to comply with the installation regulations in the country where the appliance is to be installed. The ventilation must be in accordance with EN 13410.

In addition, the installation instructions shall include a complete wiring diagram and a technical data table. The technical data table shall include:

i) the appliance heat input;

j) the rating of any ignition burner;

k) the burner pressure and, for an appliance with an adjustable regulator, the setting pressure as measured upstream of the burner but downstream of any adjuster in relation to the Wobbe index of the gas used;

l) the injector size;

m) the number of injectors;

n) the gas connection size;

o) the physical dimensions;

p) the weight;

q) any other technical data as may be required by the installer and commissioning engineer.

The installation instructions shall state that an isolation valve, or valves, has to be fitted immediately adjacent to the appliance which, when closed, allow(s) the complete burner and control assembly to be disconnected for maintenance or repair.

In addition, for an appliance with a draught diverter, the instructions shall specify the method of checking for spillage of products of combustion from the draught diverter.

8.2.2.2 Instructions for servicing

The servicing instructions shall indicate the frequency of servicing and the scope of the service programme recommended by the manufacturer. They shall also specify such special tools as are necessary for any servicing procedure.

The procedure for removing or gaining access to parts or components to be serviced, together with the recommended service work and associated procedures, shall be clearly defined.

The instructions shall also include complete electrical functional and wiring diagrams and a short list of appliance parts and part numbers of those items that the manufacturer considers may be required for replacement purposes during the life of the appliance.

Reference shall also be made to the necessity for consulting the appliance manufacturer before replacing parts other than those specified or recommended in the servicing instructions.

A fault-finding chart shall be incorporated as an aid to servicing. The servicing instructions shall also include a line or block diagram showing the arrangement of the gas controls.

The servicing instructions shall draw attention to the necessity for recommissioning the appliance after servicing.

8.2.2.3 Conversion instructions

The manufacturer's conversion instructions are to be sent, on request, to all qualified installers and may form part of the installation instructions.

The parts required for conversion to another type of gas or another pressure shall be supplied with clear and adequate instructions regarding the change of parts, and the cleaning, adjustment and checking of the appliance.

In addition, a self-adhesive label shall be supplied to be placed on the appliance, indicating the nature and pressure of the gas for which it has been adjusted and also, where appropriate, the heat input set during commissioning.

8.2.3 Instructions for use and maintenance

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

These instructions, which are intended for the user, shall provide all the necessary information for the safe and sensible use of the appliance.

The instructions shall be clear and simple and the terms shall be acceptable in common usage. Wherever necessary, diagrams and/or photographs shall augment the text. The instructions shall contain notes on the care and safe operation of the appliance including its lighting and shut-down procedures.

The instructions shall specify any restrictions on the use of the appliance.

They shall also stress that a qualified installer is required to install the appliance and, if the need arises, to convert it for use with other gases. They shall state the recommended frequency of periodic servicing. Finally, they shall deal briefly with the installation regulations (connection, ventilation) in the country where the appliance is to be installed.

8.3 Presentation

All the information specified in 8.1.1, 8.1.2, 8.1.3, 8.1.4, 8.2.1, 8.2.2 and 8.2.3 shall be given in the language(s) of the country in which the appliance is to be installed. Calorific values shall be net or gross according to the custom of that country.

Annex A
(informative)

National situations

A.1 General

In each country in which this standard applies, appliances can only be installed if the category corresponds to the national situations of that country. Categories corresponding to the national situations of the EU countries are listed in tables A.1 and A.2.

In order to permit, both at the time of testing the appliance and at the time of its sale, the correct choice to be made from all the situations covered, the various national situations are summarized in A.2, A.3, A.4, A.5 and A.6.

A.2 Categories listed in the body of the standard and marketed in different countries

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

The information given in the 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 — Category I (single categories) marketed

Country	I_{2H}	I_{2L}	I_{2E}	I_{2E+}	I_{2N}	I_{2R}	$I_{3B/P}$	I_{3+}	I_{3P}	I_{3B}	I_{3R}
AT	X						X				
BE				X				X	X		
BG											
CH	X						X	X	X		
CY [a]											
CZ	X						X		X		
DE			X				X		X		
DK	X						X				
EE [a]											
ES	X							X	X		
FI	X						X				
FR	X [b]	X [b]		X			X	X	X		
GB	X							X	X		
GR	X							X	X		
HU [a]	X						X		X	X	
IE	X							X	X		
IS											
IT	X							X			
LT [a]											
LU			X								
LV [a]											
MT [a]											
NL	X [b]	X					X		X		
NO							X				
PL [a]											
PT	X							X	X		
RO											
SE	X						X				
SI [a]	X				X	X	X	X	X		X
SK [a]											

a Information on categories to be supplied by new CEN member.

b Categories applicable only to certain types of appliance, submitted to on site EC verification procedure, Annex II, article 6 of the Gas Appliance Directive (90/396/EEC) (Netherlands to clarify if applicable here).

Table A. 2 — Category II (double categories) marketed

Country	II_{1a2H}	$II_{2H3B/P}$	II_{2H3+}	II_{2H3P}	II_{2H3B}	$II_{2L3B/P}$	II_{2L3P}	$II_{2E3B/P}$	II_{2E+3+}	II_{2E+3P}	II_{2R3R} [a]
AT		X									
BE											
BG											
CH		X	X	X							
CY [a]											
CZ		X		X							
DE								X			
DK	X	X									
EE [a]											
ES			X [b]	X							
FI		X									
FR									X	X	
GB			X	X							
GR		X	X	X							
HU [a]		X		X	X						
IE			X	X							
IS											
IT	X		X								
LT [a]											
LU											
LV [a]											
MT [a]											
NL						X	X				
NO											
PL [a]											
PT			X	X							
RO											
SE	X	X									
SI [a]		X	X	X							
SK [a]											

[a] Information on categories to be supplied by new CEN member.

[b] Appliances of this category set for Group H gases of the second family may use air and commercial propane gas mixtures where the gross wobbe index (at 15 °C and 1 013,25 mbar) is between 46 MJ/m^3 and 51,5 MJ/m^3 a, at the same supply pressure, without additional tests.

A.3 Appliance supply pressures corresponding to the categories given in A.2

Table A.3 gives the conditions in the various countries concerning the supply pressures to appliances in the categories given in A.2

Other, higher supply pressures may be necessary and such pressures may be provided after consultation with the appropriate gas supplier(s) in the country(ies) concerned.

Table A. 3 — 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	X
BG												
CH		X					X			X	X	
CY [a)]												
CZ		X[b)]					X[c)]	X	X	X[d)]		
DE		X	X			x	X			X		
DK	X	X						X				
EE [a)]												
ES		X				x			X	x	X	
FI		X				X		X				
FR					X	x	x		x	x	X	
GB		X[e)]				X			X	x	X	
GR		X				X		X	X	X	x	
HU [a)]		x[f)]				x	x	x		x		
IE		X				x			X		X	
IS												
IT	X	X									X	
LT [a)]												
LU		x										
LV [a)]												
MT [a)]												
NL				X				X		X		
NO						X		X				
PL [a)]												
PT		X				X			X		X	
RO												
SE	X	X				X		X				
SI [a)]		X				X		X			X	
SK[a)]												

[a)] Information on supply pressures to be supplied by new CEN member.
[b)] Currently 18 mbar.
[c)] For certain types of industrial appliances (CZ to clarify).
[d)] For certain types of appliances (CZ to clarify).
[e)] Normal supply pressure for this appliance: 17,5 mbar.
[f)] Pressures of 25 mbar and 85 mbar.

A.4 Special categories marketed nationally or locally

A.4.1 General

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

Table A. 4 — Test gases corresponding to categories marketed nationally or locally

Category	Reference gas	Incomplete combustion limit gas	Light back limit gas	Lift limit gas	Sooting limit gas	Country
I_{2Esi}, I_{2Er}	G 20, G 25	G 21	G 222	G 231	G 21	FR
$I_{2E(S)B}$	G 20, G 25	G 21	G 222	G 231	G 21	BE
$I_{2E(R)B}$	G 20, G 25	G 21	G 222	G 231	G 21	BE
I_{2ELL}	G 20,G 25	G 21	G 222	G 231, G 271	G 21	DE
I_{2S}	G 25.1	G 26.1	G 222	G 27.1	G 26.1	HU[a]
I_{2HS}	G 20, G 25.1	G 21 G 26.1	G 222	G 27.1	G 21, G 26.1	HU[a]
II_{2Esi3+} II_{2Er3+}	G 20, G 25 G 30	G 21	G 222 G 32	G 231 G 31	G 30	FR
II_{2Esi3P} II_{2Er3P}	G 20, G 25 G 31	G 21	G 222 G 32	G 231 G 271	G 31 G 32	FR
$II_{2ELL3B/P}$	G 20, G 25, G 30	G 21, G30	G 222, G 32	G 231 G 271	G 30	DE
$II_{2S3B/P}$	G 25.1, G 30	G 26.1, G 30	G 32	G 27.1 G31	G 26.1, G 30	HU[a]
II_{2S3P}	G25.1, G 31	G 26.1, G 30	G 32	G 27.1, G 31	G 26.1, G 31, G32	HU[a]
II_{2S3B}	G 25.1, G30	G 26.1, G 30	G 32	G 27.1, G31	G 26.1, G 30	HU[a]
$II_{2HS3B/P}$	G 20, G 25.1 G 30	G 21, G 26.1, G 30	G 222 G 32	G 23, G27.1, G 31	G 21, G 26.1, G 30	HU[a]
II_{2HS3P}	G 20, G 25.1 G 31	G 21, G 26.1, G 30	G 222 G 32	G 23, G 271, G 31	G 21, G 26.1, G 31, G 32	HU[a]
II_{2HS3B}	G 20, G 25.1 G 30	G 21, G 26.1, G 30	G 222 G 32	G 23, G 271, G 31	G 21, G 26.1, G 30	HU[a]

Table A.4 (concluded)

Category	Reference gas	Incomplete combustion limit gas	Light back limit gas	Lift limit gas	Sooting limit gas	Country
$III_{1a2H3B/P}$	G 110, G 20 G 30	G 21	G 112 G 222, G 32	G 23 G 31	G 30	DK, IT
$III_{1c2E+3+}$	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
$III_{1c2Esi3+}$ $III_{1c2Er3+}$	G 130, G 20 G 25, G 30	G 21	G 132 G 222, G 32	G 231 G 31	G 30	FR
$III_{1c2Esi3P}$ $III_{1c2Er3P}$	G 130, G 20 G 25, 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
[a] Hungary to confirm selection.						

A.4.2 Definition of special categories

The definitions of the special categories given in Table A.4 are derived in the same way as those categories listed in 4.2. The characteristics of the gases distributed regionally are given in A.5.

A.4.2.1 Category I

A.4.2.1.1 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).

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.

Appliances designed for the use of gases of the second family and the gases linked to it.

Category I_{2Esi}: appliances capable of using only gases of Group E of the second family, and operating under the appropriate pressure of a pressure couple. The replacement of a gas in the range Es of Group E (Wobbe index between 44,8 MJ/m^3 and 54,7 MJ/m^3) by a gas in the range Ei of Group E (Wobbe index in the range 40,9 MJ/m^3 and 44,8 MJ/m^3) or vice versa necessitates a modification to the burner setting and possibly a change of injectors, of calibrated orifices and of the atmosphere control device.

Category $I_{2Er:}$ appliances capable of using only gases of Group E of the second family and being able to operate with a pressure couple without adjustment on the appliance. However, specific adjustment of the burner gas rate is optional for the replacement of a gas of the range Es of Group E (Wobbe index between 44,8 MJ/m^3 and 54,7 MJ/m^3) by a gas of the range Ei of Group E (Wobbe index between 40,9 MJ/m^3 and 44,8 MJ/m^3). If this adjustment has been carried out, a re-adjustment to the previous setting is then necessary in order to return to the use of a gas in the range Es of Group E.

Category I_{2LL}: appliances using only gases of Group LL linked to the second family, at a fixed supply pressure. On condition that the 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}.

Category I_{2S}: appliances using only gases of Group S linked to the second family, at the defined supply pressure.

Category I_{2HS}: appliances using only gases of Group H of the second family and gases of Group S linked to the second family. The Group H second family gases are used under the same conditions as for category I_{2H}. The Group S second family gases are used under the same conditions as for category $I_{2S.}$

A.4.2.2 Category II

A.4.2.2.1 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

No appliances belonging to these categories have been notified.

A.4.2.2.2 Appliances designed to use of gases of the second family or that are linked to it and gases of the third family

Category II_{2Esi3+}: 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_{2Esi}. The third family gases are used under the same conditions as for category I_{3+}.

Category II_{2Esi3P}: 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_{2Esi}. The gases of the third family are used under the same conditions as for category I_{3P}.

Category II_{2Er3+}: 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_{2Er}. The gases of the third family are used under the same conditions as for category I_{3+}.

Category II_{2Er3P}: 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_{2Er}. The gases of the third family are used under the same conditions as for category I_{3P}.

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 $I_{3B/P}$.

Category $II_{2S3B/P:}$ appliances capable of using gases of Group S linked to the second family and gases of the third family. The gases linked to the second family are used under the same conditions as for category I_{2S}. The third family gases are used under the same conditions as for category $I_{3B/P}$.

Category $II_{2S3P:}$ appliances capable of using gases of Group S linked to the second family and gases of Group P of the third family. The gases linked to the second family are used under the same conditions as for category I_{2S}. The third family gases are used under the same conditions as for category I_{3P}.

Category $II_{2S3B:}$ appliances capable of using gases of Group S linked to the second family and gases of Group B of the third family. The gases linked to the second family are used under the same conditions as for category I_{2S}. The third family gases are used under the same conditions as for category I_{3B}.

Category $II_{2HS3B/P:}$ appliances capable of using gases of Group H of the second family, gases of Group S linked to the second family and gases of the third family. Gases of the second family or gases linked to it are used under the same conditions as for category I_{2HS}. The third family gases are used under the same conditions as for category $I_{3B/P}$.

Category $II_{2HS3P:}$ appliances capable of using gases of Group H of the second family, gases of Group S linked to the second family and gases of Group P of the third family. Gases of the second family or gases linked to it are used under the same conditions as for category I_{2HS}. The third family gases are used under the same conditions as for category I_{3P}.

Category $II_{2HS3B:}$ appliances capable of using gases of Group H of the second family, gases of Group S linked to the second family and gases of Group B of the third family. Gases of the second family or gases linked to it are used under the same conditions as for category I_{2HS}. The third family gases are used under the same conditions as for category I_{3B}.

A.4.2.3 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 $III_{1c2H3B/P}$: appliances capable of using gases of Group C linked to 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_{1c}. 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_{1c2H3+}: appliances capable of using gases of Group C linked to 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_{1c}. 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_{1c2H3P}: appliances capable of using gases of Group C linked to 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_{1c}. 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 $III_{1c2E+3+}$: 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 $III_{1c2Esi3+}$: 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_{2Esi}. The third family gases are used under the same conditions as for category I_{3+}.

Category $III_{1c2Esi3P}$: 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_{2Esi}. The third family gases are used under the same conditions as for category I_{3P}.

Category $III_{1c2Er3+}$: 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_{2Er}. The third family gases are used under the same conditions as for category I_{3+}.

Category $III_{1c2Er3P}$: 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_{2Er}. 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 $I_{3B/P}$.

A.4.3 Gas rate adjusters, aeration adjusters and regulators

This clause has been included to enable CEN members to provide information equivalent to that given in 5.2.2, 5.2.3, 5.2.4 and 5.2.6 in relation to the special categories they have requested, detailed in A.4.1.

A.4.4 Conversion to different gases

This clause has been included to enable certain member states to provide information equivalent to that given in 5.1.1.1 in relation to the special appliance categories listed in A.4.1. Test gases corresponding to the special categories given in A.4.

A.5 Test gases corresponding to the special categories given in A.4

The characteristics of the test gases corresponding to the gases distributed nationally or locally and the corresponding test pressures are given in Table A.5 (reference conditions only).

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.

Table A. 5 — Test gases corresponding to local situations

Gas family and group		Nature of gas	Desig-nation	Composition Volume %	*WI* MJ/m3	*HI* MJ/m3	*Ws* MJ/m3	*Hs* MJ/m3	*d*	Test Pressure mbar	Country
Gases linked to the first family	Group b	Reference Incomplete combustion Sooting	G 120	H_2 = 47 CH_4 = 32 N_2 = 21	24,40	15,68	27,64	17,77	0,413	p_n = 8 p_{min} = 6 p_{max} = 15	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[a]	C_3H_8 = 26,9 Air = 73,1[1]	22,14	23,66	24,07	25,72	1,142	p_n = 8 p_{min} = 6 p_{max} = 15	FR
		Light back	G 132	C_3H_8 = 13,8 C_3H_6 = 13,8 Air[a] = 72,4	22,10	23,56	23,84	25,41	1,136		
Gases Linked to the second family	Group LL	Reference	G 25[b]	CH_4 = 86 N_2 = 14	37,38	29,25	41,52	32,49	0,612	p_n = 20 p_{min} = 18 p_{max} = 25	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		
	Group S	Reference	G 25.1	CH_4 = 86 CO_2 = 14	35,25	29,30	39,11	32,51	0,691	p_n = 25 p_{min} = 20 p_{max} = 33 0R p_n = 85 p_{min} = 73 p_{max}= 100	HU
		Incomplete combustion Sooting	G 26.1	CH_4 = 80 C_3H_8 = 6 CO_2 = 14	37,61	32,60	41,58	36,04	0,751		
		Lift limit	G 27.1	CH_4 = 82 CO_2 = 18	32,70	27,94	36,29	31,00	0,730		
Gases of the second family	Range Es of Group E	Reference	G 20[b]	CH_4 = 100	45,67	34,02	50,72	37,78	0,555	p_n = 20 p_{min} = 17 p_{max} = 25	FR
		Incomplete combustion Sooting	G 21	CH_4 = 87 C_3H_8 = 13	49,60	41,01	54,76	45,28	0,684		
		Light back	G 222	CH_4 = 77 H_2 = 23	42,87	28,53	47,87	31,86	0,443		
		Lift limit	G 26	CH_4 = 80 C_3H_8 = 7 N_2 = 13	40,52	33,36	44,83	36,91	0,678		
	Range Ei of Group E	Reference Light back	G 25[b]	CH_4 = 86 N_2 = 14	37,38	29,25	41,52	32,49	0,612	p_n = 25 p_{min} = 20 p_{max} = 30	
		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		
		Lift limit	G 231	CH_4 = 85 N_2 = 15	36,82	28,91	40,90	32,11	0,617		

[a] Composition of the air (%): 0_2 = 20,95; N_2 = 79,05.
[b] For the characteristics of the reference gases G 20 and G 25, see Table 4.

A.6 Gas connections in the various countries

Table A.6 shows the national situations concerning the various types of gas connection specified in 5.1.6.

Table A.6 — Permitted inlet connections

Country	Category I_{3+}, I_{3P}, I_{3B}, $I_{3B/P}$			Other categories		
	Threaded connections		Other connections	Threaded connections		Other connections
	EN 10226-1 :2004 and EN 10226-2 :1995	EN ISO 228-1: 2003		EN 10226-1 :2004 and EN 10226-2 :1995	EN ISO 228-1: 2003	
AT	Yes	—	Yes	Yes	—	—
BE	Yes	Yes	Yes	—	Yes	—
BG	—	—	—	—	—	
CH	Yes	Yes	Yes	Yes	Yes	—
CY	—	—	—	—	—	—
CZ	—	—	—	—	—	—
DE	Yes	—	Yes	Yes	—	—
DK	Yes	Yes	Yes	—	Yes	—
EE	—	—	—	—	—	—
ES	—	—	—	—	—	—
FI	Yes	Yes	Yes	Yes	Yes	—
FR	—	Yes	Yes	—	Yes	—
GB	Yes	—	Yes	Yes	—	Yes
GR	Yes	—	Yes	Yes	—	—
HU	—	—	—	—	—	—
IE	Yes	—	Yes	Yes	—	Yes
IS	—	—	—	—	—	—
IT	Yes	—	Yes	Yes	—	—
LU	—	—	—	—	—	—
LV	—	—	—	—	—	—
MT	—	—	—	—	—	—
NL	Yes	—	—	Yes	—	—
NO	Yes	Yes	Yes	—	—	—
PL	—	—	—	—	—	—
PT	Yes	Yes	Yes	Yes	Yes	Yes
RO	—	—	—	—	—	—
SE	—	—	—	—	—	—
SI	Yes	Yes	Yes	Yes	Yes	Yes
SK	Yes	Yes	—	Yes	Yes	—

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 5.2.2 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 regulators (see 5.2.5) 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 7.1.5.1.

EXAMPLE 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 7.1.5.1 are carried out, after changing the injectors, if necessary.

EXAMPLE 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 given in 7.1.5.1 after changing the injectors, if necessary, and after adjusting the regulator in accordance with 5.2.5.

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 5.2.2 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:

[7)] Throughout Annex B the word “adjusters” refers to gas rate adjusters and to fixed primary aeration adjusters as appropriate.

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 [8], 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 regulators (see 5.2.5) 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 7.1.5.1.

EXAMPLE 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 7.1.5.1 for the test pressures and the test gases relating to category I_{2Esi} or I_{2Er} [9] and with corresponding injectors and adjustments. These adjustments take into account the requirements of 5.2.5.

EXAMPLE 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 tests specified in 7.1.5.1 for the test pressures corresponding to category I_{2E+} [9]. In addition, any adjusters are locked and sealed in the appropriate positions, taking account of the requirements of 5.2.5.

B.3 Conversion to 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 is to be submitted to the tests specified in 7.1.5.1 using the test gases and test pressures for the proposed new category. Where appropriate, account should be taken of the special national conditions given in Annex E.

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[8] Throughout Annex B the word “adjusters” refers to gas rate adjusters and to fixed primary aeration adjusters as appropriate.

[9] When the intended country of destination is Belgium account should be taken of the special national conditions given in Annex E.

Annex C
(informative)
Identification of the types of gas in use in the various countries

Table C. 1 — Means of identification of gas types in use in various countries

Type of gas Country code [2)]	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
CY								
CZ								
DE					Erdgas E W_o,(12,0 – 15,7) kWh/m^3 0°C	Erdgas LL W_o, (10,0 – 13,1) kWh/m^3 0°C	Flüssiggas B/P Butan	 Propan
DK	Bygas				Naturgas		F-Gas	F-Gas
EE								
ES	Gas manufacturado		Aire propanado	Aire metanado	Gas natural		Butano	Propano
FI					Maakaasu, Naturgas		Butaani, Butan	Propaani, Propan
FR [1)]			Air propané/ Air butané		Gaz naturel Lacq	Gaz naturel Groningue	Butane	Propane
GB					Natural Gas		Butane	Propane
GR					Qυσικὸ Aèριο		Υγραèριο Μείγμα	Προπανιο
HU								
IE					Natural Gas		Butane	Propane
IS								
IT	Gas di Città				Gas naturale/ Gas metano		GPL	
LT								
LU								
LV								
MT								
NL						Aardgas	Butaan	Propaan
NO							Butan	Propan
PL								
PT					Gás Natural		Butano	Propano
SE								
SK								
SI					Zemeljski plin		Utekočinjeni naftni plin (UNP) Butan	 Propan

[1)] The meaning of the symbol corresponding to the type of gas shall be explained in detail in the technical instructions. Concerning the system and its packaging, if an additional marking is intended by the manufacturer to explain the symbol, this text shall be in conformity with the description given in this table. In the case of pressure couples, the two descriptions of the family shall be mentioned.

[2)] See E.1.4 for codes.

Annex D
(normative)

Special national conditions

D.1 General

Special national conditions: 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 special national conditions apply these provisions are normative; for other countries they are informative.

D.2 Belgium

Appliances of categories I_{2E+}, $I_{2E(R)B}$ and $I_{2E(S)}$ 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.

D.3 Italy

Appliances in categories $I_{3B/P,}$ $II_{2H3B/P}$ and $III_{1a2H3B/P}$ without pressure regulators marketed in Italy, shall have successfully undergone a test for flame stability with the limit gas G 31 at the pressure of 45 mbar.

Annex E
(informative)

Example of calculation of the weighting factors for an appliance with several rates

E.1 Appliance rates

The appliance rates used are 100 %, 50 % and 30%.

Table E.1 — Weighting $Q_{pi,\%}$ and F_{pi}

$Q_{pi,\%}$ (%)	70	60	40	20
F_{pi}	0,15	0,25	0,3	0,3

E.2 Weighting of $Q_{pi,\%}$ = 20

Q_{min} is 30 %, which is larger than 20 %, so the F_{pi} of 20 % is added to the F_{pi} of 30 %.

$$F_{pi}(30\%) = 0,3$$

E.3 Weighting of $Q_{pi,\%}$ = 40

$Q_{pi,\%}$ = 40 has to be apportioned between $Q_{pi,\%}$ = 30 (low rate) and $Q_{pi,\%}$ = 50 (high rate).

$$\text{High rate}: F_{pi}(50\%) = F_{pi}(40\%) \times \frac{Q_{pi,\%}40 - Q_{pi,\%}30}{Q_{pi,\%}50 - Q_{pi,\%}30} \times \frac{Q_{pi,\%}50}{Q_{pi,\%}40}$$

$$F_{pi}(50\%) = 0,3 \times \frac{40 - 30}{50 - 30} \times \frac{50}{40} = 0,1875$$

$$\text{Low rate}: F_{pi}(30\%) = F_{pi}(40\%) - F_{pi}(50\%) = 0,3 - 0,1875 = 0,1125$$

E.4 Weighting of $Q_{pi,\%}$ = 60

$Q_{pi,\%}$ = 60 has to be apportioned between $Q_{pi,\%}$ = 50 (low rate) and $Q_{pi,\%}$ = 100 (high rate).

$$\text{High rate}: F_{\text{pi}}(100\%) = F_{\text{pi}}(60\%) \bullet \frac{Q_{\text{pi},\%}60 - Q_{\text{pi},\%}50}{Q_{\text{pi},\%}100 - Q_{\text{pi},\%}50} \bullet \frac{Q_{\text{pi},\%}100}{Q_{\text{pi},\%}60}$$

$$F_{\text{pi}}(100\%) = 0{,}25 \times \frac{60 - 50}{100 - 50} \times \frac{100}{60} = 0{,}0833$$

$$\text{Low rate}: F_{\text{pi}}(50\%) = F_{\text{pi}}(60\%) - F_{\text{pi}}(100\%) = 0{,}25 - 0{,}0833 = 0{,}1667$$

E.5 Weighting of $Q_{\text{pi},\%}$ = 70

$Q_{\text{pi},\%}$ = 70 has to be apportioned between $Q_{\text{pi},\%}$ = 50 (low rate) and $Q_{\text{pi},\%}$ = 100 (high rate).

$$\text{High rate}: F_{\text{pi}}(100\%) = F_{\text{pi}}(70\%) \times \frac{Q_{\text{pi},\%}70 - Q_{\text{pi},\%}50}{Q_{\text{pi},\%}100 - Q_{\text{pi},\%}50} \times \frac{Q_{\text{pi},\%}100}{Q_{\text{pi},\%}70}$$

$$F_{\text{pi}}(100) = 0{,}15 \times \frac{70 - 50}{100 - 50} \times \frac{100}{70} = 0{,}0857$$

$$\text{Low rate}: F_{\text{pi}}(50\%) = F_{\text{pi}}(70\%) - F_{\text{pi}}(100\%) = 0{,}15 - 0{,}0857 = 0{,}0643$$

E.6 Total weighting

Table E.2 — Total weighting

Rate	20 %	40 %	60 %	70 %	Total
30 %	0,30	0,112 5	—	—	0,412 5
50 %	—	0,187 5	0,166 7	0,064 3	0,418 5
100 %	—	—	0,083 3	0,085 7	0,169 0
Total	0,30	0,30	0,25	0,15	1

The ponderation is given by Equation E.1.

$$\text{NO}_{\text{x,pond}} = 0{,}412\,5 \times \text{NO}_{\text{x,mes(30\%)}} + 0{,}418\,5 \times \text{NO}_{\text{x,mes(50\%)}} + 0{,}169 \times \text{NO}_{\text{x,mes(100\%)}} \qquad \text{(E.1)}$$

Annex F
(informative)

Calculation of conversions of NO_x

F.1 NO_x emission conversion factors

Table F.1 — NO_x emission value conversion for first family gases

		G 110	
		mg/kWh	mg/MJ
O_2 = 0 %	1 ppm[a)]	1,714	0,476
	1 mg/m^3 [a)]	0,834	0,232
O_2 = 3 %	1 ppm	2,000	0,556
	1 mg/m^3	0,974	0,270
a) 1 ppm = 2,054 mg/m^3 and 1 ppm = 1 cm^3/m^3			

Table F.2 — NO_x emission value conversion for second family gases

		G 20		G 25	
		mg/kWh	mg/MJ	mg/kWh	mg/MJ
O_2 = 0 %	1 ppm [a)]	1,764	0,490	1,797	0,499
	1 mg/m^3 [a)a]	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
a) 1 ppm = 2,054 mg/m^3 and 1 ppm = 1 cm^3/m^3					

Table F.3 — NO_x emission value conversion for third family gases

		G 30		G 31	
		mg/kWh	mg/MJ	mg/kWh	mg/MJ
O_2 = 0 %	1 ppm[a)]	1,792	0,498	1,778	0,494
	1 mg/m^3 [a)a]	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
a) 1 ppm = 2,054 mg/m^3 and 1 ppm = 1 cm^3/m^3					

F.2 NO_x conversion calculation

Flowchart for the calculation of the NO_x emission to the reference conditions mg/MJ, mg/kWh and ppm; dry, with a certain amount of O_2.

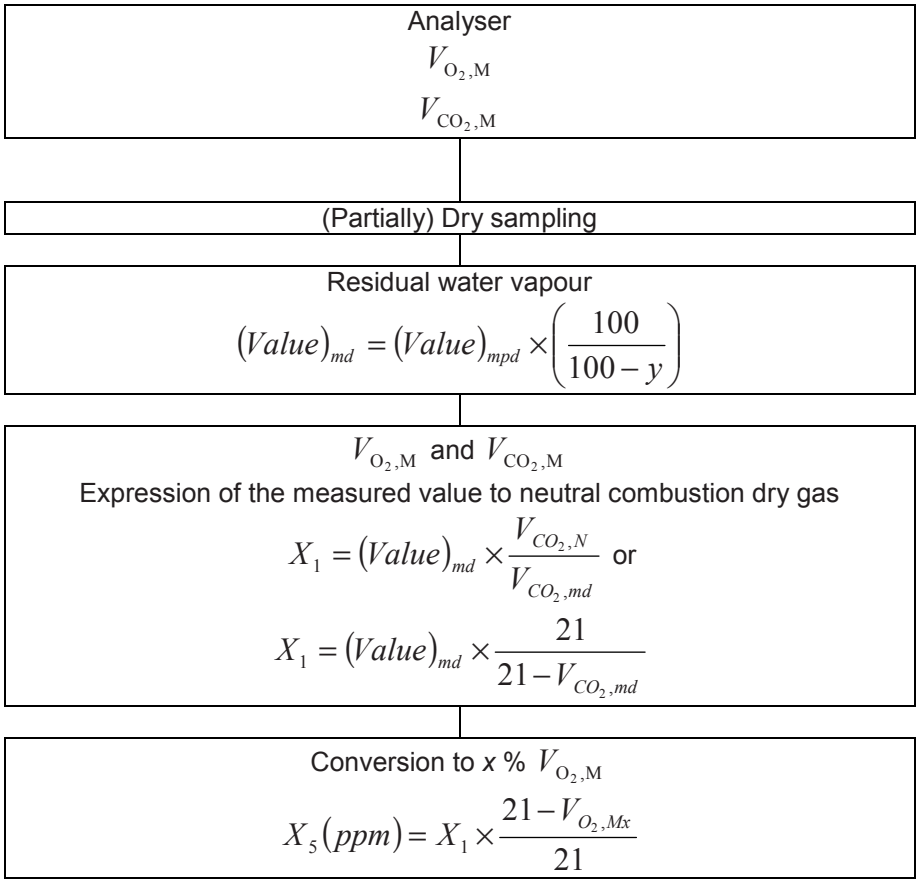

Table F.4 — Relationship of symbols in EN 419-1:1999 and CR 1404:1994

EN 419-1:1999	CR 1404:1994	Explanation
$V_{CO,M}$ $V_{NO_X,M}$ $V_{NO,M}$ $V_{NO_2,M}$	$(CO)_m$ $(NO_x)_m$ $(NO)_m$ $(NO_2)_m$	are measured concentrations in the sample taken during the combustion test (ppm, *V/V*): $V_{NO_x,M} = V_{NO,M} + V_{NO_2,M}$
$V_{CO_2,M}$ $V_{O_2,M}$	(CO_2) (O_2)	are measured concentrations in the sample taken during the combustion test (%, *V/V*)
$V_{CO_2,N}$	$(CO_2)_n$	is the maximum carbon dioxide content of the dry, air-free combustion products (%, *V/V*)
$V_{O_2,md}$ $V_{CO_2,md}$	$(O_2)_{md}$ $(CO_2)_{md}$	is the correction of measured value at partially dry (mpd) sample gas to dry (md) sample gas
y	*y*	is the content of water vapour in dried sample gas (%,*V/V*)
x	*x*	is the reference level of O_2 dry gas (%) (e.g. 3% O_2)
X_1	X_1	is the NO_x value at neutral combustion conditions dry gas at 0% O_2 (ppm, mg/MJ or mg/kWh)
X_5	X_5	is the NO_x value at *x* % O_2 dry gas converted from neutral combustion conditions (ppm, mg/MJ or mg/kWh)

Annex G
(informative)

National situations of countries whose national bodies are CEN associate members

NOTE: This Annex has been retained to enable the current associate members of CEN to provide information concerning any national situations. At present no information has been received from any associate member state of CEN.

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, 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 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

Essential requirement	Subject	Relevant clauses in EN 419-1
1.1	Safe design and construction	Whole standard
1.2	Instructions and warning notices	
1.2.1	Installation instructions Type of gas used Gas supply pressure Fresh air- for combustion - products dispersal	8.2.2.1 8.1.1 8.1.1, 8.1.3 8.1.2, 8.1.3 8.1.3, 8.2.2.1
1.2.2	Instructions for use and servicing	8.2.1, 8.2.3
1.2.3	Warning notices on appliance and packaging	8.1.2, 8.1.3
1.3	Fittings Instructions	5.2 Not applicable
2.1	Characteristic of material	5.1.2, 6.7
2.2	Properties of materials	1
3.1.1	Durability	5.1.2
3.1.2	Condensation	6.8 d)
3.1.3	Explosion risk	5.1.2, 5.1.4.1
3.1.4	Air/water penetration	6.1.1
3.1.5	Normal auxiliary energy fluctuation	5.1.9, 6.7.2
3.1.6	Abnormal auxiliary energy fluctuation	5.1.9, 6.7.2
3.1.7	Electrical hazards	5.1.8
3.1.8	Parts under pressure	Not applicable
3.1.9	Safety/control device failure: — automatic burner control systems multifunctional control automatic shut-off valve — thermostat/cut-off device — air proving device	 5.2.11.15.2.8 5.2.9, 5.2.11.5, 5.2.11.6 Not applicable Not applicable
3.1.10	Overruling of safety devices	5.2.5.1
3.1.11	Pre-set adjuster protection	5.2.1
3.1.12	Levers and setting devices	5.2.5.3
3.2.1	Gas leakage	5.1.4, 6.1
3.2.2	Gas release during ignition, extinction, re-ignition	5.2.8, 5.2.9, 5.2.11

(continued)

Table ZA.1 (concluded)

Essential requirement	Subject	Relevant clauses in EN 419-1
3.2.3	Unburned gas accumulation	5.2.11
3.3	Ignition — Ignition, re-ignition — Cross-lighting	 5.2.11.4, 5.2.11.5, 5.3.1, 6.4 5.2.11.4, 5.2.11.5, 5.3.3, 6.4
3.4.1	Flame stability Harmful substances	6.4 6.7
3.4.2	Combustion products release - normal use	6.1.2
3.4.3	Combustion products release - abnormal draught conditions	6.1.2 (See NOTE)
3.4.4	Flueless domestic appliances	Not applicable
3.5	Rational use of energy	(see EN 419-2)
3.6.1	Wall etc. temperatures	6.3.1
3.6.2	Temperature of knobs/levers	Not applicable
3.6.3	External parts	Not applicable
3.7	Foodstuffs and water	Not applicable
NOTE These appliances are installed at such a height relative to the persons who may be exposed to the combustion products, that natural ventilation would prevent the build up of a dangerous quantity.		

Bibliography

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

[2] EN 60730-1:2001, *Automatic electrical controls for household and similar use - Part 1: General requirements*

[3] EN 60730-2-1:1997, *Automatic electrical controls for household and similar use - Part 2-1: Particular requirements for electrical controls for household appliances*

[4] EN 60730-2-9:2002, *Automatic electrical controls for household and similar use - Part 2-9: Particular requirements for temperature-sensing controls*

[5] ISO 274:1975, Copper tubes of circular section — Dimensions

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