

Decorative fuel-effect gas appliances

The European Standard EN 509:1999, with the incorporation of amendments A1:2003 and A2:2004, has the status of a British Standard

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National foreword

This British Standard is the official English language version of EN 509:1999, including amendments A1:2003 and A2:2004. It supersedes BS 5258-12:1990 which is withdrawn.

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

The UK participation in its preparation was entrusted to Technical Committee GSE/36, Independent gas-fired space heaters, which has the responsibility to:

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Decorative fuel-effect gas appliances
(includes amendment A1:2003 and A2:2004)

Appareils à effet décoratif de combustion utilisant les
combustibles gazeux
(inclut les amendements A1:2003 et A2:2004)

Dekorative Gasgeräte mit Brennstoffeffekt
(enthält Änderungen A1:2003 und
A2:2004)

This European Standard was approved by CEN on 8 November 1998. Amendment A1 was approved by CEN on 14 February 2003 and amendment A2 was approved by CEN on 4 November 2004.

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Foreword

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

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of an identical text or by endorsement, at the latest by May 2000, and conflicting national standards shall be withdrawn at the latest by May 2000.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this standard.

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Foreword to amendment A1

This document (EN 509:1999/A1:2003) has been prepared by Technical Committee CEN/TC 62 "Independent gas-fired space heaters", the secretariat of which is held by BSI.

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This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

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Foreword to amendment A2

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1 Scope

This European Standard specifies the requirements and test methods for the construction, safety, and marking of decorative fuel effect gas appliances not exceeding a nominal heat input of 20 kW, (based on the net calorific value), thereafter referred to as appliances.

This standard is applicable to appliances that are designed to simulate a solid fuel fire and incorporate a natural draught burner with or without an ignition burner. The appliances are for decorative purposes only and are not heating appliances.

This standard is applicable to type B_{AS}, as described in 4.2.2, decorative fuel effect gas appliances that are designed to be installed within a non-combustible builder's opening or a non-combustible fireplace recess.

In addition, this standard is applicable to decorative fuel-effect gas appliances that are designed to be installed under a non-combustible canopy which may be independent or integral with a flue box, for which additional requirements are specified in annex C.

This standard is not applicable to:

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

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

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

Requirements concerning the rational use of energy have not been included in this European Standard because the appliances are for decorative purposes.

⌈A₂⌋ This document includes additional requirements for Type B_{BS} appliances which are specified in Annex J. ⌋A₂⌋

2 Normative references

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

EN 88: 1991	Pressure governors for gas appliances for inlet pressures up to 200 mbar
EN 125: 1991	Flame supervision devices for gas burning appliances - Thermo-electric flame supervision devices
EN 126: 1995	Multifunctional controls for gas burning appliances
EN 161	Automatic shut-off valves for gas burners and gas appliances
EN 298: 1993	Automatic gas burner control systems for gas burners and gas burning appliances with or without fans
EN 437: 1993	Test gases - Test pressures - Appliance categories
☐ _{A1} EN 50165	Electrical equipment of non-electric appliances for household and similar purposes – Safety requirements. ☐ _{A1}
EN 60335-1: 1994	Safety of household and similar electrical appliances - Part 1: General requirements (IEC 60335-1 : 1991)
EN 60529: 1991	Degrees of protection provided by enclosures (IP Code) (IEC 60529 : 1989)
☐ _{A1} EN ISO 3166-1:1997	Codes for the representations of names of countries and their subdivisions – Part 1: Country Codes (ISO 3166-1:1997) ☐ _{A1}
☐ _{A1} CR 1404	Determination of emissions from appliances burning gaseous fuels during type-testing ☐ _{A1}
ISO 7 - 1: 1994	Pipe threads where pressure-tight joints are made on the threads - Part 1: Dimensions, tolerances and designation
ISO 228 - 1: 1994	Pipe threads where pressure-tight joints are not made on the threads - Part 1: Dimensions, tolerances and designation
ISO 274: 1975	Copper tubes of circular section - Dimensions

3 Definitions

For the purposes of this standard the following definitions apply:

3.1 Decorative fuel effect gas appliances

3.1.1 decorative fuel effect gas fire (see figure 1): An appliance designed to simulate a solid fuel appliance for decorative purposes and intended to be installed so that the products of combustion pass unrestricted from the firebed to the chimney or flue.

3.1.2 working surfaces: These include those parts of an appliance which, due to the nature of the appliance, have temperatures exceeding the limits specified in 6.4.1. Examples are:

- Bricks, refractories, imitation fuel;
- Fire fronts;
- Fire baskets;
- Canopies, burners, burner trays and bracketry.

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

3.2 Gases

3.2.1 reference conditions:

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

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

A distinction is made between:

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

Symbol: H_s

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

Symbol: H_i

Units: either:

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

[EN 437: 1993]

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

Symbol: d

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

Symbol:

gross Wobbe index: W_s

net Wobbe index: W_i

Units: either:

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

[EN 437: 1993]

3.2.4 test pressures: Gas pressures used to verify the operational characteristics of appliances using combustible gases. They consist of normal and limit pressures.

They are expressed in millibar (mbar).

NOTE: 1 mbar = 100 Pa.

3.2.5 normal pressure: The pressure under which appliances operate in nominal conditions, when they are supplied with the corresponding reference gas.

Symbol: p_n .

3.2.6 limit pressures: Pressures representative of the extreme variations in the appliance supply conditions.

Symbols: maximum pressure: $p_{\max}$
minimum pressure: $p_{\min}$

3.2.7 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:

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

[EN 437: 1993]

3.3 Appliance construction

3.3.1 The gas circuit

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

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

NOTE: For example the following:

- cone seated joints;
- torroidal sealing rings ('O' rings);

- flat joints;
- metal to metal joints.

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

3.3.1.4 *gas restrictor*: A non-adjustable device which is placed in the gas circuit so as to create a pressure drop and thus reduce the gas pressure at the burner to a predetermined value for a given supply pressure and rate.

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

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

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

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

3.3.1.6 *gas rate control*: A component allowing the user to open or close the gas supply to one or more burners. It may also be used to adjust the gas rate of certain burners to a predetermined value, called the 'reduced rate'. This device may be a 'tap'.

3.3.1.7 *injector*: A component that admits the gas into a burner.

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

3.3.2 Burner

3.3.2.1 *main burner*: A burner which assures the function of the appliance. It is usually called simply "burner".

3.3.2.2 *pan burner*: A main burner which utilizes a particulate medium (e.g. sand) for the distribution of gas over a defined area.

3.3.2.3 *ignition burner*: A separate burner intended to light the main burner.

3.3.2.3.1 *permanent ignition burner*: An ignition burner that operates continuously throughout the whole period that the appliance is in use.

3.3.2.3.2 *intermittent ignition burner*: An ignition burner that is ignited before and extinguished at the same time as the main burner.

3.3.2.4 *fixed primary aeration restrictor*: A non-adjustable device which limits the supply of primary air to a burner.

3.3.2.5 *flame picture adjuster*: A device operated by the user to vary the flame picture. This is achieved by varying the aeration between maximum and minimum values which are defined by the design of the appliance.

3.3.3 Combustion products circuit

3.3.3.1 *builder's opening*: The enclosure constructed by the builder to accommodate fireplace components (see figure 1).

3.3.3.2 *fireplace opening*: The aperture formed in the face of the builder's opening, the fireplace recess or fire surround if fitted.

3.3.3.3 *fireplace recess*: The recess formed by the inclusion of fireplace components in the builder's opening.

3.3.3.4 *hearth*: The floor area in front of the plane of the builder's opening or fireplace opening.

3.3.3.5 *flue box*: A non-combustible enclosure that provides a substitute for the builder's opening or fireplace recess.

3.3.3.6 *canopy*: An enclosure situated at the base of a flue system and which is permanently fixed above the appliance to facilitate the passage of the products of combustion into the flue.

3.3.4 Auxiliary equipment

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

3.3.4.2 *ignition device*: A device that ignites one or more burners.

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

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

3.3.4.5 *control knob*: A component designed to be moved by hand in order to operate an appliance control (e.g. tap).

3.3.4.6 *programming unit*: A unit which reacts to signals from control and safety devices, gives control commands, controls the start-up sequence, supervises the burner operation and causes controlled shut-down, and if necessary safety shut-down and lock-out. The programming unit follows a predetermined sequence of actions and always operates in conjunction with a flame detector device.

3.3.4.7 *flame detector device*: A device by which the presence of a flame is detected and signalled.

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

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

3.3.4.9 *non-automatic burner system*: A burner system with an ignition device which is operated under manual supervision.

3.4 Adjusters and controls

3.4.1 *setting an adjuster*: The action of immobilizing an adjuster in position by some means such as a screw, etc. It is said that the adjuster is "set" in this position.

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

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

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

3.4.3 *putting a control out of service*: The procedure by which a control (of pressure, etc.) is put out of action and sealed in this position. The appliance then functions as if this device had been removed.

3.5 Appliance performance

3.5.1 Gas rates

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

Symbol: V

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

[EN 437: 1993]

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

Symbol: M

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

[EN 437: 1993]

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

Symbol: Q

Unit: kilowatt (kW)

[EN 437: 1993]

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

Symbol: Q_n

Unit: kilowatt (kW)

3.5.2 Gas combustion

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

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

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

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

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

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

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

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

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

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

3.5.8 *non-volatile lock-out*: A shut down condition such that a start can only be accomplished by a manual reset.

3.5.9 *volatile lock-out*: A shut down condition such that a start can be accomplished by restoration of the electrical supply, after its loss.

3.6 Marking of the appliance and packaging

3.6.1 *direct country of destination*: A 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: A country for which the appliance has been certified, but for which, in its present state of adjustment, it is not suitable. Subsequent modification or adjustment shall be made in order that it can be utilized safely and correctly in the country.

4 Classification of appliances

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

4.1.1 *Classification of gases*

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

Table 1: Classification of gases

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

4.1.2 *Appliance categories*

4.1.2.1 *General*

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

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

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

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

4.1.2.2 *Category I*

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

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

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

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

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

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

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

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

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

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

Category I₃₊: Appliances capable of using gases of the third family (propane and butane) and operating with a pressure couple without adjustment of the appliance. However for certain types of appliance specified adjustment of the primary combustion air may be permitted when changing from propane to butane and vice versa. No gas pressure regulating device is permitted on the appliance.

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

4.1.2.3 *Category II*

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

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

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

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

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

Category II_{2H3+}: Appliances capable of using gases of group H of the second family and gases of the third family. The second family gases are used under the same conditions as for category I_{2H}. The third family gases are used under the same conditions as for category I₃₊.

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

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

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

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

Category II_{2E+3+}: Appliances capable of using gases of group E of the second family and gases of the third family. The second family gases are used under the same conditions as for category I_{2E+}. The third family gases are used under the same conditions as for category I₃₊.

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

4.1.2.4 Category III

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

This category is not in general use.

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

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

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

4.2.1 Type B: For the purposes of this standard an appliance when installed beneath a flue within a builders opening or fireplace recess, whereby all the products of combustion are evacuated by natural draught. The combustion air is drawn directly from the room.

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

5 Constructional requirements

5.1 General

5.1.1 *Conversion to different gases*

5.1.1.1 *General*

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

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

5.1.1.2 *Category I*

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

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

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

5.1.1.3 *Category II*

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

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

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

If the appliance is intended to function without an operational governor for use with gases of the second family, it is obligatory to put the governor out of service in these circumstances (see 5.2.5).

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

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

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

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

The governor shall be put out of service where this is required in accordance with the requirements of 5.2.5.

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

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

- Replacement of the injectors or restrictors in order to convert from one pressure couple to another within the third family (e.g. 28 mbar to 30 mbar /37 mbar $\Leftrightarrow$ 50 mbar/67 mbar).
- Exchange of fixed primary aeration restrictor when changing from one pressure couple to another or from one pressure to another within a pressure couple is permitted.

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

5.1.1.4 Category III

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

5.1.2 Materials and method of construction

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

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

In addition, the appliance shall be designed in such a way that there is no condensation at the operating temperature provided by the controls.

If condensation is produced at start-up, this shall not:

- affect the operational safety;
- drip outside the appliance.

If the appliance has any bricks, radiants or imitation fuel that is not fixed, then the appliance when installed shall incorporate a fire basket or fire front or both, to contain the fuel. When the fire front is removable without the use of tools its removal shall not allow the imitation fuel to fall out.

Asbestos or materials containing asbestos shall not be used.

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

Thermal or acoustic insulation shall be non-combustible, securely located and protected against mechanical damage.

Copper shall not be used for those parts of the gas circuit which exceed 100 °C when the appliance is in normal use, when tested in accordance with 7.4.

5.1.3 *Accessibility for use and maintenance*

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

Removable parts shall be so designed or marked that they are easy to reassemble correctly according to the manufacturer's instructions and difficult to reassemble incorrectly.

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

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

Parts that are not intended to be removed by the user and that on removal may result in a hazard, e.g. injector jets, shall require the use of tools for their removal.

If the manufacturer's instructions specify the removal of the appliance for servicing, any joint specified in the gas circuit for this purpose shall be capable of being checked for gas soundness after re-assembly.

5.1.4 Connections

5.1.4.1 *Appliance inlet connections*

For appliance inlet connections see A.5.

Appliances shall not be supported by their connections.

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

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

- b) a thread conforming to ISO 7-1: 1994;
- c) a compression fitting suitable for copper tube conforming to table 2 of ISO 274: 1975;
- d) a straight tube at least 30 mm long, the end of which is cylindrical, smooth and clean, to allow connection by means of a compression fitting as specified in c);
- e) a cone-seated union.

5.1.4.2 Access to the inlet connection

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

5.1.5 Soundness of the gas circuit

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

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

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

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

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

5.1.6 Spacing

If, on installation, it is necessary to leave a gap between the back of the appliance and the back of the opening, suitable stops shall be incorporated on, or be supplied with, the appliance.

5.1.7 *Electrical equipment*

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

Ⓐ Text deleted Ⓐ

If the appliance is fitted with electronic components or electronic systems providing a safety function, these shall comply with the relevant requirements of EN 298: 1993 with regard to electromagnetic compatibility immunity levels.

If the manufacturer specifies the nature of the electrical protection of the appliance on the data plate, this specification shall comply with EN 60529: 1991 to give the degree of personal protection against contact with dangerous electrical components.

5.1.8 *Safety in the event of 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 non-volatile lockout.

The appliance is deemed to be safe in the event of normal and abnormal fluctuation of the mains voltage supply by carrying out the test described in 7.7.3.2 and complying with the requirements of 6.5.4 and 6.7.2.

5.2 *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.

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

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

5.2.2 *Gas rate adjusters*

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

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

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

Ⓐ) Appliances in categories I_{2H}, I_{2L}, I_{2E}, I_{2E+}, I_{3B/P}, I_{3P}, I₃₊, II_{2H3B/P}, II_{2H3+}, II_{2H3P}, II_{2L3P}, II_{2L3B/P}, II_{2E3B/P} and II_{2E+3+} shall not be fitted with gas rate adjusters. However governed appliances in all of these categories except category I_{2E+} and II_{2E+3+} may have a gas rate adjuster consisting of an adjusting screw on the gas governor. Ⓐ)

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

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

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

5.2.3 Flame picture adjuster

If a flame picture adjuster is provided the following shall be carried out:

- a) set it to the position of minimum aeration

Under this condition the appliance shall comply with 6.7.1 and 6.8;

- b) set it to the position of maximum aeration

Under this condition the appliance shall comply with 6.5.2;

- c) with the flame picture adjuster set to the position where spillage is most likely to occur, check that the appliance complies with 6.2.2.

5.2.4 Manual controls

5.2.4.1 General

The appliance shall be provided with such gas taps, push-buttons or electric switches as are essential for normal operation of the appliance by the user.

5.2.4.2 Tap design

All gas taps shall comply with the parameters specified by the tap manufacturer.

Any gas cock or tap shall be designed, identified or positioned to avoid inadvertent operation but shall be easy to operate when required. It shall be so designed that the OFF and ON positions are readily distinguishable.

Any gas cock or tap used for the purposes of OFF-ON operation shall be provided with positive stops at the OFF and full ON positions. The gas shall not be shut off in any position of the tap except between the OFF stop and the end of the circumferential seal. For the purpose of this standard any operating mechanism between the control and the tap handle shall be deemed part of the control.

A multi-position tap shall be clearly marked at the ignition position and it shall not be possible to move from the OFF to the ON position without a halt at the ignition position unless the control incorporates another device to avoid a hazard arising, e.g. flame supervision device or ignition cut-out.

Any cock or tap shall be easy to operate at the highest working temperature obtained on the appliance and shall be sound at that temperature.

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

The various tap positions shall be marked indelibly and clearly as follows:

Off	:	disc
ignition burner ignition	:	stylized star
Full-on (burner)	:	large stylized flame
Reduced rate (if any)	:	small stylized flame

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

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

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

If the appliance has a burner that includes fine granular material (e.g. sand), the gas tap shall be protected either by design or position from ingress of such material into the tap mechanism.

5.2.5 Pressure governors

Pressure governors shall comply with EN 88: 1991.

An appliance of category I₃₊ shall not have a governor.

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

Governors are optional for an appliance in the other categories.

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

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

5.2.6 Multifunctional controls

Any multifunctional control shall comply with EN 126: 1995.

5.2.7 Flame supervision devices

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

The flame detector of an automatic burner control system shall comply with EN 298: 1993.

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

5.2.8 Shut-off valves

5.2.8.1 General

An electrically operated automatic gas shut-off valve shall comply with EN 161  *Text deleted* .

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

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

The gas line shall be fitted with either a thermoelectric device or a valve of class A, B or C to shut off the gas supply to the main burner and ignition burner, if any; the flame detector can operate this valve.

5.2.8.2 *Non-automatic burner system*

Appliances shall have a tap or second valve of either class A, B, C or D.

NOTE. The thermoelectric device/main valve and tap/second valve may be either combined or in separate units.

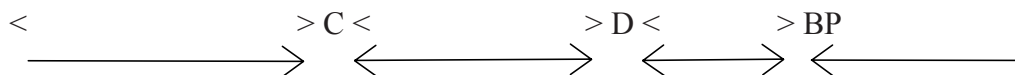
5.2.8.3 *Automatic burner system*

Appliances shall have a second valve of either class A, B, C or D.

The following arrangement is an example. Any other arrangement giving at least an equivalent level of safety is permissible:

Legend BP = main burner

Appliances with direct ignition of the main burner.



5.2.9 *Automatic burner control systems*

The automatic burner control system shall not operate when the appliance is left unattended.

Automatic burner control systems shall comply with EN 298: 1993.

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

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

5.2.10 Atmosphere sensing device

The appliance shall incorporate an atmosphere sensing device, or equivalent, to prevent the release of combustion products in a dangerous quantity into the room under abnormal draught conditions.

5.3 Ignition devices

5.3.1 General

Ignition of the ignition burner (or main burner if there is no ignition burner) shall be possible from a safe and easily accessible position.

If an appliance is not fitted with an automatic burner control system, it shall be possible to light the ignition burner safely with a match or a wooden spill in the event of failure of the ignition device, (e.g. piezo).

[A1] The appliance shall be designed such that it shall not be possible to achieve ignition of the ignition burner and/or main burner by any means when the appliance is left unattended.

The appliance shall be designed such that it shall only be possible to achieve ignition of the ignition burner and/or main burner by a person in the room in which it is installed. **[A1]**

It shall be possible to determine readily that the ignition burner (or main burner if there is no ignition burner) is alight.

Any specific instructions that are necessary in respect of operation of the tap shall be stated in the instructions for use and maintenance.

Ignition burners and ignition devices shall be protected by design and position against diminution or extinction resulting from, for example, 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 burners

If different ignition burners are used for different gases, 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.

Any ignition burner aeration adjuster shall be pre-set and locked or sealed by the manufacturer.

5.4 Flame supervision systems

5.4.1 General

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

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

An atmospheric sensing device, or equivalent, in conjunction with an ignition burner, may serve as a flame supervision device and ignition burner.

5.4.2 Appliances with automatic burner systems

Upon flame failure during the running condition the flame supervision device shall cause non-volatile lock-out except in the case of appliances with direct ignition of the main burner, in which case an immediate smooth re-ignition attempt is permitted within a maximum of 10 s. In the event that re-ignition is unsuccessful during this period, non-volatile lock-out shall occur.

5.5 Ignition burner or start-gas flame establishment

5.5.1 Appliances with non-automatic burner systems

If an appliance is fitted with a separate ignition burner, the heat input of the ignition burner shall not exceed 0,3 kW.

5.5.2 Appliances with automatic burner systems

A start gas flame may be established at the main burner.

The manufacturer shall specify the safety time which shall be not more than 10 s.

The start-gas automatic shut-off valve(s) shall not be energized before the ignition spark (or other means of ignition) is energized.

If the start-gas flame is not detected by the end of the first safety time, non-volatile lock-out shall result.

5.6 Main flame establishment

5.6.1 General

Flame failure at any time before and after the main gas safety shut-off valves have been signalled to open shall lead to safety shut-down and non-volatile lock-out.

5.6.2 Appliances with non-automatic burner systems

Main gas shall not be admitted to the burner until the start-gas flame has been detected by the flame supervision system and manual intervention has occurred (e.g. release of a push-button).

5.6.3 Appliances with automatic burner systems

The main gas safety shut-off valves shall not be energized to admit the main gas flow to the burner until after the start-gas flame has been detected.

NOTE: The upstream safety shut-off valve in the main gas supply may be opened to permit start-gas flow where the start-gas supply is taken from downstream of the first main gas safety shut-off valve.

5.6.4 Direct establishment of the main flame

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

- a) incorporate an automatic ignition system;
- or
- b) have a heat input less than or equal to 4 kW during the ignition procedure.

The ignition source shall not be energized before a safe-start check has been made of the flame supervision system and shall be de-energized at, or before, the end of the safety time.

If the flame has not been detected before the end of the safety time, non-volatile lock-out shall result.

This extinction time shall not exceed 3 seconds, as verified under the test conditions described in 7.10.2.3.

5.7 Burners

5.7.1 General

The section of the flame ports shall not be adjustable.

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

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

5.7.2 Pan burners

For those appliances using a pan burner, the pan shall hold and define the quantity of distribution medium.

5.8 Clocks and timing devices

The failure of a clock or timing device shall not affect the safety of the appliance. The operation of a manual override, if provided, shall not affect the safe operation of the appliance.

5.9 Gas pressure test points

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

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

6 Operational requirements

6.1 General

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

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

6.2.1 *Soundness of the gas circuit*

The gas circuit shall be sound. It is deemed to be sound if, when tested as described in 7.2.1, the leakage of air does not exceed 100 cm³/h irrespective of the number of components, whether mounted in series or parallel on the appliance.

6.2.2 *Correct evacuation of combustion products*

Under the test conditions described in 7.2.2 any leakage of products from the appliance shall not exceed the ambient CO₂ by more than 0,02 %.

6.2.3 *Escape of unburnt gas from the burner*

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

6.3 Heat inputs

6.3.1 *Nominal heat input*

When calculated in accordance with 7.3.1:

- a) for an appliance without a gas rate adjuster, under the test conditions described in 7.3.2, the heat input obtained at normal test pressure shall be within ± 5 % of the nominal heat input;
- b) for an appliance with a gas rate adjuster but no governor, the heat input shall be at least equal to the nominal heat input when measured under the conditions described in 7.3.3, test No.1, and shall not exceed the nominal heat input when measured under the conditions described in 7.3.3, test No. 2;
- c) an appliance with a pressure governor shall comply with 6.6.

6.3.2 *Start gas heat input*

When measured in accordance with 7.3.4, the heat input shall be as specified by the manufacturer (see 5.5.1 or 5.6.4).

6.3.3 *Reduced rate*

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

6.4 Temperature of various parts of the appliance and its surroundings

6.4.1 *Temperature of external parts of the appliance*

When tested as described in 7.4.2, the surface temperature of the control handles and of all the parts that have to be manipulated during normal operation of the appliance, measured only in the areas intended to be touched, shall not exceed the ambient temperature by more than:

35 K for metals and equivalent materials;

45 K for porcelain and equivalent materials;

60 K for plastics and equivalent materials.

If, when tested as described in 7.4.1, the temperature of the end of the appliance gas inlet connection exceeds the ambient by more than 30 K, the technical instructions for installation and adjustment shall state the precautions to be taken when connecting the appliance by means of a flexible pipe. This requirement only applies to those countries where this type of connection is permitted.

When tested as described in 7.4.1, the temperature of those parts of the appliance, other than working surfaces (see 3.1.2), and those parts that have to be removed during normal operation of the appliance, shall not exceed the ambient temperature by more than:

80 K for bare metal;

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

100 K for plastics, rubber or wood.

6.4.2 *Temperature of components*

Under the test conditions described in 7.4.3, the temperature measured of any component (including taps) shall not exceed that declared by the component manufacturer.

6.4.3 *Floor temperatures*

When the appliance is tested under the conditions described in 7.4.4, the temperature of the area of the floor shall not exceed the ambient by more than 60 K. If this temperature is exceeded, the manufacturer shall state that the appliance is to be installed on a non-combustible hearth (see figure 6).

6.5 Ignition, cross-lighting and flame stability

6.5.1 Ignition and cross lighting

6.5.1.1 For all appliances

When tested as described in 7.5.1.1 to 7.5.1.4 inclusive, correct ignition of the ignition burner and main burner by the ignition burner, or, main burner if this is ignited directly, shall be smooth and cross-lighting assured.

For piezo ignition devices, the appliance shall successfully ignite eight out of ten operations of the device.

6.5.1.2 Supplementary tests

When tested as described in 7.5.1.1, 7.5.1.5.1 and 7.5.1.5.2, as appropriate, the main burner shall not cause a hazard to the user or deformation to the fire and/or its components which affects safety.

NOTE: The test described in 7.5.1.5.1 and 7.5.1.5.2 are not carried out if the appliance is fitted with a re-start interlock, or, if the safety time (ie for automatic burner systems) is less than or equal to 5 s.

Under the test conditions described in 7.5.1.1 and 7.5.1.5.3 correct ignition of the main burner shall be assured.

6.5.2 Flame stability

When tested as described in 7.5.2, the flames shall be stable.

NOTE: In general, stability implies that the flames do not lift from the burner ports, combustion surfaces or jets. However, with some burners, flames may lift intermittently because of the effects of local heating or vitiation, and this should be taken into account.

6.5.3 Effect of room draughts

Under the test conditions described in 7.5.3, the main burner shall not light-back or be permanently extinguished.

6.5.4 Fluctuation of auxiliary energy

When tested as described in 7.7.3.2 the appliance shall ignite and continue to operate

6.6 Pressure governors

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

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

6.7 Combustion

6.7.1 CO concentration for all appliances

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

- a) 0,10 % when the appliance is supplied with reference gas under the test conditions described in 7.7.1 and 7.7.2.1;
- b) 0,20 % when the appliance is supplied with the incomplete combustion limit gas under the test conditions described in 7.7.1, and 7.7.2.2.

6.7.2 Supplementary tests under special conditions

Under the test conditions described in 7.7.3, the CO concentration in the air-free, dry products of combustion shall not exceed 0,2 %.

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

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

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

Table 2: NO_x concentration limits

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

