

Domestic gas-fired forced convection air heaters for space heating, with fan-assisted burners not exceeding a net heat input of 70 kW

The European Standard EN 1319:1998, with the incorporation of amendments A1:2001 and A2:1999, has the status of a British Standard

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National foreword

This British Standard is the official English language version of EN 1319:1998, including amendments A1:2001 and A2:1999.

The UK participation in its preparation was entrusted to Technical Committee GSE/20, Non-domestic space heaters (gas), to Subcommittee GSE/20/4, Air heaters (gas), which has the responsibility to:

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

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

Cross-references

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English version

Domestic gas-fired forced convection air heaters for space heating, with fan-assisted burners not exceeding a net heat input of 70 kW

(includes amendments A1:2001 and A2:1999)

Générateurs d'air chaud à convection forcée utilisant les combustibles gazeux pour le chauffage de locaux à usage d'habitation, comportant des brûleurs avec ventilateur de débit calorifique inférieur ou égal à 70 kW (sur pouvoir calorifique inférieur)
(inclut les amendements A1:2001 et A2:1999)

Gasbefeuerte Warmlufterzeuger mit erzwungener Konvektion zum Beheizen von Räumen für den häuslichen Gebrauch, mit gebläseunterstützten Gasbrennern mit einer Nennwärmebelastung gleich oder kleiner als 70 kW
(enthält Änderungen A1:2001 und A2:1999)

This European Standard was approved by CEN on 1997-12-27. Amendment A1 was approved by CEN on 2001-08-18. Amendment A2 was approved by CEN on 1999-07-22. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 179, Gas-fired air heaters, the Secretariat of which is held by NNI.

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 February 1999, and conflicting national standards shall be withdrawn at the latest by February 1999.

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 Directives.

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

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

This European Standard covers type-testing only.

The test gases, test pressures and appliance categories given in this standard are in accordance with those specified in EN 437:1993, Test gases, test pressures and appliance categories.

NOTE 1 For countries requesting special categories (specified in EN 437:1993), the absence of specific information concerning **A.3.3** and **A.3.4** implies that the general requirements described in the body of the standard (clauses **4.1.1**, **4.2.2**, **4.2.3** and **4.2.5**) also apply to these special categories.

Type B₁₂, B₁₃ and B₁₄ appliances shall be fitted with an atmosphere sensing device or a combustion products discharge safety device in order to meet the Essential Requirement of **3.4.3** of the Directive 90/396/EEC. In this standard these appliances are designated as type B_{12AS}, B_{12BS}, B_{13AS}, B_{13BS}, B_{14AS} or B_{14BS}, according to the device. However, appliances intended to be installed in a space separated from living rooms and provided with appropriate ventilation directly to the outside, need not carry such a device, but in this case, appropriate warnings on the packaging and in the instructions shall clearly indicate the limit on the use of this type of appliance. In this standard these appliances are designated as type B₁₂, B₁₃ or B₁₄.

Other European Standards covering gas-fired air heaters are as follows.

EN 525, *Non-domestic direct gas-fired forced convection air heaters for space heating not exceeding a net heat input of 300 kW*.

EN 621, *Non-domestic gas-fired forced convection air heaters for space heating not exceeding a net heat input of 300 kW, without a fan to assist transportation of combustion air and/or combustion products*.

EN 778, *Domestic gas-fired forced convection air heaters for space heating not exceeding a net heat input of 70 kW, without a fan to assist transportation of combustion air and/or combustion products*.

EN 1020, *Non-domestic gas-fired forced convection air heaters for space heating not exceeding a net heat input of 300 kW, incorporating a fan to assist transportation of combustion air and/or combustion products*.

EN 1196, *Specific requirements for gas-fired condensing air heaters for domestic and non-domestic use*.

prEN 12669, *Non-domestic gas-fired hot air blowers for agriculturalized and supplementary space heating including special requirements for use in greenhouses*.

Foreword to amendment A1

This amendment EN 1319:1998/A1:2001 to the EN 1319:1998 has been prepared by Technical Committee CEN/TC 179, Gas-fired air heaters, the Secretariat of which is held by NEN.

This amendment to the European Standard EN 1319:1998 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2002, and conflicting national standards shall be withdrawn at the latest by March 2002.

This amendment to the European Standard EN 1319:1998 has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Foreword to amendment A2

This amendment EN 1319:1998/A2:1999, to EN 1319:1998 has been prepared by Technical Committee CEN/TC 179, Gas-fired air heaters, the Secretariat of which is held by NNI.

This amendment to the European Standard EN 1319:1998 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2000, and conflicting national standards shall be withdrawn at the latest by February 2000.

This amendment to the European Standard EN 1319:1998 has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

This amendment has been prepared to incorporate requirements and test methods concerning fully premixed burners in domestic air heaters.

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1 Scope

This European Standard specifies the requirements and test methods for the safety and efficiency of domestic gas-fired air heaters with a fan to assist the transportation of combustion air and/or combustion products, hereafter referred to as “appliances”.

This European Standard applies to type B₁₂, B_{12AS}, B_{12BS}, B₁₃, B_{13AS}, B_{13BS}, B₁₄, B_{14AS}, B_{14BS}, B₂₂, B₂₃, C₁₂, C₁₃, C₃₂, C₃₃, C₆₂ and C₆₃ appliances with an input not exceeding 70 kW (net cv basis), intended primarily for use in single unit residential dwellings. Provision of the heated air may be by means of ducting.

This European Standard does not contain all necessary requirements for:

- appliances of the condensing type;
- appliances for outdoor installation;
- dual purpose air conditioning appliances (heating and burners);
- appliances where the air is heated by an intermediate fluid;
- appliances with forced draught package burners;
- appliances fitted with a manual means of adjusting the combustion air supply or the evacuation of the combustion products;
- portable or transportable forced convection appliances;
- appliances having multiple heating units with a single draught diverter;
- appliances fitted with more than one flue outlet;
- Type C₂₂, C₂₃, C₄₂, C₄₃, C₅₂ and C₅₃ appliances.

This European Standard covers type-testing only.

2 Normative references

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

EN 88, *Pressure governors for gas appliances for inlet pressures up to 200 mbar*.

EN 125, *Flame supervision devices for gas burning appliances — thermoelectric flame supervision devices*.

EN 126, *Multifunctional controls for gas burning appliances*.

EN 161, *Automatic shut-off valves for gas burners and gas burning appliances*.

EN 257, *Mechanical thermostats for gas burning appliances*.

EN 298, *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*.

EN 12067-1:1998, *Gas/air ratio controls for gas-burners and gas burning appliances — Part 1: Pneumatic types*.

EN 23166:1993, *Codes for the representation of names of countries*. (ISO 3166:1988)

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

EN 60335-1:1988, *Safety of household and similar electrical appliances — Part 1: General requirements*.

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

EN 60730-2-1:1992, *Automatic electrical controls for household and similar use — Part 2: Particular requirements for electrical controls for electrical household appliances*.

EN 60730-2-9:1995, *Particular requirements for temperature sensing controls*.

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 1182:1990, *Fire tests — Building materials — Non-combustibility test*.

ISO 6976:1995, *Natural gas — Calculation of calorific values, density, relative density and Wobbe index from composition*.

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, *Determination of emissions from appliances burning gaseous fuels during type testing*.

3 Definitions

For the purpose of this standard, the following definitions apply.

3.1 Appliance and its constituent parts

3.1.1

domestic air heater

an appliance designed for the heating by means of warm air and possibly ventilation of a single unit residential dwelling

3.1.2

forced convection air heater

an appliance designed to provide space heating from a central source by distributing heated air, by means of an air moving device, either through ducting or directly into the heated space

3.1.3

gas inlet connection

the part of the appliance intended to be connected to the gas supply

3.1.4

mechanical joint; mechanical means of obtaining soundness

a means of assuring the soundness of an assembly of several (generally metallic) parts without the use of liquids, pastes, tapes, etc. There are, for example:

- metal to metal joints;
- conical joints;
- toroidal sealing rings (“O” rings);
- flat joints

3.1.5

gas circuit

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

3.1.6

restrictor

a 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

a component allowing to set the gas rate of the burner to a predetermined value according to the supply conditions

the action of adjusting this device is called “adjusting the gas rate”

3.1.8

setting an adjuster

immobilization of an adjuster by some means such as a screw after the manufacturer or installer has adjusted it

the adjuster is said to be “set” in this position

3.1.9**sealing an adjuster**

setting of an adjuster using a material such that any attempt to change the adjustment breaks the sealing material and makes the interference with the adjuster apparent. The adjuster is said to be “sealed” in its adjustment position

a factory sealed adjuster is considered to be non-existent

a governor 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. The appliance then functions as if the adjuster or control had been removed

3.1.11**injector**

a component that admits the gas into a burner

3.1.12**main burner**

a burner that is intended to assure the thermal function of the appliance and is generally called the burner

3.1.12.1**fully premixed burner**

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

3.1.13**ignition device**

any means (flame, electrical ignition device or other device) used to ignite the gas at the ignition burner or at the main burner

this device can operate intermittently or permanently

3.1.14**ignition burner**

a burner whose flame is intended to ignite another burner

3.1.15**permanent ignition burner**

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

3.1.16**intermittent ignition burner**

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

3.1.17**alternating ignition burner**

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

3.1.18**interrupted ignition burner**

an ignition burner that operates only during the ignition sequence

3.1.19**aeration adjuster**

a device enabling the excess primary air to be set at the desired value according to the supply conditions the action of adjusting this device is called “adjusting the primary aeration”

3.1.19.1

gas/air ratio control

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

3.1.20

combustion circuit

the combustion circuit comprises the air supply circuit, the combustion chamber, the heat exchanger and the combustion products evacuation circuit so far as this is part of the appliance

3.1.21

combustion chamber

an enclosure inside which combustion of the air-gas mixture takes place

3.1.22

flue outlet

the part of an appliance that connects with a flue to evacuate the products of combustion

3.1.23

draught diverter

a device placed in the combustion products circuit to reduce the influence of flue-pull and that of down-draught on the burner performance and combustion

3.1.24

flue damper

a manual or automatic device placed in the combustion products circuit intended to restrict or fully close off the passageways for the evacuation of products of combustion when the appliance is not in use

3.1.25

flue terminal

a device fitted at the end of the duct system which enables the discharge of flue gases and may, at the same time, allow entry of combustion air

3.2 Adjusting, control and safety devices

3.2.1

range-rating device

a 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)

3.2.2

automatic burner system

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

3.2.3

automatic burner control system

a 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

3.2.4

non-automatic burner system

a burner system with an ignition burner which is ignited manually

3.2.5

programming unit

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

3.2.6**programme**

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

3.2.7**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

3.2.8**flame signal**

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

3.2.9**flame simulation**

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

3.2.10**pressure governor**

a device which maintains the outlet pressure constant independent of the variations in inlet pressure and/or flow rate within defined limits

3.2.11**adjustable pressure governor**

a governor provided with means for changing the outlet pressure setting

3.2.12**flame supervision device**

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

3.2.13**automatic shut-off valve**

a valve designed to open when energized and to close automatically when de-energized

3.2.14**room temperature control thermostat**

a device controlling the operation of the appliance (by on/off, high/low or modulating control) and enabling the room temperature to be kept automatically, within a given tolerance, at a predetermined value

3.2.15**overheat cut-off device**

a device that shuts off and locks out the gas supply before the appliance is damaged and/or before safety is put into question, and that requires manual intervention to restore the gas supply

3.2.16**temperature limiter**

a device which is intended to keep a temperature below one particular value during normal operation conditions and which may have a provision for setting by the user

3.2.17**overheat limit device**

a device which is intended to keep a temperature below one particular value during abnormal operation conditions and which has either no provision for setting or is provided with a maximum temperature limit stop

the overheat limit device may be of the automatic or the manual reset type

3.2.18

fan control

a control that starts and/or stops the air delivery fan when the temperature of the delivered air reaches certain predetermined values

3.2.19

temperature sensing element; temperature sensor

a component that detects the temperature of the environment to be supervised or controlled

3.2.20

combustion products discharge safety system

a system that automatically shuts off the gas supply to the main burner, and perhaps to the ignition burner, when spillage of combustion products from the draught diverter is detected

3.2.21

atmosphere sensing device

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

3.2.22

modulating control

an automatic control by which the heat input of the appliance can be varied in a continuous manner between the nominal heat input and a minimum value

3.2.23

high/low control

an automatic control which permits an appliance to operate either at the nominal heat input or at a fixed reduced heat input

3.2.24

closed position indicator switch

a switch fitted to an automatic shut-off valve which indicates when the closure member is in the closed position

3.2.25

proof of closure switch

a switch within an automatic shut-off valve with mechanical overtravel which indicates when the closure member is in the closed position

3.2.26

valve proving system

a system to check the effective closure of automatic shut-off valves

3.3 Operation of the appliance

3.3.1

heat input

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

Symbol: Q

Unit: kilowatts (kW)

3.3.2

nominal heat input

the value of the heat input declared by the manufacturer

Symbol: Q_n

3.3.3**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)

3.3.4**volumetric flow rate**

the volume of gas consumed by the appliance in unit time during continuous operation

Symbol: V

Units: cubic metres per hour (m³/h), litres per minute (l/min), cubic decimetres per hour (dm³/h), or cubic decimetres per second (dm³/s)

3.3.5**flame stability**

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

3.3.6**flame lift**

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

3.3.7**light-back**

the entry of a flame into the body of the burner

3.3.8**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 a flame outside the burner

3.3.9**sooting**

a 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

3.3.10**yellow tipping**

the yellowing of the tip of the blue cone of an aerated flame

3.3.11**first safety time¹⁾**

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 a flame at the end of this interval

3.3.12**second safety time**

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. This only applies where there is a first safety time applicable to either an ignition burner or start gas flame

3.3.13**start gas**

gas that is supplied at the start gas rate to establish the start gas flame

¹⁾ Where there is no second safety time, this is called the safety time.

3.3.14

start gas rate

the restricted gas flow rate admitted either to a separate ignition burner or to the main burner during the first safety time

3.3.15

start gas flame

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

3.3.16

running condition of the system

the condition of the system in which the burner is in normal operation monitored by the flame supervision device and/or programming unit

3.3.17

controlled shut-down

the process by which the power to the gas valve(s) is removed immediately. This is achieved by the opening of a control loop which includes an external control device. The unit returns to its start position

3.3.18

safety shut-down

the process which is initiated in response to the signal from a limiting device or sensor and which causes the main burner to shut down the same way as for a controlled shut-down

3.3.19 Lock-out

3.3.19.1

non-volatile lock-out

the 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

3.3.19.2

volatile lock-out

the 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 main power and its subsequent restoration

3.3.20

spark restoration

the process by which, after disappearance of the flame signal, the ignition device is energized again without the gas supply having been totally interrupted. 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

the process by which, following loss of flame signal 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. 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 lock-out or non-volatile lock-out

3.3.22

ignition opening time

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

3.3.23

extinction safety time

the time interval between extinction of the supervised flame and the gas supply being shut off to the main burner and/or to the ignition burner

3.3.24**purge**

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

- *pre-purge*: the purge that takes place between the start command and the ignition device being energized;
- *post-purge*: the purge that is carried out after burner shut-down

3.4 Gases**3.4.1****test gases**

gases intended for the verification of the operational characteristics of appliances using combustible gases they comprise the reference and the limit gases

3.4.2**reference gases**

test gases on which appliances operate under nominal conditions, when they are supplied at the corresponding normal pressure

3.4.3**limit gases**

test gases representative of the extreme variations in the characteristics of the gases for which appliances have been designed

3.4.4**gas pressure**

the static pressure, relative to the atmospheric pressure, measured at right angles to the direction of flow of the gas

it is expressed in millibars (mbar) or in bars

3.4.5**test pressures**

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

they are expressed in millibars (mbar)

NOTE 1 mbar = 10^2 Pa.

3.4.6**normal pressure**

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

Symbol: p_n

3.4.7**limit pressures**

pressures representative of the extreme variations in the appliance supply conditions

Symbols:

maximum pressure: $p_{\max}$

minimum pressure: $p_{\min}$

3.4.8**pressure couple**

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

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

3.4.9**relative density**

the ratio of the masses of equal volumes of dry gas and dry air under the same conditions of temperature and pressure

Symbol: d

3.4.10**calorific value**

the quantity of heat produced by the 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:

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

Symbol: H_s

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

Symbol: H_i

Units: either:

- megajoules per cubic metre (MJ/m³) of dry gas at the reference conditions; or
- megajoules per kilogram (MJ/kg) of dry gas

3.4.11**Wobbe index**

the ratio of the calorific value of a gas per unit volume to 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 gross or net

Symbols:

gross Wobbe index: W_s

net Wobbe index: W_i

Units: either:

- megajoules per cubic metre (MJ/m³) of dry gas at the reference conditions; or
- megajoules per kilogram (MJ/kg) of dry gas

3.5 Conditions of operation and measurement**3.5.1****reference conditions**

- for calorific values, temperature: 15 °C;
- 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**

a condition of the appliance required for some tests and obtained with the appliance at room temperature

3.5.3**hot condition**

a condition of the appliance required for some tests and obtained by heating to thermal equilibrium at the nominal heat input and heating air rate or temperature rise specified by the manufacturer, any thermostat remaining fully open

3.5.4**thermal equilibrium**

the operating state of the appliance corresponding to a particular setting of the input, in which the measured value of the flue gas temperature remains steady within a tolerance of ± 2 % (°C reading) over a period of 10 min

3.5.5**maximum allowable pressure drop**

the maximum pressure drop in the flue system, as a result of the total resistance to flow, that is allowed for safe operation of the appliance and that is stated by the appliance manufacturer in millibars

3.5.6**equivalent length**

the length in case of a straight flue system with the same diameter as the appliance outlet, that results in the same pressure drop as a flue system including components such as bends, restrictions, terminal etc., in meters

3.6 Classification**3.6.1 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 gases used in this standard

3.6.2 classification of appliances

appliances can be classified according to:

- the gases they can use;
- the mode of evacuation of the combustion products

Table 1 — Classification of gases

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

3.6.2.1 classification according to the gases capable of being used**3.6.2.1.1 category I**

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

3.6.2.1.1.1 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.)

3.6.2.1.1.2 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 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 on the appliance. The appliance gas pressure regulating device, if it exists, is not operative in the range of the two normal pressures of the pressure couple

3.6.2.1.1.3 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 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

3.6.2.1.2 category II

appliances of category II are designed for use on gases of two families

3.6.2.1.2.1 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}

3.6.2.1.2.2 appliances designed for use on gases of the second and third families

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

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

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

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

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

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

category II_{2E3+}: 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 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}

3.6.2.1.3 category III

category III appliances are designed for use on gases of the three families. This category is not in general use. Category III appliances permitted in certain countries are given in **A.3**

3.6.2.2 classification according to the mode of evacuation of the combustion products

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

3.6.2.2.1 type B

an appliance intended to be connected to a flue which evacuates the products of combustion to the outside of the room containing the appliance. The combustion air is taken directly from the room

- *type B₁*: a type B appliance incorporating a draught diverter;
- *type B₁₂*: a type B₁ appliance designed for a natural draught flue incorporating a fan downstream of the combustion chamber/heat exchanger and upstream of the draught diverter;
- *type B_{12AS}*: a type B₁₂ appliance with an atmosphere sensing device;
- *type B_{12BS}*: a type B₁₂ appliance with a combustion products discharge safety system;
- *type B₁₃*: a type B₁ appliance for a natural draught flue with a fan upstream of the heat exchanger;
- *type B_{13AS}*: a type B₁₃ appliance with an atmosphere sensing device;
- *type B_{13BS}*: a type B₁₃ appliance with a combustion products discharge safety system;
- *type B₁₄*: a type B₁ appliance having an integral fan downstream of the draught diverter;
- *type B_{14AS}*: a type B₁₄ appliance with an atmosphere sensing device;
- *type B_{14BS}*: a type B₁₄ appliance with a combustion products discharge safety system;
- *type B₂*: a type B appliance without a draught diverter;
- *type B₂₂*: a type B₂ appliance incorporating a fan downstream of the combustion chamber/heat exchanger;
- *type B₂₃*: a type B₂ appliance incorporating a fan upstream of the combustion chamber/heat exchanger

3.6.2.2.2 type C

an appliance in which the combustion circuit (air supply, combustion chamber, heat exchanger, evacuation of the combustion products) is sealed with respect to the room in which the appliance is installed

- *type C₁*: a type C appliance which is designed for connection via ducts to a horizontal terminal which at the same time admits fresh air to the burner and discharges the products of combustion to the outside through orifices which are either concentric or close enough to come under similar wind conditions;
- *type C₁₂*: a type C₁ appliance incorporating a fan downstream of the combustion chamber/heat exchanger;
- *type C₁₃*: a type C₁ appliance incorporating a fan upstream of the combustion chamber/heat exchanger;
- *type C₃*: a type C appliance which is designed for connection via ducts to a vertical terminal which at the same time admits fresh air to the burner and discharges the products of combustion to the outside through orifices which are either concentric or close enough to come under similar wind conditions;
- *type C₃₂*: a type C₃ appliance incorporating a fan downstream of the combustion chamber/heat exchanger;
- *type C₃₃*: a type C₃ appliance incorporating a fan upstream of the combustion chamber/heat exchanger;
- *type C₆*: a type C appliance marketed without the terminal or the combustion air supply and combustion products evacuation ducts;
- *type C₆₂*: a type C₆ appliance incorporating a fan downstream of the combustion chamber/heat exchanger;
- *type C₆₃*: a type C₆ appliance incorporating a fan upstream of the combustion chamber/heat exchanger

4 Construction and design requirements

4.1 General

4.1.1 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 appliance category.

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

4.1.1.1 Category I

Category I_{2H} , I_{2L} , I_{2E} , I_{2E+} : No modification to the appliance.

Category $I_{3B/P}$: No modification to the appliance.

Category I_{3+} : Replacement of injectors or calibrated orifices but only in order to convert from one pressure couple to another, e.g. from 28–30 mbar/37 mbar to 50 mbar/67 mbar or vice versa.

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.

4.1.1.2 Category II

4.1.1.2.1 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 governor;
- 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 valve(s);
- putting the governor out of service under the conditions of 4.2.5;
- putting the gas rate adjusters out of service under the conditions of 4.2.2.2.

The adjustments or component changes are only acceptable when converting from a gas of the 1st family to a gas of the 2nd family or vice versa.

4.1.1.2.2 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 governor;
- 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 valve(s);
- putting the governor out of service under the conditions of 4.2.5;
- putting the gas rate adjuster(s) out of service under the conditions of 4.2.2.2.

These adjustments or component changes are only acceptable when:

- converting from a gas of the 2nd family to a gas of the 3rd family or vice versa;
- converting from one butane/propane pressure couple to another, e.g. 28-30 mbar/37 mbar to 50 mbar/67 mbar and vice versa.

4.1.1.3 Category III

Category III appliances admitted in certain countries are given in A.3.2.3.

4.1.2 Materials and method of construction

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

In particular, when the appliance is installed according to accepted practice, all components shall withstand the mechanical, chemical and thermal conditions to which they may be subjected in the course of normal operation.

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

If condensation occurs at start-up, this shall not affect the operational safety. With the exception of the outlet of the flue system, any condensate formed shall not drop outside the appliance.

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

Asbestos or materials containing asbestos shall not be used.

Hard solder containing cadmium in its formulation shall not be used. Solder that has a melting point below 450 °C after application shall not be used for gas carrying parts.

Materials downstream of the heat exchanger shall be corrosion-resistant or be effectively protected against corrosion. Zinc-coated steel materials are not allowed if they come into contact with combustion products during normal operation.

Where appropriate, materials used on the appliance shall be non-combustible in accordance with the requirements of ISO 1182:1990.

4.1.3 Accessibility for maintenance and use

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

It shall be possible to clean the combustion chamber and the parts in contact with combustion products in accordance with the manufacturer's instructions without using special tools unless these are supplied as necessary accessories with the appliance.

Access shall be possible to all handles, buttons etc. required during normal use of the appliance, without having to remove any part of the case. For this purpose, the opening of a door or the removal of an access panel is permitted.

Constructional parts accessible during use and maintenance shall be free from sharp edges and corners that might cause damage, personal injury during use or maintenance, or incorrect operation.

4.1.4 Thermal insulation

Any thermal insulation shall retain its insulating properties under the influences of heat and ageing. The insulation shall withstand the normally expected thermal and mechanical stresses. The insulation shall be non-combustible, securely located and shall be protected against mechanical damage and condensate.

4.1.5 Gas connection

The appliance gas connection shall be accessible.

The clearance around the connection, after removing the case if necessary, shall be adequate to allow the use of tools required to make the connection. It shall be possible to make all the connections without special tools.

It shall be possible to connect the appliance by rigid metallic means to the gas supply.

If the appliance has a threaded connection, this thread shall comply with ISO 228-1:1994 or ISO 7-1:1994. In the first case, the end of the appliance inlet connection shall be sufficiently flat to allow the use of a sealing washer.

If flanges are used, they shall comply with ISO 7005-1:1992, ISO 7005-2:1988 or ISO 7005-3:1988, as appropriate, and the manufacturer shall provide the counterflanges and sealing gaskets.

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

4.1.6 Soundness

4.1.6.1 Soundness of the gas circuit

Holes for screws, studs, etc., intended for the assembly of parts shall not open into gasways. The wall thickness between drillings and gasways shall be at least 1 mm. This does not apply to orifices for measurement purposes.

The soundness of parts and assemblies making up the gas circuit and likely to be dismantled for routine maintenance in situ shall be achieved by means of mechanical joints, e.g. metal-to-metal joints, packing, or O-ring joints, i.e. excluding the use of all sealing materials such as tape, paste or liquid. However, the sealing materials mentioned above may be used for permanent assemblies. These sealing materials shall remain effective under normal conditions of appliance use.

4.1.6.2 Soundness of the combustion circuit

Any means to achieve soundness of the combustion circuit shall be such that it does not deteriorate under normal conditions of use and maintenance.

In particular, the soundness of parts likely to be removed in the course of routine maintenance shall be achieved by mechanical means.

4.1.7 Supply of combustion air and evacuation of combustion products

4.1.7.1 Appliance combustion air supply

4.1.7.1.1 General

Adequate air flow to the appliance shall be assured during pre-purge (where applicable), ignition and over the whole range of possible heat inputs during operation.

All appliances shall be fitted with an air proving device to prove adequate combustion air during the pre-purge period (where applicable) and burner operation.

4.1.7.1.2 Type B₁₄ appliances

The cross-section of the combustion air passageways to the appliance shall not be adjustable.

4.1.7.1.3 Other appliances of Type B and Type C

The adjustment of the combustion air is permitted by manual or automatic means. The method of adjusting any damper, or other combustion air controlling device, shall be clearly defined in the manufacturer's instructions for installation and adjustment.

Automatic adjustment of the combustion air to the appliance is only permitted if the appliance is fitted with an air-gas ratio control.

4.1.7.2 Flue connection and parts

The flue system shall be designed in accordance with the manufacturer's instructions taking into account possible penetration of rain or snow into the appliance.

In addition, a terminal guard shall be fitted in accordance with the national regulations applicable in the various member countries.

4.1.7.2.1 Type B₁ appliances

The flue outlet shall be female and shall allow, if necessary by means of an adaptor supplied with the appliance, connection to a flue pipe whose diameter complies with the standards in force where the appliance is to be installed (see Annex A). The internal diameter of the flue outlet shall be such as to ensure compliance with requirements concerning operation. It shall be possible to insert a flue pipe with an external diameter $(D - 2)$ mm to a depth of at least $D/4$ (where D is the internal diameter of the flue outlet) but not so far that the evacuation of the combustion products is impaired.

4.1.7.2.2 Type B₁₂, B₁₂AS, B₁₂BS, B₁₃, B₁₃AS, B₁₃BS, B₁₄, B₁₄AS and B₁₄BS appliances

Connection to the flue shall be made by means of a flue outlet preceded by a draught diverter. This is part of the appliance.

Appliances shall be constructed to prevent release of combustion products in a dangerous quantity into the installation room under abnormal draught condition (see 5.1.9 and 5.1.10). To meet this requirement, type B₁₂, B₁₃ and B₁₄ appliances shall be factory fitted with a suitable device; in this case the appliance is designated as a type B₁₂AS, B₁₂BS, B₁₃AS, B₁₃BS, B₁₄AS or B₁₄BS appliance, according to the device (see 3.6.2.1.1 for classifications).

The device shall be an integral part of the appliance and resist the thermal, chemical and mechanical effects occurring in normal use. The device shall be protected by the manufacturer against adjustment and shall be so designed that it cannot be removed without the use of a tool. It shall be difficult to fit the device incorrectly after servicing.

However, appliances intended to be installed in a place separated from living rooms and provided with appropriate ventilation directly to the outside need not carry such a device, but in this case, appropriate warnings on the packaging and in the instructions shall clearly indicate the limit on the use of this type of appliance; in this case the appliance is designated as a type B₁₂, B₁₃ or B₁₄ appliance.

4.1.7.2.3 Additional requirements for appliances of Type B₁₄, B₁₄AS and B₁₄BS

The manufacturer shall state the maximum allowable pressure drop in the flue system.

Where the appliance is intended to be fitted to a flue having a wall termination, the manufacturer shall either supply a flue terminal or state the type of termination which shall be used. The design of this shall be such that it will not allow entry of a ball of 16 mm diameter applied with a force of 5 N. The design of

the flue system shall be such that any condensate formed when operating the appliance from cold shall either be retained and subsequently re-evaporated or discharged clear of the wall.

4.1.7.2.4 Type B_{22} and B_{23} appliances

The manufacturer shall state the maximum allowable pressure drop in the flue system.

Where the appliance is intended to be fitted to a flue having a wall termination, the manufacturer shall either supply a flue terminal or state the type of termination which shall be used. The design of this shall be such that it will not allow entry of a ball of 16 mm diameter applied with a force of 5 N. The design of the flue system shall be such that any condensate formed when operating the appliance from cold shall either be retained and subsequently re-evaporated or discharged clear of the wall.

4.1.7.2.5 Type C_{12} , C_{13} , C_{32} and C_{33} appliances

The terminal shall be supplied by the appliance manufacturer and any necessary combustion air and combustion products ducts shall be described in the installation instructions.

The manufacturer shall state the minimum and maximum lengths of ducts which can be used.

An opening in a terminal for C_1 appliances shall not permit the entry of a ball of 16 mm diameter, and for C_3 appliances 35 mm diameter, when applied with a force of 5 N.

If the terminal performance is dependent on a chamber within the wall, a chamber lining shall be provided with the appliance.

If the appliance is fitted with separate combustion air inlet and combustion products ducts, the centres of these ducts shall be in a distance of not more than 50 cm at their termination point.

The design of the flue system shall be such that any condensate formed when operating the appliance from cold shall either be retained and subsequently re-evaporated or discharged.

4.1.7.2.6 Type C_{62} and C_{63} appliances

The manufacturer shall state that the appliance shall only be installed with a (combined combustion air and combustion products discharge) terminal approved for use with type C_6 appliances.

NOTE 1 Requirements and test methods for terminals for use with type C_6 appliances are given in Annex C.

In addition, the manufacturer shall state the increase of the pressure difference measured between the inlet and the outlet of the appliance equivalent to the maximum allowable resistance and the equivalent length of the combustion air supply and combustion products evacuation duct system.

4.1.8 Supply and distribution of air for space heating

4.1.8.1 Air inlets

Where the air inlet is intended to be ducted to the appliance, the appliance shall be provided with flanges, spigots or other suitable connections on the air inlet.

4.1.8.2 Air outlets

Ducted appliances shall be capable of being located positively with respect to the outlet ductwork.

4.1.9 Checking the state of operation

The installer shall be able to observe visually the ignition and correct operation of the burner(s) and also the flame(s) of the ignition burner, if any. A door may be opened or a case removed provided that the operation of the burner is not disturbed.

If the means of observation is a viewing port, it shall, when located in an area of high temperature, be covered with a suitable material, for example heat resistant toughened glass and, if necessary, sealed with a suitable heat resistant sealant.

However, when the main burner is fitted with its own flame detector, an indirect means of identification (e.g. an indicator light) is allowed. The means of indicating presence of flame shall not be used to indicate any other fault, except for a fault in the operation of the means of checking the flame itself which shall result in an indication that there is no flame.

It shall be possible for the user, perhaps after opening a door or removing an access panel, to check at any time that the appliance is operating, either by visual observation of the flame or by some other indirect means.

4.1.10 Electrical equipment

The electrical equipment of the appliance shall comply with the relevant requirements of EN 50165:1997, except where reference is made to another electrical standard in 4.2.

If the appliance is fitted with electronic components or electronic systems providing a safety function, these shall comply with the relevant requirement of EN 298 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 inside the appliance case;
- to give the degree of electrical protection, inside the appliance case, against harmful actions due to water penetration.

4.1.11 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) safety shut-down; or
- c) volatile or non-volatile lock-out.

NOTE 1 Requirements and test methods relating to the continued and safe operation of the appliance in the event of normal and abnormal fluctuation of auxiliary energy are specified in 5.1.6.1 and 6.3.6.1.

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.

4.1.12 Motors and fans

The direction of rotation of fans shall be clearly marked.

Access to motors and fans shall not be possible without the use of commonly available tools, unless guarded. The guard must comply with IP 20 as a minimum as defined in EN 60529:1991.

Belt drives, where used, shall be so designed or positioned as to afford protection to the operator.

Means shall be provided to facilitate adjustment of belt tension. Access to such means shall be possible only with the use of commonly available tools.

Motors and fans shall be mounted in such a way as to minimize noise and vibration.

Lubrication points, if provided, shall be readily accessible.

The combustion chamber and heat exchanger shall be positioned on the pressure side of the air delivery fan. Products of combustion shall not be drawn into the air distribution system, even when user access panels are removed.

4.1.13 Air filter

An air filter shall be placed upstream of the heat exchanger in the heated air circuit.

It shall be easy to inspect and to replace the filter following the manufacturer's instructions, without requiring special tools.

4.2 Adjusting, control and safety devices

4.2.1 General

All the following devices or the multifunctional control in which they might be fitted shall be removable or exchangeable if this is necessary for cleaning or replacement of the device. Adjusters for the devices shall not be interchangeable if this could result in confusion.

When there are several control knobs (taps, thermostats, etc.), they shall not be interchangeable if this could lead to confusion or they shall be clearly marked to identify their function.

For ducted appliances, gas connections shall be sited externally to the air duct so as to prevent ingress of gas into the duct system.

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

4.2.2 Gas rate adjusters and range-rating devices

4.2.2.1 Common requirements

Gas rate adjusters and range-rating devices shall be designed so that they are protected against accidental maladjustment by the user once the appliance has been installed and put into service. It shall be possible to seal them (e.g. with paint) after adjustment; the sealing shall resist the heat to which it is subjected during normal operation of the appliance. The adjusting screws of the gas rate adjusters and range-rating devices shall be located so that they cannot fall into the gasways.

The soundness of the gas circuit shall not be put at risk by the presence of gas rate adjusters and range-rating devices.

4.2.2.2 Gas rate adjusters

Appliances in categories I_{2H}, I_{2L}, I_{2E}, I_{2E+}, I_{3B/P}, I_{3P}, II_{2H3B/P}, II_{2H3+}, II_{2H3P}, II_{2L3B/P}, II_{2E3B/P}, II_{2E+3+} and II_{2E+3P} shall not be fitted with gas rate adjusters. However, governed appliances in all of these categories except category II_{2E+3+} may have a gas rate adjuster consisting of an adjusting screw on the gas governor. Appliances in category II_{1a2H} shall have a gas rate adjuster for 1st family gases.

For appliances in categories II_{2H3+} and II_{2E+3+} having a gas rate adjuster, it shall be possible to put these devices out of service when these appliances are supplied with a 3rd family gas. This also applies to appliances in category II_{1a2H} when they are supplied with a 2nd 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 4.2.5) when these appliances are supplied with a 2nd family gas.

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

4.2.2.3 Range-rating devices

A range-rating device on an appliance is optional.

For appliances in 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 2nd family gas, the gas rate adjuster or its sealed part shall no longer be used by the installer as a range-rating device.

4.2.3 Aeration adjusters

Any means of adjusting the primary aeration at the burner shall be pre-set and sealed by the manufacturer to discourage unauthorized interference.

4.2.4 Manual controls

4.2.4.1 Application

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, where they are not integral with the appliance, specified in the manufacturer's installation instructions.

4.2.4.2 Manual valves

Manual valves shall be of the 90° turn type. Their closing direction shall be clockwise.

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 an appliance isolating valve is provided as an integral part 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.

4.2.5 Governors

Governors shall comply with the requirements of EN 88.

Appliances in categories I_{2H}, I_{2E}, I_{3B/P}, I_{3P}, II_{1a2H}, II_{2H3B/P}, II_{2H3+}, II_{2H3P}, II_{2E3B/P} and II_{2E+3P} shall be fitted with a gas governor. Appliances in categories I_{2L} and II_{2L3B/P} may be fitted with a gas governor. In addition, appliances in categories I_{2E+}, and II_{2E+3+} may be fitted with a gas governor. However, the governor, if it exists, shall not be operational in the range of the two normal pressures of the second family pressure couple, i.e. 20–25 mbar.

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 categories II_{2E+3+} and II_{2E+3P}, 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. 20–25 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.

A governor 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 pressure corresponding to the appliance category.

4.2.6 Multifunctional controls

Any multifunctional control shall comply with the requirements of EN 126. In addition, multifunctional controls shall comprise as a minimum the appropriate valving requirements of clauses 4.2.8.1 and 4.2.8.2. For permanent ignition burner systems it shall be possible to operate directly manually the upstream automatic shut-off valve in the gas line to both the ignition and main burners.

No markings are required if incorrect operation is impossible, for example when a single button controls a flame supervision device for the burner and the ignition burner. However, where it is necessary to use markings, they shall be as follows:

- Off: full disc;
- Ignition of the ignition burner (if any): stylized star;
- Full rate of the burner: stylized flame.

If the appliance has two distinct gas rate controls, one for the burner and one for the ignition burner, the operation of these devices shall be interlocked in such a way that it is impossible for the burner to be supplied before the ignition burner. If the burner and ignition burner are served by a single control, the position for ignition of the latter shall have a stop or notch making this position clearly perceptible to the user. It shall be possible to carry out the unlatching operation (if any) with one hand.

A control knob that operates by turning shall turn off in a clockwise direction as seen by an observer facing the knob.

4.2.7 Flame supervision devices

Heat sensitive flame supervision devices shall comply with the requirements of EN 125. Other flame supervision devices shall comply with EN 298.

4.2.8 Automatic shut-off valves

4.2.8.1 General requirements

Automatic shut-off valves shall comply with EN 161.

Class D valves as specified in 4.2.8.2 and 4.2.8.3 may be replaced by Class C, B or A valves, Class C valves may be replaced by Class B or A valves, and Class B valves may be replaced by Class A valves.

4.2.8.2 Application

For all appliances the gas supply/supplies shall be under the control of automatic shut-off valves connected to the gas line in series as given in Figure 1 and of a capability not less than that specified in Table 2.

Table 2 — Valving requirements

System	Valving		Pre-purge ¹⁾	Pre-purge ²⁾
	V1	V2		
permanent or alternating ignition burner	C ³⁾	D	NO	YES
intermittent or interrupted ignition burner or direct ignition of main burner	C	D	YES	YES
	C	C	NO	YES
	B	D	NO	YES

¹⁾ Normal start of the appliance; i.e. preceded by controlled shut-down.
²⁾ Restart of the appliance; i.e. preceded by safety shut-down, lock-out or maintenance shut-down.
³⁾ A permanent flame supervision system (pilot) is only permitted if it acts via a reliable shut-down device (e.g. a thermo-electric shut-off valve) of the required class (EN 161).

4.2.8.3 Shut-down

For automatic systems, the flame supervision system and overheat cut-off device shall effect the closure of all shut-off valves.

In the case of non-automatic systems, the flame supervision system need only effect closure of the V1 valve as permitted in 4.2.8.2, in which instance the room temperature control thermostat, the temperature limiter and the overheat limit device shall each effect closure of the V2 valve as a minimum requirement (see Table 2).

4.2.9 Automatic burner control systems

4.2.9.1 General

Automatic burner control systems shall comply with the requirements of EN 298.

4.2.9.2 Manually operated devices

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

In particular, under the test conditions described in 6.2, the rapid (on and off) operation of any start switch shall not set up a hazardous condition.

4.2.10 Gas strainers

A strainer shall be fitted at the inlet of any system 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 comply with the requirements as laid down in EN 161 or shall not exceed 0,20 mm when a Class D valve is used.

In systems comprising multiple automatic shut-off valves, only one strainer need be fitted, provided it gives adequate protection to all valves.

Where a governor is fitted upstream of the safety shut-off system, the strainer shall be fitted upstream of the governor.

4.2.11 Combustion air proving device

Appliances shall be fitted with a suitable device for proving adequate flow of combustion air or flue gases during pre-purge (where applicable), ignition and over the whole range of possible heat inputs during operation. This device is not required if an air/gas ratio control is fitted.

NOTE 1 This requirement is linked to 5.1.6.1, verified in 6.3.6.3.4 through 6.3.6.3.6.

4.2.11.1 Combustion air flow

Failure to prove adequate flow of combustion air or flue gases shall either cause safety shut-down to occur or prevent the opening of the main gas valves.

4.2.11.2 Appliances without pre-purge

The air proving device shall be proved in the “no flow” state prior to start-up of the main burner. Failure to prove “no flow” shall prevent start-up of the main burner or cause lock-out.

Prior to any attempt at ignition of the main burner or opening of the main burner gas automatic shut-off valves, adequate flow of combustion air or flue gases shall be proved.

4.2.11.3 Appliances with pre-purge

Immediately before any attempt at ignition or the opening of any gas shut-off valve, the appliance shall be purged. The pre-purge period shall be as long as to ensure 5 volume changes of the combustion chamber or shall be a minimum of 30 s at the combustion air rate appropriate to maximum rated heat input, or pro rata longer periods at lower air rates. The pre-purge shall be at the highest possible flow rate, but shall not be less than 25 % of the full combustion air rate.

The air proving device shall be proved in the “no flow” state prior to start-up. Failure to prove “no flow” shall prevent start-up or cause lock-out.

During pre-purge, ignition and operation of the appliance, adequate flow of combustion air or flue gases shall be proved.

4.2.12 Air/gas ratio controls

Air/gas ratio controls shall be designed and constructed so that reasonably foreseeable damage does not give rise to a change capable of affecting safety. Where a pneumatic air/gas ratio control is used, this shall comply with the requirements of EN12067-1:1998. Control tubes shall be made of metal with suitable mechanical connections or other materials with at least equivalent properties and in this case are considered immune to breakage, accidental disconnection and leakage after initial soundness checks. If this requirement is met, they are not subject to the tests in 6.3.2.6.

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

4.3 Ignition devices

4.3.1 General

It shall be possible to light the appliance from a readily accessible position.

Ignition burners and ignition devices shall be protected by design and position against external influences.

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.

4.3.2 Ignition device for the main burner

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

4.3.3 Ignition burners

If different ignition burners are used for the 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 (see 4.2.10).

4.4 Flame supervision system

Flame supervision devices shall be designed to be fail-safe (e.g. thermoelectric type) or prevent any shut-off valve opening and/or any electric ignition, if the flame detector erroneously signals the presence of a flame when the burner is started from the completely shut-down condition.

Means shall be provided to prevent electrical interference from giving rise to flame detector signals that falsely indicate the presence of a flame.

4.4.1 Appliances with non-automatic burner systems

The burner shall be fitted with a flame supervision device to monitor the ignition burner flame and protect the main flame.

4.4.2 *Appliances with automatic burner systems with pre-purge*

The burner shall be fitted with a flame supervision device.

The flame supervision device shall incorporate a suitable means to provide safety shut-down or lock-out if the flame detector signals flame presence at any time during pre-purge.

4.4.3 *Appliances with automatic burner systems without pre-purge*

The burner shall be fitted with a flame supervision device.

When the burner is started from the shut-down condition, the flame supervision system shall prevent any attempt at ignition and the opening of any gas valve if a flame or flame simulating condition is present.

The design of the appliance shall be such that, during the shut-down condition, there is sufficient natural ventilation to ventilate safely any minor gas leakage.

4.5 Start-gas flame establishment

4.5.1 *Appliances without pre-purge*

4.5.1.1 *Appliances with non-automatic burner systems*

Direct ignition of the main burner is not allowed.

The gas rate of an ignition burner shall be as low as possible, consistent with satisfactory ignition and shall not exceed 0,6 kW.

The ignition opening time shall not exceed 30 s. This time is verified under the test conditions of 6.3.3; it can be raised to 60 s if no manual intervention is required.

Provision shall be made to establish the start-gas flame safely and easily, either manually or by means of an ignition device incorporated in the appliance. Where an ignition device is incorporated in the appliance, it shall also be possible to ignite the ignition burner by manual means.

Gas shall not be admitted to the main burner until the start-gas flame has been detected by the flame supervision device.

The flame supervision device, under all conditions of operation, shall detect the start-gas flame only at rates which will ignite the main gas reliably and smoothly.

4.5.1.2 *Appliances with automatic burner systems*

A start-gas flame shall be established either at a separate ignition burner or at the main burner.

The start-gas rate shall be such that when tested under the conditions of 6.3.5.1.2, the system is safe on ignition.

The ignition source shall not be energized before a safe-start check has been made of the flame supervision system. The ignition source shall be de-energized at, or before, the end of the first safety time. If the start-gas flame has not been detected by the end of the first safety time, safety shut-down and lock-out shall result.

4.5.1.2.1 *Appliances featuring a separate ignition burner*

The ignition burner rate shall not exceed 10 % of the main burner rate.

Where the gas rate of the ignition burner does not exceed 0,25 kW, the first safety time is not limited.

Where the gas rate of the ignition burner exceeds 0,25 kW, but does not exceed 0,6 kW, the first safety time shall not exceed 30 s.

For appliances where the start-gas rate does not exceed 0,6 kW, either safety shut-down or a single immediate attempt at re-ignition by direct spark restoration shall occur in the event of start-gas flame failure after establishment of the start-gas flame, but before the main gas automatic shut-off valves have been signalled to open.

If re-ignition is attempted and the start-gas flame is not detected within the first safety time, safety shut-down and lock-out shall result.

Where the gas rate of the ignition burner exceeds 0,6 kW, the first safety time shall not exceed 5 s. For these appliances, safety shut-down and lock-out shall occur in the event of start-gas flame failure after its establishment and before the main gas automatic shut-off valves have been signalled to open.

However, the upstream automatic shut-off valve in the main gas supply may be opened to permit gas flow where the start gas supply is taken from downstream of the first main gas automatic shut-off valve, provided that:

- a) a means to prove closure of the downstream main shut-off valve prior to ignition is fitted;

NOTE A valve proving system, proof of closure switch or a closed position indicator switch is deemed to satisfy this requirement.

or

- b) the requirement of **5.1.5.1.3** is met.

4.5.1.2.2 Appliances where the start-gas flame is established on the main burner

The start-gas rate shall not exceed 10 % of the main burner rate, otherwise the ignition is seen as direct on the main burner.

Where the start-gas rate does not exceed 0,25 kW, the first safety time is not limited.

Where the start-gas rate exceeds 0,25 kW, but does not exceed 0,6 kW, the first safety time shall not exceed 30 s.

Where the gas rate of the ignition burner exceeds 0,6 kW, the first safety time shall not exceed 5 s. For these appliances, safety shut-down and lock-out shall occur in the event of start-gas flame failure after its establishment and before the main gas automatic shut-off valves have been signalled to open.

However, the upstream automatic shut-off valve in the main gas supply may be opened to permit gas flow where the start-gas supply is taken from between the main gas automatic shut-off valves, provided that the downstream main gas automatic shut-off valve is checked for closure prior to start-up, e.g. valves fitted with closed position indicator switches. If the check indicates that the valve is not closed, start-up shall be prevented or lock-out shall occur.

Where the downstream main gas automatic shut-off valve is a two-stage valve controlling both the start-gas rate and the main gas rate, the start position of the valve shall be checked. If the check indicates that the downstream valve is not in the start position, start-up shall be prevented or at least volatile lock-out shall occur. In addition, any means of adjustment of the start-gas rate shall be preset and sealed by the manufacturer.

4.5.1.2.3 Appliances with direct ignition of the main burner

For appliances incorporating direct ignition of the main burner, a single ignition attempt is permitted with a safety time not exceeding 5 s.

The spark shall continue until the flame has been established and detected or the safety time has elapsed.

If the main burner flame has not been established and detected by the end of the safety time, safety shut-down and lock-out shall result.

Where the downstream main gas automatic shut-off valve is a two-stage valve controlling both the start-gas rate and the main gas rate, the start position of the valve shall be checked. If the check indicates that the downstream valve is not in the start position, start-up shall be prevented or at least volatile lock-out shall occur. In addition, any means of adjustment of the start-gas rate shall be preset and sealed by the manufacturer.

4.5.2 Appliances with pre-purge

Any start-gas flame shall be established either at the main burner or at a separate ignition burner.

The ignition burner or start-gas rate shall be such that when tested under the conditions of **6.3.5.1.2**, the system is safe on ignition.

4.5.2.1 Appliances featuring a separate ignition burner

Where the start-gas flame is established at a separate ignition burner with a gas rate exceeding 0,25 kW but not exceeding 0,6 kW, the first safety time shall not exceed 30 s.

Where the start-gas flame is established at a separate ignition burner with a gas rate not exceeding 0,25 kW, the first safety time is not limited.

If during the safety time the required flame has not been established, safety shut-down shall occur.

If after the fourth restart attempt the required flame has not been established, lock-out shall occur.