

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

The European Standard EN 1020:1997, with the incorporation of Amendment A1:2001, has the status of a British Standard

ICS 91.140.10

National foreword

This British Standard is the English language version of EN 1020:1997, including amendment A1:2001.

The UK participation in its preparation was entrusted by 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 subcommittee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index” or by using the “Find” facility of the BSI Standards Electronic Catalogue.

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English version

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

(includes amendment A1:2001)

Générateurs d'air chaud à convection forcée utilisant les combustibles gazeux pour le chauffage de locaux autres que l'habitat individuel de débit calorifique inférieur ou égal à 300 kW (sur pouvoir calorifique inférieur), comportant un ventilateur pour aider l'alimentation en air comburant et/ou l'évacuation des produits de combustion (inclut l'amendement A1:2001)

Gasbefeuerte Warmlufterzeuger mit verstärkter Konvektion zum Beheizen von Räumen für den nicht-häuslichen Gebrauch mit einer Nennwärmebelastung nicht über 300 kW, mit Gebläse zur Beförderung der Verbrennungsluft und/oder der Abgase (enthält Änderung A1:2001)

This European Standard was approved by CEN on 29 October 1997. Amendment A1 was approved by CEN on 18 August 2001.

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.

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CEN

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

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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 June 1998, and conflicting national standards shall be withdrawn at the latest by June 1998.

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 Annex ZA, which is an integral part of this standard.

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

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 — Appliance categories*”.

NOTE 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.

Work is in progress to look for a device to detect failure of the heat exchanger. If successful, this could be an alternative to the “heat exchanger thermal cycle” requirement, 5.1.7.

In preparation of this European Standard, it was recognized that these air heating appliances were likely to be fitted with forced draught burners complying with the European Standard for automatic forced draught burners (EN 676:1996). Given these circumstances, it was felt that it would be useful to identify requirements of this standard for which at least equivalent requirements are likely to be included in the burner standard. This information is given in Annex G.

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*.

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*.

prEN 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*.

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

prEN 1319, *Domestic gas-fired forced convection air heaters for space heating not exceeding a net heat input of 70 kW, incorporating a fan to assist transportation of combustion air and/or combustion products*.

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

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

Foreword to amendment A1

This amendment EN 1020:1997/A1:2001 to the EN 1020:1997 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 1020:1997 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 1020:1997 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.

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1 Scope

This European Standard specifies the requirements and test methods for the safety and efficiency of non-domestic gas-fired air heaters having a fan to assist the transportation of combustion air and/or flue gases, hereafter referred to as “appliances”. This includes appliances having forced draught burners.

This European Standard applies to Type B₁₂, B₁₃, B₁₄, B₂₂, B₂₃, C₁₂, C₁₃, C₃₂, C₃₃, C₆₂ and C₆₃ appliances with a heat input not exceeding 300 kW (based on net calorific value) intended for use in other than single unit residential dwellings. It also applies to appliances intended for outdoor installation. Provision of the heated air may be by means of ducting or may be directly into the heated space.

For Type B₂₂ appliances, this European Standard only applies to appliances having automatic ignition. For Type C₆₂ and C₆₃ appliances, this European Standard only applies when such appliances are intended for final installation in a similar manner to Type C₃ appliances.

This standard does not apply to:

- appliances intended for use in a single unit residential dwelling;
- appliances of the condensing type;
- appliances with atmospheric burners without a fan to assist the transportation of combustion air and/or flue gases;
- dual purpose air conditioning appliances (heating and cooling);
- appliances where the air is heated by an intermediate fluid;
- appliances fitted with manual or automatic flue dampers;
- portable or transportable forced convection appliances;
- appliances having multiple heating units with a single draught diverter;
- appliances fitted with more than one flue outlet.

This European Standard is applicable to appliances which are intended to be type tested.

NOTE Requirements for appliances which are not type tested would need to be subject to further consideration.

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 — thermoelectric flame supervision devices*.

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

EN 161:1991, *Automatic shut-off valves for gas burners and gas burning appliances*.

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

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

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

EN 676:1996, *Forced draught burners for gaseous fuels*.

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

prEN 50165:1993, *Electrical equipment of non-electric heating appliances for household and similar appliances*.

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 60730-1:1991, *Automatic electrical controls for household and similar general purposes — Part 1: General requirements*.

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

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

EN 61058-1:1992, *Switches for appliances — Part 1: General requirements*

IEC 479-1:1994, *Effects of current passing through the human body — Part 1: General aspects.*

IEC 479-2:1987, *Effects of current passing through the human body — Part 2: Special aspects.*

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 6976:1991, *Natural gas — Calculation of the calorific value, the density and the relative density.*

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 purposes of this standard, the following definitions apply:

3.1 Appliance and its constituent parts

3.1.1

non-domestic air heater

an appliance designed for the heating and possibly ventilation of a building other than 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 an authorized person to set the gas rate of the burner to a predetermined value according to the supply conditions

adjustment may be progressive (screw adjuster) or in discrete steps (by changing restrictors)

the adjusting screw of an adjustable governor is regarded as a gas rate adjuster

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

a factory sealed gas rate adjuster is considered to be non-existent

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

3.1.13**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**aeration adjuster**

a device enabling the air to be set at the desired value according to the supply conditions

the action of adjusting this device is called “adjusting the aeration”

3.1.16 Combustion products circuit

3.1.16.1

combustion chamber

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

3.1.16.2

flue outlet

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

3.1.16.3

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

3.1.16.4

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

3.1.16.5

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

3.1.16.6

C₆ flue terminal

a terminal which is specially approved for Type C₆ appliances

3.1.16.7

flue adaptor box

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

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 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

3.2.3

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

3.2.4**programme**

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

3.2.5**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

3.2.6**flame signal**

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

3.2.7**flame simulation**

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

3.2.8**pressure governor¹⁾**

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

3.2.9**adjustable pressure governor**

a governor provided with means for changing the outlet pressure setting

3.2.10**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

3.2.11**automatic shut-off valve**

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

3.2.12**control thermostat**

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

3.2.13**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

this device is preset and sealed by the manufacturer (see 4.10.4)

3.2.14**overheat control device**

an automatic reset device that shuts down the gas supply to the burner when the temperature of the delivered air exceeds a certain preset value during abnormal operating conditions

3.2.15**fan delay control**

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

¹⁾ The term "governor" is used in this case and for a volume governor.

3.2.16

temperature sensing element; temperature sensor

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

3.2.17

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

3.2.18

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

3.3 Operation of the appliance

3.3.1

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 decimetres per hour (dm^3/h), or cubic decimetres per second (dm^3/s)

3.3.2

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)

3.3.3

heat input

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

symbol: Q

units: kilowatts (kW)

3.3.4

nominal heat input

the value of heat input declared by the manufacturer

symbol: Q_n

3.3.5

flame stability

the characteristic of flames which remain on the burner 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 time²⁾**

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, 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

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**

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

3.3.17**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 without manual intervention

3.3.18**non-automatic burner system**

a burner system with an ignition burner which is ignited under manual supervision

3.3.19**controlled shut-down**

the process by which the power to the gas shut-off valve(s) is removed immediately, e.g. as a result of the action of a controlling function

3.3.20**safety shut-down**

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

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

3.3.21 Lock-out

3.3.21.1

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

3.3.21.2

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 electrical supply and its subsequent restoration

3.3.22

spark restoration

the process by which, after disappearance of the flame signal in the running condition, 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

3.3.23

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

3.3.24

ignition opening time

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

3.3.25

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

3.3.26

ignition interlock

a part which prevents the operation of the igniter as long as the main gasway is open

3.3.27

re-start interlock

a mechanism which prevents the re-opening of the gasway to the main burner or the main burner and the ignition burner until the armature plate has separated from the magnetic element

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

units: millibars (mbar) or 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

units: 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_g
 - 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_g

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 at the reference conditions

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 by allowing the unlit appliance to attain thermal equilibrium 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 specified by the manufacturer, any thermostat remaining fully open

3.5.4

equivalent resistance

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

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

3.7 Classification

3.7.1 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 15 °C and 1 013,25 mbar MJ/m ³	
	Minimum	Maximum
First family * Group a	22,4	24,8
Second family * Group H * Group L * Group E	39,1 45,7 39,1 40,9	54,7 54,7 44,8 54,7
Third family * Group B/P * Group P * Group B	72,9 72,9 72,9 81,8	87,3 87,3 76,8 87,3

3.7.2 Classification of appliances

Appliances can be classified according to:

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

3.7.2.1 Classification according to the gases capable of being used

3.7.2.1.1 Category I

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

3.7.2.1.1.1 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).

3.7.2.1.1.2 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 governor, if it exists, is not operative in the range of the two normal pressures of the pressure couple.

3.7.2.1.1.3 Appliances designed for use on 3rd 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 the third family (propane and butane) and operating with a pressure couple without adjustment of the appliance other than a possible adjustment of the primary air in order to change from butane to propane and vice versa. No operational 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.

3.7.2.1.2 Category II

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

3.7.2.1.2.1 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}.

3.7.2.1.2.2 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 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}.

3.7.2.1.3 Category III

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

3.7.2.2 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.

3.7.2.2.1 *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 drawn directly from the room.

- Type B₁: A Type B appliance incorporating a draught diverter.
- Type B₂: A Type B appliance without a draught diverter.

For appliances in which the combustion air is supplied and/or in which the products of combustion are evacuated by mechanical means, five types are identified (see Annex B).

- 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 B₁₃: A type B₁ appliance designed for a natural draught flue incorporating a fan upstream of the combustion chamber/heat exchanger.
- Type B₁₄: A type B₁ appliance having an integral fan downstream of both the combustion chamber/heat exchanger and the 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.

3.7.2.2.2 *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 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 I₃₊: replacement of injectors or calibrated orifices but only in order to convert from one pressure couple to another (e.g. from 28-30/37 mbar to 50/67 mbar or vice versa). In addition, it is permissible to adjust the primary air in order to change from butane to propane and vice versa.

Category I_{3P}: no modification to 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, restrictors or governor.
- Adjustment of the gas rate of ignition burners, either by using an adjuster or by a change of injectors or restrictors and, if necessary, a change of complete ignition burners or of some of their parts.
- 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, restrictors or governor.
- Adjustment of the gas rate of ignition burners, either by using an adjuster or by a change of injectors or restrictors and, if necessary, a change of complete ignition burners or of some of their parts.
- 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.

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. from 28–30/37 mbar to 50/67 mbar or vice versa).

4.1.1.3 *Category III*

Category III appliances admitted in certain countries are given in A.3 and A.4.

4.1.2 *Materials and method of construction*

When the appliance is installed in accordance with the manufacturer's instructions, all components, including the heat exchanger, shall withstand the mechanical, chemical and thermal conditions to which they may be subjected in the course of normal 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 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.

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

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 access panel is permitted.

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

Panels that are required to be removed for normal servicing, maintenance and cleaning, shall be fitted with means of retention, where the appliance is intended to be installed more than 1,8 m above floor level, measured from the underside of the appliance. This requirement shall be deemed to be satisfied if suitable hinges are fitted.

The products of combustion shall not be drawn into the air distribution system when user access panels are removed.

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, condensate and vermin.

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 (ISO 228-1:1994), 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.6.

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, gasket, 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 General

All appliances shall be designed so that there is an adequate supply of combustion air during ignition and operating over the whole range of possible heat inputs stated by the manufacturer.

Openings for the access of primary air shall have dimensions greater than 4 mm.

4.1.7.2 Appliance combustion air inlet

4.1.7.2.1 Type B_{14} appliances

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

4.1.7.2.2 Other appliances of Type B and Type C

All such appliances shall be fitted with an air proving device to prove adequate combustion air during the pre-purge period and burner operation. 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.³⁾

4.1.7.3 Appliance flue gas outlet

The cross-section of the appliance flue gas outlet shall not be adjustable.

A terminal guard shall be fitted in accordance with the National Regulations applicable in the various Member States.

4.1.7.4 Type B_{12} , B_{13} and B_{14} appliances

4.1.7.4.1 All 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 A.7).

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 of nominal external diameter ($D - 2$) mm to a depth of at least $D/4$ but not so far that the evacuation of the combustion products is impaired. However, for a vertical connection, the depth of insertion can be reduced to 15 mm for an appliance with heat input up to 70 kW and 25 mm for an appliance with heat input exceeding 70 kW.

NOTE D is the outside diameter of the duct.

4.1.7.4.2 Additional requirements for appliances of Type B_{14}

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

Where the appliance is intended to be connected to a vertical flue, the manufacturer shall specify a suitable means of protecting the fan from damage arising from objects dropping into the flue.

³⁾ A European Standard for air-gas ratio controls is under consideration in CEN/TC 58.

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.

4.1.7.5 Type B_{22} and B_{23} 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 rules in force where the appliance is to be installed (see A.7).

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 of nominal external diameter $(D - 2)$ mm to a depth of at least $D/4$ but not so far that the evacuation of the combustion products is impaired. However, for a vertical connection, the depth of insertion can be reduced to 15 mm for an appliance with heat input up to 70 kW and 25 mm for an appliance with heat input exceeding 70 kW.

NOTE D is the outside diameter of the duct.

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

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.

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

The terminal and any necessary combustion air and combustion products ducts shall be supplied by the manufacturer to the test house.

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

The terminal shall be designed to prevent the penetration of rain or snow to the appliance or to the fabric of the building. All openings in the external surfaces of the terminal shall not permit the entry of a ball of 16 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.

Any condensate formed when operating the appliance from cold shall either be retained and subsequently re-evaporated or discharged clear of the wall.

If the appliance is fitted with separate air inlet and combustion products ducts, the outlet of these ducts shall be so positioned that the distance between the axis of the duct is no more than $3D_m$ (where D_m is the mean outer diameter between the inlet and outlet ducts).

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

The manufacturer shall state in the installation instructions that the appliance can only be installed with a suitable C_6 flue terminal.

NOTE Appropriate requirements for assessing the suitability of C_6 flue terminals are given in Annex C of this standard.

In addition, the manufacturer shall state the pressure difference measured between the combustion air inlet duct and the combustion products outlet duct which is equivalent to the maximum allowable resistance of the duct system which can be fitted.

4.1.7.8 Appliances designed for outdoor installation

The flue outlet shall be so designed and positioned that it cannot be obstructed (e.g. by products of corrosion, air borne dirt, leaves, snow, etc.) and that staining of adjacent surfaces is minimized.

The flue outlet, if integral with the appliance, shall be protected against the ingress of rain or snow. Any opening in the protective guard shall not permit the entry of a ball 16 mm in diameter applied with a force of 5 N.

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 heater, the appliance shall be provided with flanged or spigot connections on the air inlet.

NOTE If necessary, the manufacturer may supply a suitable adaptor in order to meet this requirement.

4.1.8.2 Air outlets

If a ductless heater is fitted with directional louvres, the appliance shall continue to operate satisfactorily i.e. the overheat cut-off device shall not operate when the louvres are in the position of maximum closure as marked and specified by the manufacturer.

Ducted air heaters shall have air outlets equipped with flanges or spigots to facilitate connection of ductwork or flexible connectors.

NOTE If necessary, the manufacturer may supply a suitable adaptor in order to meet this requirement.

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 length of 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.

When the main burner is fitted with its own flame detector, an indirect means of observation (e.g. an indicator light) may be used. This indirect means shall be used only for indicating presence of a flame following a successful ignition or absence of a flame due to failure to ignite or the failure of the flame detector to detect a 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 60335-1:1988, EN 60730-1:1991 and EN 61058-1:1992.

The electrical safety of high voltage ignition circuits shall be assessed in accordance with Annex D.

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 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 continued safe operation, or:

- a) for appliances not fitted with an automatic burner control system, shut-down of the burner such that manual reignition of the burner is required; or
- b) for appliances fitted with an automatic burner control system, safety shut-down.

Interruption and subsequent restoration of the electricity supply shall not override any non-volatile lock-out condition.

NOTE Requirements and tests 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 5.1.5.1 and 6.3.5.3.4.

4.1.12 Motors and fans

The direction of rotation of fans shall be clearly marked.

Motors and fans, including any belt drives, shall be so protected by suitable guards, shields or screens of adequate size, strength and durability that they are not liable to be touched (see also EN 60529:1991, class IP 20). Removal of such guards, shields or screens shall be possible only with the use of commonly available tools.

Means shall be provided to facilitate the adjustment of the belt tension by 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.

4.2 Adjusting, control and safety devices

4.2.1 General

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

All controls and safety devices shall be appropriate for use over the range of ambient temperatures declared by the appliance manufacturer (see 7.4.2).

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.

Where gas-carrying connections are enclosed in a separate compartment of the appliance, the compartment shall be adequately ventilated by means of equal sized openings situated at the top and bottom of the compartment.

The ventilation openings shall have a total free open area equal to, or greater than, 2 % of the area of the largest plane surface of the compartment.

The vent shall be so sited that it cannot be obstructed by foreign matter, birds etc.

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; this 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 the 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, and the same applies for 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 adjustable only with 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 shall be pre-set and sealed by the manufacturer to discourage unauthorized interference.

If the appliance is provided with another means of adjusting the cross-section of the combustion air passageways to the appliance, this means of adjustment shall be so designed that, after adjustment in accordance with the manufacturer's instructions, it is capable of being set and sealed.

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 (other than those incorporated in a multifunctional control)

Separate manual valves shall be of the 90° turn type.

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 88:1991.

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.

Appliances in categories I_{2E+} and II_{2E+3+} may be fitted with a gas governor. However, the gas 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.

Where a gas governor is fitted, it shall control the gas supply to the main burner and any ignition burner having a heat input of more than 2 kW.

NOTE Separate governors for the main burner and the ignition burner are acceptable.

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.

4.2.6 Multifunctional controls

Any multifunctional control shall comply with the requirements of EN 126:1995.

4.2.7 Flame supervision devices

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

4.2.8 Automatic shut-off valves

4.2.8.1 General requirements

Automatic shut-off valves shall comply with the requirements of EN 161:1991.

The sub-clauses of 4.2.8.2 give the minimum valve requirements.

4.2.8.2 Application

4.2.8.2.1 Type B₁₄ appliances

4.2.8.2.1.1 Appliances with a start gas flame

All gas supplies shall be under the control of automatic shut-off valves connected to the gas line in series, of a class according to Table 2.

Table 2 — Minimum valving requirements for type B₁₄ appliances

Input	Main gas valves required		Start gas valves required	
	non-automatic systems	automatic systems	non-automatic systems	automatic systems
135 kW and below	1 × class C plus 1 × class D ¹⁾	1 × class B plus 1 × class D ⁵⁾	1 × class C ²⁾	1 × class B ³⁾ plus 1 × class D ⁴⁾⁵⁾
Between 135 kW and 300 kW	1 × class B plus 1 × class C	1 × class B plus 1 × class C	1 class × B ³⁾	1 × class B ³⁾ plus 1 × class D ⁴⁾⁵⁾

¹⁾ This class D valve shall have a minimum sealing force of 1 N per m. The sealing force is calculated from the spring force in the closed position divided by the circumference or length of the seal.
²⁾ This valve may be replaced with a thermoelectric valve conforming to the requirements of EN 125:1991 having a sealing force capability at least equivalent to a class C valve conforming to EN 161:1991.
³⁾ This valve may be the class B valve controlling the main gas supply.
⁴⁾ This class D valve is not required if the start gas rate does not exceed, depending on the heat input of the appliance (see 4.6.1.1), either 0,6 kW or 1 % of the nominal heat input of the main burner up to a maximum of 1,5 kW, as applicable.
⁵⁾ If a class D valve is used for automatic systems, a strainer shall be used such that it does not pass a 0,2 mm pin gauge. This strainer shall be fitted upstream of the valve.

NOTE At the present time, this document has been drafted for appliances which will be type tested. For larger appliances, not intended for type testing, the valving requirements would need further consideration.

4.2.8.2.1.2 Appliances with direct main burner ignition (see 4.6.2)

Such appliances shall be fitted with two automatic shut-off valves in series. One of these shall be of at least class B and the other of at least class D.

4.2.8.2.2 Appliances of types B₁₂, B₂₂, C₁₂, C₃₂ and C₆₂, and outdoor appliances incorporating a fan in the combustion circuit downstream of the combustion chamber/heat exchanger

Each main gas supply shall be under the control of two automatic shut-off valves in series (see Table 3). For appliances with a heat input not exceeding 135 kW, one valve shall be of at least class B and the other valve shall be of either class B, class C or class D. For appliances with a heat input greater than 135 kW, the two valves shall be of at least class B.

Where the main flame establishment is by means of a start-gas flame, the start-gas supply shall be either:

- under the control of the downstream main gas automatic shut-off valve incorporating a start-gas rate control. The valve shall incorporate a device to enable the start-gas rate to be set such that the energy available during the start-gas flame ignition period cannot exceed the value given in 4.6; or,
- under the control of at least one class B automatic shut-off valve (see Table 3). If, however, the conditions specified in Table 3, footnote ³⁾, are not met, a second valve shall be fitted as specified in this table.

Where the main gas automatic shut-off valve incorporates a start-gas rate control, it shall not be possible to adjust the start-gas rate to a level exceeding 50 % of the fully open flow rate at the same differential pressure.

Where the start-gas rate is greater than 10 % of the main gas rate, the start-gas supply shall be under the control of two automatic shut-off valves in series. Where a separate start-gas automatic shut-off valve(s) is fitted, the resulting valve train shall incorporate valve(s) having class(es) equivalent to the minimum requirements for the main gas supply.

NOTE The above requirements should be read in conjunction with 4.6.

Table 3 — Minimum valving requirements for types B₁₂, B₂₂, C₁₂, C₃₂ and C₆₂ appliances, and outdoor appliances

Input	Main gas valves required	Start gas valves required
	automatic systems	automatic systems
135 kW and below	1 × class B plus 1 class × D ²⁾	1 × class B ²⁾ plus 1 × class D ¹⁾³⁾
Between 135 kW and 300 kW	2 × class B	1 × class B ²⁾ plus 1 × class B ³⁾
¹⁾ If a class D valve is used, a strainer shall be used such that it does not pass a 0,2 mm pin gauge. The strainer shall be fitted upstream of the valve. ²⁾ This valve may be the valve controlling the main gas supply. ³⁾ This valve is not required if all of the following conditions are met: — the start gas rate is 10 % or below of the main gas rate; — the appliance is not designed for burning 3rd family gases; — the appliance is not capable of being installed such that the combustion air inlet is higher than the exit from the combustion chamber; — the pre-purge gives at least 5 volume changes.		

NOTE At the present time, this document has been drafted for appliances which will be type tested. For larger appliances, not intended for type testing, the valving requirements would need further consideration.

4.2.8.2.3 Appliances of types B₁₃, B₂₃, C₁₃, C₃₃ and C₆₃, and outdoor appliances incorporating a fan in the combustion circuit upstream of the combustion chamber/heat exchanger

Each main gas supply shall be under the control of two automatic shut-off valves in series (see Table 4). For appliances with a heat input not exceeding 135 kW, these valves shall be of at least class B. For appliances with a heat input greater than 135 kW, one valve shall be of class A and the other valve shall be of at least class B.

Where the main flame establishment is by means of a start-gas flame, the start-gas supply shall be either:

- under the control of the downstream main gas automatic shut-off valve incorporating a start-gas rate control. The valve shall incorporate a device to enable the start-gas rate to be set such that the energy available during the start-gas flame ignition period cannot exceed the value given in 4.6; or,
- under the control of at least one class A automatic shut-off valve if the appliance heat input is greater than 135 kW, or at least a class B automatic shut-off valve if the appliance heat input does not exceed 135 kW (see Table 4). Irrespective of the heat input, if the conditions specified in Table 4, footnote ²⁾, are not met, a second valve shall be fitted as specified in this table.

Where the main gas automatic shut-off valve incorporates a start-gas rate control, it shall not be possible to adjust the start-gas rate to a level exceeding 50 % of the fully open flow rate at the same differential pressure.

Where the start-gas rate is greater than 10 % of the main gas rate, the start-gas supply shall be under the control of two automatic shut-off valves in series.

Where a separate start-gas automatic shut-off valve(s) is fitted, the resulting valve train shall incorporate valve(s) having class(es) equivalent to the minimum requirements for the main gas supply.

NOTE The above requirements should be read in conjunction with 4.6.

Table 4 — Minimum valving requirements for types B₁₃, B₂₃, C₁₃, C₃₃ and C₆₃ appliances, and outdoor appliances

Input	Main gas valves required	Start gas valves required
	automatic systems	automatic systems
135 kW and below	2 × class B	1 × class B ¹⁾ plus 1 × class B ²⁾
Between 135 kW and 300 kW	1 × class A plus 1 × class B	1 × class A ¹⁾ plus 1 × class B ²⁾
¹⁾ This valve may be the valve controlling the main gas supply. ²⁾ This valve is not required if all of the following conditions are met: — the start gas rate is 10 % or below of the main gas rate; — the appliance is not designed for burning 3rd family gases; — the appliance is not capable of being installed such that the combustion air inlet is higher than the exit from the combustion chamber; — the pre-purge gives at least 5 volume changes.		

NOTE At the present time, this document has been drafted for appliances which will be type tested. For larger appliances, not intended for type testing, the valving requirements would need further consideration.

4.2.8.3 Action of the flame supervision system and overheat cut-off device

The flame supervision system and the overheat cut-off device shall effect closure of all automatic shut-off valves in the systems specified except for non-automatic systems having heat inputs less than 135 kW.

In the case of non-automatic systems with heat inputs less than 135 kW, the flame supervision system and the overheat cut-off device need only effect closure of the class C valve or the alternative permitted in Table 2, in which instance the overheat cut-off device shall effect closure of the class C valve.

In no case shall the air temperature and overheat cut-off devices effect closure of the same single shut-off valve.

4.2.9 Burner control systems

4.2.9.1 Application

A type B₁₄ appliance may have a non-automatic burner control system in which the start-gas flame is ignited manually. Alternatively, a type B₁₄ appliance may have an automatic burner control system.

All other appliances shall have an automatic burner control system.

4.2.9.2 Automatic burner control systems

4.2.9.2.1 General

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

In addition, the control system shall be in accordance with the requirements of this standard which determine that it is suitable for its application.

NOTE The suitability of the burner control system is verified by inspection and methods of tests specified.

4.2.9.2.2 Manually operated devices

Operating 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 6.2.1, 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 automatic shut-off valve(s) to prevent the ingress of foreign matter. The maximum strainer hole dimension shall not be greater than 1,5 mm and the mesh shall not pass a 1 mm pin gauge. The strainer may be integral with the upstream automatic shut-off valve.

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

NOTE For systems incorporating a class D valve, see Table 2 and Table 3.

Where a governor is fitted upstream of the automatic shut-off valve system, the strainer may be fitted upstream of the governor.

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 a 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 Transportation of combustion air and/or flue gases

4.4.1 Type B₁₄ appliances

4.4.1.1 General

Appliances shall be fitted with a suitable device for proving adequate flow of flue gases prior to and during ignition and operation of the burner (see 5.1.4.1.4.2, 5.1.4.2.2.2, 5.1.5.1, 6.3.5.3.5 and 5.1.5.2.2).

4.4.1.2 Appliances with permanent ignition burners

The 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.

Prior to any attempt at ignition of the main burner or the opening of the main gas automatic shut-off valve(s), adequate flow of flue gases be proved. Failure to prove adequate flow of flue gases shall either cause safety shut down to occur or prevent the opening of the main gas automatic shut-off valve(s) providing that this valve, or one of these valves, is:

- a) a class A or B valve, for appliances having heat inputs exceeding 135 kW, or;
- b) a class A, B, C or D valve where the appliance heat input does not exceed 135 kW.

If the valve is a class D valve, this shall have a closing force of at least 1 N per m (see Table 2).

4.4.1.3 Appliances fitted with automatic burner control systems

The 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 to occur.

Prior to any attempt at ignition of the main burner or opening of the main gas automatic shut-off valves, adequate flow of flue gases shall be proved. Failure to prove adequate flow of flue gases shall prevent start-up or cause lock-out.

Flue gas flow failure during operation of the main burner shall either cause safety shut-down or lock-out to occur.

4.4.2 All appliances except Type B₁₄

4.4.2.1 Combustion air

Appliances shall be fitted with a suitable device for proving adequate combustion air flow during the pre-purge, ignition and operation of the burner (see 5.1.4.1.4, 5.1.4.2.2, 5.1.5.1, 6.3.5.3.5 and 5.1.5.2). Combustion air flow failure at any time during the pre-purge, ignition or operation of the main burner shall cause safety shut-down. The air proving device shall be proved in the “no air” position prior to start-up. Failure to prove “no air” shall prevent start-up or cause lock-out.

4.4.2.2 *Pre-purge and post-purge*

Immediately before any attempt at ignition or the opening of automatic shut-off valves, the appliance shall be purged. The pre-purge period shall be a minimum of 30 s at the combustion air rate appropriate to maximum rated heat input, or pro rata for longer periods at lower combustion air rates. The pre-purge flow shall not be less than 25 % of the full combustion air rate.

Unless any start-gas supply is under the control of two automatic shut-off valves having classes at least equivalent to those of the main gas supply, the pre-purge shall be such as to give at least five volume changes of the combustion chamber and gas passages up to the flue exit from the appliance (see Table 3 and Table 4, and 5.1.8).

The purge air shall be proved to be at the required rate. If the purge air flow falls below the required rate at any time during the pre-purge period, then either:

- a) the burner shall go to safety shut-down; or
- b) the purge shall be continued upon restoration of the required rate provided that the combustion air flow does not fall below 25 % of the combustion air rate appropriate to the maximum rated input and that the total purge time at the required combustion air rate is not reduced.

Post-purge is optional.

4.5 Flame supervision system

4.5.1 *Type B₁₄ appliances*

4.5.1.1 *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.

The ignition opening time of heat sensitive flame supervision devices shall not exceed 20 s. This is verified under the test conditions of 6.2.2.

Upon flame failure, the control system shall cause non-volatile lock-out. The extinction safety time the flame supervision system to shut down the burner shall not be more than 60 s for appliances with permanent ignition burners protected by a heat sensitive flame supervision system. However, for appliances with a heat input greater than 135 kW, the extinction safety time shall not exceed 3 s. The extinction safety time is verified under the test conditions of 6.2.3.

Flame supervision devices shall be designed such:

- a) that the failure of the sensor causes safe shut down of the burner (e.g. thermoelectric type); or
- b) as to prevent any automatic shut-off valve opening and/or any ignition attempt occurring if a flame or flame-simulating condition is signalled when the burner is started from the completely shut-down condition.

NOTE Care should be taken to prevent electrical interference from giving rise to flame detector signals that falsely indicate the presence of a flame.

Where thermoelectric flame supervision devices are used in conjunction with electric ignition, gas shall not flow to the main burner unless the ignition burner is alight when any control tap or equivalent device that is accessible to the user is turned "OFF" and then "ON" again after 3 s. For the purposes of this requirement, a piezo-electric ignition is not regarded as electric ignition.

4.5.1.2 *Automatic burner systems*

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 or the opening of any gas valve if a flame or flame-simulating condition is present.

This safe-start check shall last for more than 5 s and shall cease not more than 5 s prior to any attempt at ignition.

NOTE Care should be taken to prevent electrical interference from giving rise to flame detector signals that falsely indicate the presence of a flame.

Upon flame failure, the control system shall cause safety shut-down and non-volatile lock-out. The extinction safety time for the flame supervision system to detect the absence of flame and shut down the burner(s) shall not be more than 3 s. This is verified under the test conditions of 6.2.3.

4.5.2 All appliances except Type B₁₄

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 the pre-purge. This is the safe-start check. The safe-start check may cease during the 5 seconds preceding an attempt at ignition. If a flame-simulating condition lasts for 5 s or more, lock-out shall occur.

NOTE Care should be taken to prevent electrical interference from giving rise to flame detector signals that falsely indicate the presence of a flame.

Upon flame failure the flame supervision device shall either cause non-volatile or volatile lock-out, or permit an immediate reignition attempt by spark restoration, or permit automatic recycling.

Where reignition by spark restoration is used, the immediate reignition attempt shall commence within 1 s. If the reignition attempt is unsuccessful by the end of the first safety time, non-volatile lock-out shall result.

If, in the case of automatic recycling, ignition is unsuccessful at the end of the first safety time, non-volatile lock-out shall result.

The time for the flame supervision device to de-energize the automatic shut-off valves upon flame failure shall be not more than 1 s. However, where a self-checking flame supervision device is used, the time for the flame supervision device to de-energize the automatic shut-off valves upon flame failure shall comply with the requirements of Table 5.

4.6 Start-gas flame establishment

4.6.1 Type B₁₄ appliances

4.6.1.1 Non-automatic burner systems

For an appliance of heat input not exceeding 60 kW, the gas rate of a start-gas burner shall not exceed 0,6 kW. For an appliance of heat input greater than 60 kW, the gas rate of a start-gas burner shall not exceed 1 % of the gas rate of the main burner or 1,5 kW, whichever is the lower rate.

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.

The main gas valve shall not admit gas to the burner until the start-gas flame has been detected by the flame supervision system.

If the start-gas flame is established at a separate burner, the flame detector, under all conditions of operation, shall detect the start-gas flame only at rates which will ignite the main gas reliably and smoothly.

4.6.1.2 Automatic burner systems

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

No start-gas rate shall exceed 25 % of the main burner rating.

Where the start-gas flame is established at a separate burner, the start-gas rate shall not exceed 10 % of the main burner rating.

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

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 the following requirements are met.

Table 5 — Flame supervision device de-energization times

Frequency of check	Drop-out time excluding any delay due to the checking circuits, in s	Drop-out time including any delay due to the action of the checking circuits, in s
More frequently than once per 2 s	—	—
Less frequently than once per 2 s but more frequently than once per min	1	2
Less frequently than once per min but more frequently than once per h	1	3

On burners with a nominal heat input of 135 kW and below, where the start-gas supply is taken from between the two main gas valves, either:

- a) a means shall be provided to prove closure of the downstream main shut-off valve prior to ignition⁴⁾; or
- b) the requirement of 5.1.4.1.2 shall be met.

On burners with a nominal heat input of more than 135 kW, where the start-gas supply is taken from between the two main gas valves, the downstream main gas automatic shut-off valve shall be checked for closure prior to start-up. If the check indicates the valve is not closed, the start-up shall be prevented.

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 first safety time. Where a hot surface ignition system is used, the ignition system shall be so energized that the ignition source is capable of igniting incoming gas before the gas valves are opened.

The first safety time shall not exceed:

- 30 s in case of start-gas burners having a heat input not exceeding 0,6 kW;
- 15 s in case of start-gas burners having a heat input greater than 0,6 kW and not exceeding 1,5 kW;
- 5 s (and preferably not less than 2 s) for appliances where the start-gas rate exceeds 1,5 kW.

The safety time shall be verified under the test conditions of 6.2.4.

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, either safety shut-down shall occur or a single immediate attempt at re-ignition by direct spark restoration may occur. This single re-ignition attempt within 1 s shall only be permitted in the following circumstances:

- for appliances with heat inputs of 135 kW and below and where the start-gas rate, established on a separate burner, does not exceed 0,6 kW or 1 % of the main burner rating, whichever is the greater;
- for appliances with heat inputs of more than 135 kW and where the start-gas rate, established on a separate burner, is less than 1 kW plus 1 % of the main burner rating.

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

For appliances where the start-gas rate exceeds the values given above, safety shut-down and non-volatile 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.

4.6.2 All appliances except Type B₁₄

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

On burners with a heat input rating of 135 kW and below, where the start-gas supply is taken from between the two main gas automatic shut-off valves, either:

- a means shall be provided to prove closure of the downstream main shut-off valve prior to ignition⁴⁾; or
- the requirement of 5.1.4.1.2 shall be met.

⁴⁾ A valve proving system or a proof of closure switch is deemed to satisfy this requirement.

On burners with a heat input rating of more than 135 kW, where the start-gas supply is taken from between the two main gas automatic shut-off valves, the downstream main gas automatic shut-off valve shall be checked for closure prior to start-up. If the check indicates the valve is not closed, the start-up shall be prevented.

The start-gas flame establishment shall consist of:

- a) the start-gas flame ignition period, the duration of which shall not be more than:
 - 30 s in case of start-gas burners having a heat input not exceeding 0,6 kW;
 - 15 s in case of start-gas burners having a heat input greater than 0,6 kW and not exceeding 1,5 kW;
 - 5 s (and preferably not less than 2 s) for appliances where the start-gas rate exceeds 1,5 kW.
- b) in the case of appliances having a nominal heat input of more than 135 kW, a start-gas flame proving period, the duration of which shall not be less than 5 s.

The ignition circuit (or other means of ignition) shall not be energized before the completion of the pre-purge period and shall be de-energized at or before the end of the start-gas flame ignition period.

The start-gas valve(s) shall not be energized before the ignition spark (or other means of ignition) is energized. However, where a hot surface ignition system is used, the ignition system shall be so energized that the ignition source is capable of igniting incoming gas before the gas valve(s) are opened.

If the start-gas flame has not been detected by the end of the first safety time, either automatic safety shut-down and non-volatile lock-out shall result or 4 automatic recycling attempts are permitted; after the fourth unsuccessful restart attempt, safety shut-down and non-volatile lock-out shall result.

If the start-gas flame is established at a separate ignition burner, the flame detector, under all conditions of operation, shall detect the ignition burner flame only at rates which will ignite the main gas reliably and smoothly. This requirement is verified in 6.3.4.1.1.2.

The energy released during the start-gas flame ignition period shall be limited in such a way that any pressure rise resulting from a delayed ignition will not cause damage to the appliance or ducting. This requirement shall be deemed to be satisfied when the start-gas rate does not exceed 25 % of the main gas rate.

When the start-gas rate is controlled by a start-gas rate position contained within the downstream main automatic shut-off valve, this valve shall comply with EN 161:1991. In addition, any means of adjustment of the start-gas rate or the operating position of an interlock, if fitted, shall be pre-set and sealed by the manufacturer.

On burners with a heat input of 135 kW and above and where start-gas position of the valve is controlled by an interlock, the interlock shall be proved in the correct state throughout the start-gas flame establishment period.

If the interlock indicates that the start-gas rate has been exceeded, the time taken to de-energize the valve shall not be more than 1 s and the burner shall proceed to lock-out.

On burners with a heat input rating of 135 kW and above and where a start-gas interlock is not fitted, the valve shall be checked for closure prior to start-up by means of a closed position indicator switch. If the check indicates that the valve is not closed start-up shall be prevented.

4.7 Main flame establishment

4.7.1 Type B₁₄ appliances

4.7.1.1 Establishment by means of a start-gas flame

4.7.1.1.1 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).

Flame failure in the running condition shall result in non-volatile lock-out.