

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

The European Standard EN 778:1998, with the incorporation of amendment A1:2001, has the status of a British Standard

ICS 91.140.20

National foreword

This British Standard is the English language version of EN 778:1998, including amendment A1:2001. It supersedes BS 5258-4:1987 and BS 6332-5:1986 which are withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GSE/20, Non-domestic space 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.

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English version

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

(includes amendment A1:2001)

Générateurs d'air chaud à convection forcée utilisant les combustibles gazeux pour le chauffage de locaux à d'habitation de débit calorifique sur H_i inférieur ou égal à 70 kW, sans ventilateur pour aider l'alimentation en air comburant et/ou l'évacuation des produits de combustion
(inclut l'amendement A1:2001)

Gasbefeuert Warmluft erzeuger mit erzwungener Konvektion zum Beheizen von Räumen für den häuslichen Gebrauch mit einer Nennwärmebelastung nicht über 70 kW, ohne Gebläse zur Beförderung der Verbrennungsluft und/oder der Abgase
(enthält Änderung A1:2001)

This European Standard was approved by CEN on 9 August 1997. Amendment A1 was approved by CEN on 18 August 2001.

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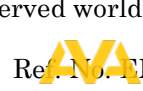
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Foreword

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 July 1998, and conflicting national standards shall be withdrawn at the latest by July 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 covers type-testing only.

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

NOTE 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, 5.2.7.

Type B₁₁ appliances shall be fitted with an atmosphere sensing device or a combustion products discharge safety device in order to meet the Essential Requirement of 3.4.3 of the Directive 90/396/EEC. In this standard these appliances are designated as type B_{11AS} and B_{11BS}, according to the device. However, appliances intended to be installed in a space separated from living rooms and provided with appropriate ventilation directly to the outside, need not carry such a device, but in this case, appropriate warnings on the packaging and in the instructions shall clearly indicate the limit on the use on this type of appliance. In this standard these appliances are designated as type B₁₁.

Other European Standards covering gasfired air heaters are as follows:

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

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

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

prEN 1196, *Domestic and nondomestic gas-fired air heaters — Supplementary requirements for condensing air heaters*.

prEN 1319, *Domestic gas-fired forced convection air heaters for space heating, with fan-assisted burners not exceeding a net heat input of 70 kW*.

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 778:1998/A1:2001 to the EN 778:1998 has been prepared by Technical Committee CEN/TC 179, Gas-fired air heaters, the Secretariat of which is held by NEN.

This amendment to the European Standard EN 778:1998 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2002, and conflicting national standards shall be withdrawn at the latest by March 2002.

This amendment to the European Standard EN 778:1998 has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

According to the CEN/CENELEC Internal Regulations, the national standards organization 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 standard specifies the requirements and test methods for the safety and efficiency of domestic gas-fired air heaters with (an) atmospheric burner(s) and without a fan to assist the transportation of combustion air and/or flue gases, hereafter referred to as “appliances”.

This standard applies to type B₁₁, B_{11AS}, B_{11BS}, C₁₁, C₂₁, C₃₁ and C₄₁ appliances with an input not exceeding 70 kW (net cv-basis), intended primarily for use in single unit residential dwellings. Provision of the heated air may be by means of ducting.

This standard does *not* apply to:

- appliances of the condensing type;
- appliances for outdoor installation;
- dual purpose air conditioning appliances (heating and cooling);
- appliances where the air is heated by an intermediate fluid;
- appliances with forced draught burners;
- appliances fitted with a manual or automatic means of adjusting the combustion air supply or the combustion products evacuation (including 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;
- C₂₁ and C₄₁ appliances for 3rd family gases.

NOTE For C₄₁ appliances: see all requirements and test methods that are valid for C₂₁ appliances, unless otherwise stated.

This European Standard covers type-testing only.

2 Normative references

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

EN 88:1991, *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 161:1992, *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 for gas burners and gas-burning appliances with or without fans*.

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

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 purposes — Safety requirements*.

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

EN 60529:1991, *Degrees of protection provided by enclosures*.

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

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

- EN 60730-2-9:1995, *Automatic electrical controls for household and similar use — Part 2: Particular requirements for temperature-sensing controls.*
- EN 61058-1:1992, *Switches for appliances — Part 1: General requirements.*
- IEC 479-1:1994, *Effect of current passing through the human body — Part 1: General aspects.*
- IEC 479-2:1987, *Effect 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 7005-1:1992, *Metallic flanges — Part 1: Steel flanges.*
- ISO 7005-2:1988, *Metallic flanges — Part 2: Cast iron flanges.*
- ISO 7005-3:1988, *Metallic flanges — Part 3: Copper flanges and composite flanges.*
- CR 1404, *Determination of emissions from appliances burning gaseous fuels during type testing.*

3 Definitions

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

3.1 appliance and its constituent parts

3.1.1

domestic air heater

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

3.1.2

forced convection air heater

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

3.1.3

gas inlet connection

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

3.1.4

mechanical joint; mechanical means of obtaining soundness

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

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

3.1.5

gas circuit

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

3.1.6

restrictor

a device with an orifice, which is placed in the gas circuit so as to create a pressure drop and thus reduce the gas pressure at the burner to a predetermined value for a given supply pressure and rate

3.1.7

gas rate adjuster

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

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

3.1.8

setting an adjuster

immobilization of an adjuster by some means such as a screw after the manufacturer or installer has adjusted it. The adjuster is said to be “set” in this position

3.1.9

sealing an adjuster

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

a factory sealed adjuster is considered to be non-existent

a governor is considered to be nonexistent 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 excess primary air to be set at the desired value according to the supply conditions

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

3.1.16

combustion circuit

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

3.1.17

combustion chamber

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

3.1.18

flue outlet

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

3.1.19**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

3.2 adjusting, control and safety devices**3.2.1****range-rating device**

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

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

3.2.2**automatic burner system**

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

3.2.3**automatic burner control system**

a system comprising at least a programming unit and all the elements of a flame detector device. The various functions of an automatic burner control system may be in one or more housings

3.2.4**non-automatic burner system**

a burner system with an ignition burner which is ignited manually

3.2.5**programming unit**

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

3.2.6**programme**

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

3.2.7**flame detector device**

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

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

3.2.8**flame signal**

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

3.2.9**flame simulation**

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

3.2.10

pressure governor¹⁾

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

3.2.11

adjustable pressure governor

a governor provided with means for changing the outlet pressure setting

3.2.12

flame supervision device

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

3.2.13

automatic shut-off valve

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

3.2.14

room temperature control thermostat

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

3.2.15

overheat cut-off device

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

3.2.16

temperature limiter

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

3.2.17

overheat limit device

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

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

3.2.18

fan control

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

3.2.19

temperature sensing element; temperature sensor

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

3.2.20

combustion products discharge safety system

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

3.2.21

atmosphere sensing device

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

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

3.2.22**modulating control**

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

3.2.23**high/low control**

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

3.2.24**closed position indicator switch**

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

3.2.25**proof of closure switch**

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

3.2.26**valve proving system**

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

3.3 operation of the appliance**3.3.1****heat input**

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

Symbol: Q

Unit: kilowatts (kW)

3.3.2**nominal heat input**

the value of the heat input declared by the manufacturer

Symbol: Q_n

3.3.3**mass flow rate**

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

Symbol: M

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

3.3.4**volumetric flow rate**

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

Symbol: V

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

3.3.5**flame stability**

the characteristic of flames which remain on the 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, the start gas valve or main gas valve, as applicable, being de-energized if the flame detector signals the absence of a flame at the end of this interval

3.3.12

second safety time

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

3.3.13

waiting time

the time between safety shut-down and any (re)start attempt

3.3.14

start gas

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

3.3.15

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

3.3.16

start gas flame

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

3.3.17

running condition of the system

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

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

3.3.18**controlled shut-down**

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

3.3.19**safety shut-down**

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

3.3.20**lock-out****3.3.20.1****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

3.3.20.2**volatile lock-out**

the safety shut-down condition of the system, such that a restart can only be accomplished by either the manual reset of the system, or an interruption of the main power and its subsequent restoration

3.3.21**spark restoration**

the process by which, after disappearance of the flame signal, the ignition device is energized again without the gas supply having been totally interrupted. This process ends with the restoration of the running condition or, if there is no flame signal at the end of the safety time, with volatile or non-volatile lock-out

3.3.22**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

3.3.23**ignition opening time**

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

3.3.24**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

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

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

3.4.2**reference gases**

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

3.4.3**limit gases**

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

3.4.4**gas pressure**

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

it is expressed in millibars (mbar) or in bars

3.4.5**test pressures**

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

they are expressed in millibars (mbar)

NOTE 1 mbar = 10^2 Pa.

3.4.6**normal pressure**

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

Symbol: p_n

3.4.7**limit pressures**

pressures representative of the extreme variations in the appliance supply conditions

Symbols:

maximum pressure: $p_{\max}$

minimum pressure: $p_{\min}$

3.4.8**pressure couple**

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

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

3.4.9**relative density**

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

Symbol: d

3.4.10**calorific value**

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

a distinction is made between:

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

Symbol: H_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_n

Units: either:

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

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

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

3.5.2**cold condition**

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

3.5.3**hot condition**

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

3.5.4**thermal equilibrium**

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

3.6 marking of the appliance and packaging**3.6.1****direct country of destination**

a country for which the appliance has been certified and which is specified by the manufacturer as the intended country of destination. At the time of putting the appliance on the market and/or installation, the appliance shall be capable of operating, without adjustment or modification, with one of the gases distributed in the country concerned, at the appropriate supply pressure

more than one country can be specified if the appliance, in its current state of adjustment, can be used in each of these countries

3.6.2**indirect country of destination**

a country for which the appliance has been certified, but for which, in its current 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 gases used in this standard

Table 1 — Classification of gases

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

3.7.2

classification of appliances

appliances can be classified according to:

- the gases they can use;
- the mode of evacuation of the 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 pressure regulating device, 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 third family gases only**

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

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

category I_{3P}: appliances using only gases of group P of the third family (propane) at the prescribed supply pressure

3.7.2.1.2**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 the gases of group L of the second family and gases of group P of the third family. The second family gases are used under the same conditions as for category I_{2L}. The third family gases are used under the same conditions as for category I_{3P}

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

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

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

3.7.2.1.3**category III**

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

3.7.2.2

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 taken directly from the room

- **type B₁**: a type B appliance incorporating a draught diverter
- **type B₁₁**: a natural draught type B₁ appliance
- **type B_{11AS}**: a type B₁₁ appliance with an atmosphere sensing device
- **type B_{11BS}**: a type B₁₁ appliance with a combustion products discharge safety system

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 C₁₁**: a natural draught type C₁ appliance
- **type C₂**: a type C appliance connected via two ducts to a common duct system serving more than one appliance. This system consists of a single duct which supplies the combustion air and evacuates the combustion products
- **type C₂₁**: a natural draught type C₂ appliance
- **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 C₃₁**: a natural draught type C₃ appliance
- **type C₄**: a type C appliance connected via two ducts to a common duct system serving more than one appliance. This system consists of two ducts, one of which supplies the combustion air and the other which evacuates the products of combustion
- **type C₄₁**: a natural draught type C₄ appliance

4 Construction and design requirements

4.1 General

4.1.1 Conversion to different gases

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

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

4.1.1.1 Category I

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

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

Category I₃₊: Replacement of injectors or calibrated orifices but only in order to convert from one pressure couple to another, e.g. from 28–30 mbar/37 mbar to 50 mbar/67 mbar or vice versa.

Category I_{3p}: No modification to the appliance relative to a change of gas. For a change of pressure, replacement of injectors and adjustment of gas rates.

4.1.1.2 *Category II*

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

- Adjustment of the gas rate with, if necessary, a change of injector, restrictor or governor.
- Adjustment of the gas rate of the ignition burner(s), either by using an adjuster or by a change of injector or restrictor and, if necessary, a change of the complete ignition burner(s) or of some of its/their parts.
- A change, if necessary, of the automatic shut-off valve(s).
- Putting the governor out of service under the conditions of 4.2.5.
- Putting the gas rate adjusters out of service under the conditions of 4.2.2.2.

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

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

- Adjustment of the gas rate with, if necessary, a change of injector, restrictor or governor.
- Adjustment of the gas rate of the ignition burner(s), either by using an adjuster or by a change of injector or restrictor and, if necessary, a change of the complete ignition burner(s) or of some of its/their parts.
- A change, if necessary, of the automatic shut-off valve(s).
- Putting the governor out of service under the conditions of 4.2.5.
- Putting the gas rate adjuster(s) out of service under the conditions of 4.2.2.2.

These adjustments or component changes are only acceptable when:

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

4.1.1.3 *Category III*

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

4.1.2 *Materials and method of construction*

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

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

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

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

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

Asbestos or materials containing asbestos shall not be used.

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

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

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

4.1.3 Accessibility for maintenance and use

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

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

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

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

Panels that are normally removed for servicing shall be fitted with anchor lines where the appliance is intended to be installed at heights above floor level greater than 1,8 m. This requirement shall be deemed to be satisfied if suitable hinges are fitted.

4.1.4 Thermal insulation

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

4.1.5 Gas connection

The appliance gas connection shall be accessible.

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

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

If the appliance has a threaded connection, this thread shall comply with ISO 228-1:1994 or ISO 7-1:1994. In the first case (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.5**.

4.1.6 Soundness

4.1.6.1 Soundness of the gas circuit

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

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

4.1.6.2 Soundness of the combustion circuit

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

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

4.1.6.3 Soundness of the heat exchanger

Products of combustion shall be prevented from leaking into the delivered air. Compliance with this requirement can be verified using 5.2.7.

4.1.7 Supply of combustion air and evacuation of combustion products

4.1.7.1 Appliance combustion air inlet

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

4.1.7.2 Appliance flue gas outlet

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

4.1.7.3 Type B₁₁, B₁₁AS and B₁₁BS appliances

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

Connection to the flue shall be made by means of a flue outlet preceded by a draught diverter. This device is part of the appliance. 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 (Annex A). The internal diameter of the flue outlet shall be such as to ensure compliance with requirements concerning operation. It shall be possible to insert a flue pipe with an external diameter ($D - 2$) mm to a depth of at least $D/4$ (where D is the internal diameter of the flue outlet) but not so far that the evacuation of the combustion products is impaired.

Appliances shall be constructed to prevent release of combustion products in a dangerous quantity into the installation room under abnormal draught condition (see 5.2.8 and 5.2.9). To meet this requirement, type B₁₁ appliances shall be factory fitted with a suitable device; in this case the appliance is designated as a type B₁₁AS or B₁₁BS appliance, according to the device (see 3.7.2.2.1 for classifications).

However, appliances intended to be installed in a place separated from living rooms and provided with appropriate ventilation directly to the outside need not carry such a device, but in this case, appropriate warnings on the packaging and in the instructions shall clearly indicate the limit on the use of this type of appliance; in this case the appliance is designated as a type B₁₁ appliance.

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

4.1.7.4 Type C₁₁ appliances

4.1.7.4.1 Flue terminal and ducts

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

The flue system shall be designed taking into account the possible penetration of rain or snow.

An opening in a 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.

If a type C₁₁ appliance is fitted with separate combustion air inlet and combustion products ducts, the centres of these ducts shall be within a distance of not more than 50 cm at their termination point.

4.1.7.4.2 Terminal guard

A terminal guard shall be provided in accordance with the National Regulations applicable in the various member states.

4.1.7.5 Type C₂₁ and C₄₁ appliances

All necessary connecting parts to the combustion air/combustion products duct shall be supplied by the appliance manufacturer.

4.1.7.6 Type C₃₁ appliances

4.1.7.6.1 Flue terminal and ducts

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

The flue system shall be designed taking into account the possible penetration of rain or snow.

An opening in a terminal shall not permit the entry of a ball of 35 mm diameter when applied with a force of 5 N.

4.1.7.6.2 Terminal guard

A terminal guard shall be provided in accordance with the National Regulations applicable in the various member states.

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 flanges, spigots or other suitable connections on the air inlet.

4.1.8.2 Air outlets

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

4.1.9 Checking the state of operation of the burner

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

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

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 C.

If the appliance is fitted with electronic components or electronic systems providing a safety function, these shall comply with the relevant requirement of EN 298:1993 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:

- a) continued safe operation; or
- b) safety shut-down; or
- c) volatile or non-volatile lock-out.

NOTE Requirements and test methods relating to the continued and safe operation of the appliance in the event of normal and abnormal fluctuation of auxiliary energy are specified in 5.2.5.1 and 6.3.5.3 test no. 4.

4.1.12 Motors and fans

The direction of rotation of fans shall be clearly marked.

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

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

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

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

Lubrication points, if provided, shall be readily accessible.

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

4.1.13 Air filter

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

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

4.2 Adjusting, control and safety devices

4.2.1 General

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

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

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

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

4.2.2 Gas rate adjusters and range-rating devices

4.2.2.1 Common requirements

Gas rate adjusters and range-rating devices shall be designed so that they are protected against accidental maladjustment by the user once the appliance has been installed and put into service. It shall be possible to seal them (e.g. with paint) after adjustment; 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.

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

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

4.2.2.3 Range-rating devices

A range-rating device on an appliance is optional.

For appliances in category II_{1a2H}, the gas rate adjuster and the range-rating device may be one and the same. However, if the gas rate adjuster has to be sealed, either completely or partially, when the appliance is supplied with a 2nd family gas, the gas rate adjuster or its sealed part shall no longer be used by the installer as a range-rating device.

4.2.3 Aeration adjusters

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

4.2.4 Manual controls

4.2.4.1 Application

Manual valves, push buttons or electrical switches that are essential for normal operation and commissioning of the appliance shall either be provided with the appliance or, where they are not integral with the appliance, specified in the manufacturer's installation instructions.

4.2.4.2 Manual valves (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. The "CLOSED" position shall always be clear.

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. In addition, appliances in categories I_{2E+}, and II_{2E+3+} may be fitted with a gas governor. However, the governor, if it exists, shall not be operational in the range of the two normal pressures of the second family pressure couple, i.e. 20–25 mbar.

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

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

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

4.2.6 Multifunctional controls

Any multifunctional control shall comply with the requirements of EN 126:1995. In addition, multifunctional controls shall comprise as a minimum the appropriate valving requirements of 4.2.7.2 and 4.2.7.3.

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

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

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

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

4.2.7 Automatic shut-off valves

4.2.7.1 General

Automatic shut-off valves shall comply with the requirements of EN 161:1992.

Class D valves as specified in 4.2.7.2 and 4.2.7.3 may be replaced by Class C, B or A valves, Class C valves may be replaced by Class B or A valves, and Class B valves may be replaced by Class A valves.

4.2.7.2 Appliances with separate ignition burner

For appliances in which ignition takes place at a separate ignition burner, all gas supplies shall be under the control of automatic shut-off valves connected to the gas line in series, of a capability not less than that specified in Table 2.

Table 2 — Valving requirements for appliances with a separate ignition burner

System	Main gas valves	Start gas valves
Non-automatic with ignition burner	1 Class C + 1 Class D	1 Class C ¹⁾
Automatic with waiting time ²⁾	1 Class C + 1 Class D	1 Class C ³⁾⁴⁾
Automatic without waiting time	1 Class C + 1 Class C, or 1 Class B + 1 Class D	1 Class C ³⁾⁴⁾

¹⁾ This valve may be the start-gas component integral with a thermoelectric valve or multifunctional control conforming to the requirements of EN 125:1991 or EN 126:1995, as appropriate. This valve need not be in addition to the Class C valve required for main gas control.

²⁾ The waiting time shall be at least 300 s.

³⁾ This valve may be the Class B or C valve controlling the main gas supply.

⁴⁾ If the ignition burner rate exceeds 0,6 kW, then an additional Class D valve shall be incorporated in the ignition burner supply.

4.2.7.3 Appliances with direct ignition of the main burner

Appliances incorporating direct ignition of the main burner shall be under the control of automatic shut-off valves connected to the gas-line in series, of a capability not less than specified in Table 3.

Table 3 — Valving requirements for appliances with direct ignition of the main burner

System	Gas valves
Type B and C with waiting time ¹⁾	1 Class C + 1 Class D
Type C without waiting time	1 Class C + 1 Class C or 1 Class B + 1 Class D

¹⁾ The waiting time shall be at least 300 s.

4.2.7.4 Valve action in case of shut-down

Both safety and controlled shut-down shall at least effect closure of the Class D valve (or its alternative) within 5 s.

4.2.8 Automatic burner control systems

4.2.8.1 General

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

4.2.8.2 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.

4.2.9 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 strainer may be integral with the upstream automatic shut-off valve. The maximum strainer hole dimension shall comply with the requirements as laid down in EN 161:1992, or shall be 0,2 mm when a Class D valve is used.

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

Where a governor is fitted upstream of the automatic shut-off valve system, the strainer shall 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 an ignition 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 4.2.9).

4.4 Flame supervision system

4.4.1 General

The burner shall be fitted with a flame supervision device complying with EN 125:1991 or by the flame detector of an automatic burner control system complying with EN 298:1993 to monitor the start-gas flame and protect the main flame.

4.4.2 Appliances with non-automatic burner systems

Upon flame failure, the control system shall cause at least volatile lock-out. The extinction safety time for the flame supervision system to shut down the burner shall not be more than 60 s for appliances with ignition burners protected by a thermoelectric flame supervision system. 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, piezoelectric ignition is not regarded as electric ignition.

4.4.3 Appliances with automatic burner systems

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. (Where the flame supervision system incorporates thermionic valves, etc., requiring warm-up time, the safe-start check shall last for at 5 s longer than the maximum warm-up time.)

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 during the running condition, the control system shall cause safety shut-down or a single attempt of spark restoration. However, in case of control systems which incorporate hot surface ignition, safety shut-down and at least volatile lock-out shall result following flame failure. The total 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 Start-gas flame establishment

4.5.1 Appliances with non-automatic burner systems

Direct ignition of the main burner is not allowed.

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

The ignition opening time shall not exceed 30 s. This time is verified under the test conditions of 6.2.2; it can be raised to 60 s if no manual intervention is required during it.

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

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

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

4.5.2 Appliances with automatic burner systems

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

The start gas rate shall be such that when tested under the conditions of 6.2.2, the system is safe on ignition.

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.

The first safety time shall not exceed:

- 30 s in case of ignition burners having an input ≤ 600 W;
- 15 s in case of ignition burners having an input >600 W and $\leq 1,5$ kW;
- 5 s (and preferably not less than 2 s) for appliances where the start-gas rate exceeds 1,5 kW.

The safety time is verified under the conditions of 6.2.4. Moreover, when tested under the conditions of 6.2.4.3, the appliance shall not sustain any damage likely to affect its safe operation.

If ignition does not occur, the spark shall continue until the safety time has elapsed.

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

In the event of start gas flame failure after establishment of the start gas flame, safety shut-down or a single immediate attempt at re-ignition shall occur for appliances where the start gas rate, established on a separate ignition burner, does not exceed 0,6 kW. If re-ignition is attempted and the start gas flame is not detected within the first safety time, safety shut-down and at least volatile lock-out shall result.

For appliances where the start gas rate exceeds 0,6 kW, safety shut-down and at least volatile lock-out shall occur in the event of start gas flame failure after its establishment.

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

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

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

or,

- b) the requirement of 5.2.4.1.2 is met.

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

4.6 Main flame establishment

4.6.1 Appliances with non-automatic burner systems

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

4.6.2 Appliances with automatic burner systems

The main gas automatic shut-off valves shall not be energized to admit the main gas flow to the burner until after the start gas flame has been detected and proved. The second safety time shall not exceed 3 s.

For appliances incorporating direct ignition of the main burner, a single ignition attempt shall be permitted with a safety time not exceeding 5 s. This is verified under the conditions of 6.2.4.

Flame failure up to end of the safety time shall lead to safety shut-down and non-volatile lock-out.