

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

ICS 97.100.20

National foreword

This British Standard is the UK implementation of EN 1020:2009. It supersedes BS EN 1020:1998 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GSE/20/4, Air heaters (gas).

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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English Version

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

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

Gasbefeuerte Warmluftzeuger mit verstärkter Konvektion für den nicht-häuslichen Gebrauch mit einer Nennwärmebelastung nicht über 300 kW, mit Gebläse zur Beförderung der Verbrennungsluft und/oder der Abgase

This European Standard was approved by CEN on 5 October 2009.

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 CEN Management Centre or to any CEN member.

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Foreword

This document (EN 1020:2009) has been prepared by Technical Committee CEN/TC 180 “Domestic and non-domestic gas-fired air heaters and non-domestic gas-fired overhead radiant heaters”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2010, and conflicting national standards shall be withdrawn at the latest by May 2010.

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

This document supersedes EN 1020:1997.

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

For relationship with EU Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document.

This revision modifies EN 1020:1997. It has been prepared to incorporate requirements for combustion products evacuation ducts, POCEDs, supplied as an integral part of the system to support the EU Directive 89/106/EEC on construction products under mandate M105. To this end it extends the scope of the standard to cover type B₄ and type B₅ appliances.

Furthermore, the opportunity presented by this revision has been taken to update the standard in respect to EN 437:2003.

NOTE For countries requesting special categories (specified in EN 437:2003), 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 (see 4.1.1, 4.2.2, 4.2.3 and 4.2.5) also apply to these special categories.

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

1 Scope

This European Standard specifies the requirements and test methods for the 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, B₄₂, B₄₃, B₄₄, B₅₂, B₅₃, 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 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:

- a) appliances intended for use in a single unit residential dwelling;
- b) appliances of the condensing type;
- c) appliances with atmospheric burners without a fan to assist the transportation of combustion air and/or flue gases;
- d) dual purpose air conditioning appliances (heating and cooling);
- e) appliances where the air is heated by an intermediate fluid;
- f) appliances fitted with manual or automatic flue dampers;
- g) portable or transportable forced convection appliances;
- h) appliances having multiple heating units with a single draught diverter;
- i) appliances fitted with more than one flue outlet;
- j) appliances that are designed for continuous condensation within the flue system under normal operating conditions;
- k) appliances having combustion products evacuation ducts, POCEDs, that are non-metallic.

This standard is applicable to appliances which are intended to be type tested. It also includes requirements concerning the evaluation of conformity, including factory production control, but these requirements only apply to POCEDs and their associated terminals.

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

2 Normative references

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

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

- EN 125, *Flame supervision devices for gas burning appliances — Thermo-electric flame supervision devices*
- EN 126, *Multifunctional controls for gas burning appliances*
- EN 161, *Automatic shut-off valves for gas burners and gas appliances*
- EN 257, *Mechanical thermostats for gas-burning appliances*
- EN 298:2003, *Automatic burner control systems for gas burners and gas burning appliances with or without fans*
- EN 437:2003, *Test gases — Test pressures — Appliance categories*
- EN 1859:2000, *Chimneys — Metal Chimneys — Test methods*
- EN 10226-1, *Pipe threads where pressure tight joints are made on the threads — Part 1: Taper external threads and parallel internal threads — Dimensions, tolerances and designation*
- EN 10226-2, *Pipe threads where pressure tight joints are made on the threads — Part 2: Taper external threads and taper internal threads — Dimensions, tolerances and designation*
- EN 12067-1, *Gas/air ratio controls for gas burners and gas burning appliances — Part 1: Pneumatic types*
- EN 60335-1:2002, *Household and similar electrical appliances — Safety — Part 1: General requirements (IEC 60335-1:2001, modified)*
- EN 60335-2-102, *Household and similar electrical appliances — Safety — Part 2-102: Particular requirements for gas, oil and solid-fuel burning appliances having electrical connections (IEC 60335-2-102:2004, modified)*
- EN 60529:1991, *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)*
- EN 60584-1, *Thermocouples — Part 1: Reference tables (IEC 60584-1:1995)*
- EN 60584-2, *Thermocouples — Part 2: Tolerances (IEC 60584- 2:1982 + A1:1989)*
- EN 60730-1, *Automatic electrical controls for household and similar use — Part 1: General requirements (IEC 60730-1:1999, modified)*
- EN 60730-2-9:2002, *Automatic electrical controls for household and similar use — Part 2-9: Particular requirements for temperature sensing controls (IEC 60730-2-9:2000, modified)*
- EN 61058-1, *Switches for appliances — Part 1: General requirements (IEC 61058-1:2000 + A1:2001, modified)*
- EN ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation (ISO 228-1:2000)*
- EN ISO 3166-1, *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes (ISO 3166-1:2006)*
- EN ISO 6976, *Natural gas — Calculation of the calorific values, density, relative density and Wobbe index from composition (ISO 6976:1995 including Corrigendum 1:1997, Corrigendum 2:1997 and Corrigendum 3:1999)*
- ISO 7-1, *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, *Reaction to fire tests for building products — Non-combustibility test*

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

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

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

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 Appliance and its constituent parts

3.1.1

non-domestic air heater

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

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

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

3.1.4

mechanical joint

mechanical means of obtaining soundness

means of ensuring the soundness of an assembly of several (generally metallic) parts without the use of liquids (e.g. pastes and tapes)

EXAMPLES Metal to metal joints; conical joints; toroidal sealing rings ("O" rings); flat joints.

3.1.5

gas circuit

part of the burner unit that conveys or contains the gas between the burner unit gas inlet connection and the burners

3.1.6

restrictor

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

3.1.7

gas rate adjuster

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

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

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

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

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

3.1.8

setting an adjuster

immobilizing a gas rate adjuster (e.g. by turning a screw), after the gas rate has been adjusted by the manufacturer or installer

3.1.9

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

NOTE 1 The adjuster is then said to be "sealed" in its adjustment position.

NOTE 2 A factory sealed adjuster is considered to be non-existent.

NOTE 3 A regulator is considered to be non-existent if it has been factory sealed in a position such that it is not operational in the range of supply pressures corresponding to the appliance category.

3.1.10

putting an adjuster or a control out of service

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

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

3.1.11

injector

component that admits the gas into a burner

3.1.12

main burner

burner that is intended to assure the thermal function of the appliance

3.1.13

ignition device

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

NOTE This device can operate intermittently or permanently.

3.1.14

ignition burner

burner whose flame is intended to ignite another burner

3.1.15

aeration adjuster

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

NOTE The action of adjusting this device is called "adjusting the aeration".

3.1.16 combustion products circuit

3.1.16.1

combustion chamber

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

3.1.16.2

flue outlet

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

3.1.16.3

draught diverter

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

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

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

terminal which is specially approved for Type C₆ appliances

3.1.16.7

flue adaptor box

means of adapting the appliance for connection to different duct systems

EXAMPLE From concentric to separate ducts.

3.1.16.8

POCED

combustion products evacuation duct that is intended to be used only with a specific appliance/system, this duct being either supplied with the appliance/system or specified in the manufacturers instructions

3.1.17

fully premixed burner

pre-aerated burner system in which gas is mixed in a pre-determined and adjustable ratio with all of the air necessary for combustion

3.1.18

gas/air ratio control

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

3.2 Adjustment, control and safety devices

3.2.1

range rating device

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

NOTE 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

system comprising at least a programming unit and all the elements of a flame detector device

NOTE The various functions of an automatic burner control system may be in one or more housings [EN 298:2003].

3.2.3

programming unit

device which reacts to signals from control and safety devices, gives control commands, controls the start-up sequence, supervises the burner operation and causes controlled shut-down, and if necessary safety shut-down and lock-out

NOTE The programming unit follows a predetermined sequence of actions and always operates in conjunction with a flame detector device [EN 298:2003].

3.2.4

programme

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

NOTE Safety actions such as safety shut down and lock out are also part of the programme [EN 298:2003].

3.2.5

flame detector device

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

NOTE A flame detector device 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 [EN 298:2003].

3.2.6

flame signal

signal given by the flame detector device, normally when the flame sensor senses a flame [EN 298:2003]

3.2.7

flame simulation

condition which occurs when the flame signal indicates the presence of a flame when in reality no flame is present [EN 298:2003]

3.2.8

pressure regulator¹⁾

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 regulator

regulator provided with means for changing the outlet pressure setting

3.2.10

flame supervision device

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

3.2.11

automatic shut-off valve

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

3.2.12

control thermostat

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

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

3.2.13

overheat cut-off device

device that shuts off and locks out the gas supply before the appliance is damaged and/or before safety is compromised and which requires manual intervention to restore the gas supply

NOTE This device is preset and sealed by the appliance manufacturer (see 5.10.4).

3.2.14

overheat control device

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

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

3.2.16

temperature sensing element

temperature sensor

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

3.2.17

modulating control

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

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

3.2.19

closed position indicator switch

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

3.2.20

proof of closure switch

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

3.2.21

valve proving system

system to check the effective closure of the start gas or main gas safety shut-off valves, and which is capable of detecting small gas leakage rates (e.g. by means of a pressure or vacuum proving system)

3.3 Operation of the appliance

3.3.1

volume flow rate

V

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

NOTE The volume flow rate is expressed in 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) [EN 437:2003].

3.3.2

mass flow rate

M

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

NOTE The mass flow rate is expressed in kilograms per hour (kg/h) or grams per hour (g/h) [EN 437:2003].

3.3.3

heat input

Q

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

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

3.3.4

nominal heat input

Q_n

value of the heat input (kW) declared by the manufacturer

3.3.5

flame stability

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

3.3.6

flame lift

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

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

3.3.7

light-back

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

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

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

3.3.11

first safety time

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

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

3.3.12

second safety time

where there is a first safety time to either a ignition burner or start gas flame only, 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

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

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

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

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

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

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

3.3.19

controlled shut-down

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 [EN 298:2003]

3.3.20

safety shut-down

process which is effected immediately following the response of a protection device or a fault in the automatic burner control system and puts the burner out of operation

NOTE The resulting state of the system is defined by deactivated terminals for the gas shut-off valves and the ignition device [EN 298:2003].

3.3.21 Lock-out

3.3.21.1

non-volatile lock-out

safety shut-down condition of the system, such that a restart can only be accomplished by a manual reset of the system and by no other means [EN 298:2003]

3.3.21.2

volatile lock-out

safety shut-down condition of the system, such that a restart can only be accomplished by either the manual reset of the system or an interruption of the electrical supply and its subsequent restoration [EN 298:2003]

3.3.22

spark restoration

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

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

3.3.23

automatic recycling

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

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

3.3.24

ignition opening time

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

3.3.25

extinction safety time

time interval between extinction of the supervised flame and the gas supply being shut off:

- a) to the main burner; and/or
- b) to the ignition burner.

3.3.26

ignition interlock

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

3.3.27

re-start interlock

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.

NOTE Test gases comprise the reference and the limit gases [EN 437:2003].

3.4.2

reference gases

test gases with which appliances operate under nominal conditions when they are supplied at the corresponding normal pressure [EN 437:2003]

3.4.3

limit gases

test gases representative of the extreme variations in the characteristics of the gases for which appliances have been designed [EN 437:2003]

3.4.4

gas pressure

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

NOTE Test pressures are expressed in millibars (mbar) or bars.

3.4.5

test pressure

gas pressures used to verify the operational characteristics of appliances using combustible gases

NOTE 1 Test pressures consist of normal and limit pressures.

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

3.4.6

normal pressure

p_n

pressure under which the appliances operate in nominal conditions when they are supplied with the corresponding reference gas [EN 437:2003]

3.4.7

limit pressure

(maximum limit pressure $p_{\max}$ and minimum limit pressure $p_{\min}$)

pressures representative of the extreme variations in the appliance supply conditions [EN 437:2003]

3.4.8

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:

- a) the higher pressure corresponds only to gases of low Wobbe index;
- b) the lower pressure corresponds to gases of high Wobbe index [EN 437:2003]

3.4.9

relative density

d

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

3.4.10

calorific value

quantity of heat produced by the complete combustion, at a constant pressure equal to 1 013,25 mbar, of a 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

NOTE 1 A distinction is made between:

- a) the gross calorific value H_s in which the water produced by combustion is assumed to be condensed;
- b) the net calorific value H_i in which the water produced by combustion is assumed to be in the vapour state.

NOTE 2 The calorific value is expressed either in megajoules per cubic metre of dry gas at the reference conditions (MJ/m^3) or in megajoules per kilogram of dry gas (MJ/kg) [EN 437:2003].

3.4.11

Wobbe index

gross Wobbe index: W_g ; net Wobbe index: W_i .

ratio of the calorific value of a gas per unit volume and the square root of its relative density under the same reference conditions

NOTE 1 The Wobbe index is said to be gross or net according to whether the calorific value used is the gross or net calorific value.

NOTE 2 The Wobbe index is expressed either in megajoules per cubic metre of dry gas at the reference conditions (MJ/m^3) or in megajoules per kilogram of dry gas (MJ/kg) [EN 437:2003].

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

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

3.5.3

hot condition

condition of the installation required for some tests and obtained by heating to thermal equilibrium at nominal heat input

3.5.4

equivalent resistance

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

3.5.5

thermal equilibrium

operating state of the system corresponding to a particular setting of the input in which the flue gas temperature does not change by more than $\pm 2\%$ (in °C) over a period of 10 min

3.6 Country of destination

3.6.1

direct country of destination

country for which the appliance has been certified and which is specified by the manufacturer as the intended country of destination

NOTE 1 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.

NOTE 2 More than one country can be specified if the appliance, in its current state of adjustment, can be used in each of these countries.

3.6.2

indirect country of destination

country for which the appliance has been certified, but for which, in its present state of adjustment, it is not suitable

NOTE Subsequent modification or adjustment is essential in order that it can be utilized safely and correctly in this country.

4 Classification of systems

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

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

Table 1 — Gas classification

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

4.2 Classification of appliances according to the gases capable of being used

4.2.1 Category I

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

- a) Appliances designed for use on first family gases only

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

- b) Appliances designed for use on second family gases only

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

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

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

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

- c) Appliances designed for use on third family gases only

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

Category 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.

4.2.2 Category II

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

- a) Appliances designed for use on gases of the first and second families

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

- b) Appliances designed for use on gases of the second and third families

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

Category II_{2H3+}: Appliances capable of using gases of Group H of the second family and gases of the third family. The second family gases are used under the same conditions as for category I_{2H}. The third family gases are used under the same conditions as for category 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_{2E3+}: Appliances capable of using gases of Group E of the second family and gases of the third family. The second family gases are used under the same conditions as for category I_{2E+}. The third family gases are used under the same conditions as for category I₃₊.

Category II_{2E3P}: Appliances capable of using gases of Group E of the second family and gases of Group P of the third family. The second family gases are used under the same conditions as for category I_{2E+}. The third family gases are used under the same conditions as for category I_{3P}.

4.2.3 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.

4.3 Classification of appliances 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.

This standard applies to:

a) **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.

- 1) **Type B₁**: Type B appliance incorporating a draught diverter;
- 2) **Type B₂**: Type B appliance without a draught diverter;
- 3) **Type B₄**: Type B appliance, incorporating a draught diverter, that is designed for connection via its flue duct to its flue terminal;
- 4) **Type B₅**: Type B appliance, without a draught diverter, that is designed for connection via its flue duct to its flue terminal;
- 5) **Type B₁₂**: 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;
- 6) **Type B₁₃**: Type B₁ appliance designed for a natural draught flue incorporating a fan upstream of the combustion chamber/heat exchanger;
- 7) **Type B₁₄**: Type B₁ appliance having an integral fan downstream of both the combustion chamber/heat exchanger and the draught diverter;
- 8) **Type B₂₂**: Type B₂ appliance incorporating a fan downstream of the combustion chamber/heat exchanger;
- 9) **Type B₂₃**: Type B₂ appliance incorporating a fan upstream of the combustion chamber/heat exchanger;
- 10) **Type B₄₂**: Type B₄ appliance designed for a natural draught flue incorporating a fan downstream of the combustion chamber/heat exchanger and upstream of the draught diverter;
- 11) **Type B₄₃**: Type B₄ appliance designed for a natural draught flue incorporating a fan upstream of the combustion chamber/heat exchanger;
- 12) **Type B₄₄**: Type B₄ appliance having an integral fan downstream of both the combustion chamber/heat exchanger and the draught diverter;
- 13) **Type B₅₂**: Type B₅ appliance incorporating a fan downstream of the combustion chamber/heat exchanger;
- 14) **Type B₅₃**: Type B₅ appliance incorporating a fan upstream of the combustion chamber/heat exchanger.

NOTE 1 See B.1 for the types of appliance identified.

b) **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.

This standard applies to:

- 1) **Type C₁**: Type C appliance that is designed for connection via its 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 that are either concentric or close enough to come under similar wind conditions;

- 2) **Type C₃**: Type C appliance that is designed for connection via its 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 that are either concentric or close enough to come under similar wind conditions;
- 3) **Type C₆**: Type C appliance intended to be connected to a separately approved and marketed system for the supply of combustion air and discharge of the combustion products;
- 4) **Type C₁₂**: Type C₁ appliance incorporating a fan downstream of the combustion chamber/heat exchanger;
- 5) **Type C₁₃**: Type C₁ appliance incorporating a fan upstream of the combustion chamber/heat exchanger;
- 6) **Type C₃₂**: Type C₃ appliance incorporating a fan downstream of the combustion chamber/heat exchanger;
- 7) **Type C₃₃**: Type C₃ appliance incorporating a fan upstream of the combustion chamber/heat exchanger;
- 8) **Type C₆₂**: Type C₆ appliance incorporating a fan downstream of the combustion chamber/heat exchanger;
- 9) **Type C₆₃**: Type C₆ appliance incorporating a fan upstream of the combustion chamber/heat exchanger.

NOTE 2 See B.2 for the types of appliance identified.

5 Constructional requirements

5.1 General

5.1.1 Conversion to different gases

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

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

5.1.1.1 Category I

- a) **Category I_{2H}, I_{2L}, I_{2E}, I_{2E+}**: no modification to the appliance.
- b) **Category I_{3B/P}**: no modification to the appliance.
- c) **Category I₃₊**: replacement of injectors or calibrated orifices but only in order to convert from one pressure couple to another (e.g. 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.
- d) **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.

5.1.1.2 Category II

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

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

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 regulator out of service under the conditions of 5.2.5.

Putting the gas rate adjusters out of service under the conditions of 5.2.2.2.

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

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

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

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 regulator out of service under the conditions of 5.2.5.

Putting the gas rate adjusters out of service under the conditions of 5.2.2.2.

These adjustments or component changes are only acceptable when:

- a) converting from a gas of the second family to a gas of the third family or vice versa;
- b) converting from one butane/propane pressure couple to another (e.g. 28-30/37 mbar to 50/67 mbar or vice versa).

5.1.1.3 Category III

Category III appliances admitted in certain countries are given in A.3.3 and A.3.4.

5.1.2 Materials and method of construction

When the appliance is installed in accordance with the manufacturer's instructions, all components, including the heat exchanger and its POCED in the case of Type B₄ and B₅ appliances, 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.

5.1.3 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 access devices (e.g. handles and buttons) 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.

5.1.4 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.

5.1.5 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. 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, ISO 7005-2 or ISO 7005-3, 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.

5.1.6 Soundness

5.1.6.1 Soundness of the gas circuit

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

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

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

5.1.6.2 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.

5.1.7 Supply of combustion air and evacuation of combustion products

5.1.7.1 General

All appliances shall be designed so that there is an adequate supply of combustion air during ignition and operation 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.

5.1.7.2 Appliance combustion air inlet

5.1.7.2.1 Type B₁₄ and B₄₄ appliances

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

5.1.7.2.2 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.

5.1.7.3 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.

If the appliance has a POCED (Type B₄, B₅, C₁ and C₃ appliances) that is capable of being installed in accordance with the manufacturer's instructions such that its outlet, when fitted with any terminal supplied with the appliance, or specified in the manufacturer's instructions, extends beyond the external surface of a building by more than 1,5 m, this duct, together with any associated air supply duct (Type C₁ and C₃

appliances), shall not undergo any permanent distortion when subjected to the wind load test specified in 4.3 2 of EN 1859:2000.

5.1.7.3.1 Type B₁₂, B₁₃ and B₁₄ appliances

5.1.7.3.1.1 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.

5.1.7.3.1.2 Additional requirements for appliances of Type B₁₄

The manufacturer shall state the minimum and maximum equivalent resistance. The manufacturer's instructions shall give details for calculating the equivalent resistance (e.g. the allowance to be made for bends).

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.

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.

5.1.7.3.2 Type B₂₂ and B₂₃ 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 (e.g. the allowance to be made for bends).

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.

5.1.7.3.3 Type B₄₂, B₄₃ and B₄₄ appliances

5.1.7.3.3.1 All appliances

The POCED shall either be supplied with the appliance by the manufacturer or specified in the manufacturer's instructions. The specification shall include a description of the duct including any bends, its materials of construction and any critical tolerances (e.g. in length, diameter, thickness or insertion depth).

The manufacturer shall state the minimum and maximum equivalent resistance. The manufacturer's instructions shall give details for calculating the equivalent resistance (e.g. the allowance to be made for bends).

5.1.7.3.3.2 Additional requirements for appliances of Type B₄₄

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.

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.

5.1.7.3.4 Type B₅₂ and B₅₃ appliances

The POCED shall either be supplied with the appliance by the manufacturer or specified in the manufacturer's instructions. The specification shall include a description of the duct including any bends, its materials of construction and any critical tolerances (e.g. in length, diameter, thickness or insertion depth).

The manufacturer shall state the minimum and maximum equivalent resistance. The manufacturer's instructions shall give details for calculating the equivalent resistance (e.g. the allowance to be made for bends).

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.

5.1.7.3.5 Type C₁₂, C₁₃, C₃₂ and C₃₃ 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).

5.1.7.3.6 Type C₆₂ and C₆₃ appliances

The manufacturer shall state in the installation instructions that the appliance can only be installed with a suitable C₆ flue terminal.

NOTE Appropriate requirements for assessing the suitability of C₆ 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.

5.1.7.3.7 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 or snow) 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.

5.1.8 Supply and distribution of air for space heating

5.1.8.1 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.

5.1.8.2 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.

5.1.9 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 (e.g. 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.

5.1.10 Electrical equipment

The electrical equipment of the appliance shall comply with the relevant requirements of EN 60335-2-102, EN 60730-1 and EN 61058-1.

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 with regard to electromagnetic compatibility immunity levels.

If the manufacturer specifies on the data plate the nature of the electrical protection of the appliance, this specification shall comply with EN 60529 in order to:

- a) give the degree of personal protection against contact with dangerous electrical components inside the appliance case;
- b) give the degree of electrical protection, inside the appliance case, against harmful actions due to water penetration.

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

Interruption and subsequent restoration of the main voltage electrical supply to the appliance at any time during the starting up and operation of the appliance shall result in:

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

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

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 6.1.5.1 and 7.3.5.3.4.

5.1.12 Motors and fans

The direction of rotation of motors and 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 (also see 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.

5.2 Adjusting, control and safety devices

5.2.1 General

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

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 devices described in 5.2 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 (e.g. taps and thermostats), 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 (e.g. birds).

5.2.2 Gas rate adjusters and range-rating devices

5.2.2.1 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.

5.2.2.2 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, regulated appliances in all of these categories except category II_{2E+3+} may have a gas rate adjuster consisting of an adjusting screw on the gas regulator.

Appliances in category II_{1a2H} shall have a gas rate adjuster for the first family 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 third family gas, and the same applies for appliances in category II_{1a2H} when they are supplied with a second family gas. For appliances in category II_{2E+3P} having a gas rate adjuster, it shall be possible to put these devices out of service fully or partially (see 5.2.5) when these appliances are supplied with a second family gas.

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

5.2.2.3 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 second family gas, the gas rate adjuster or its sealed part shall no longer be used by the installer as a range-rating device.

5.2.3 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.

5.2.4 Manual controls

5.2.4.1 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.

5.2.4.2 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.

5.2.5 Regulators

Regulators shall comply with the requirements of EN 88-1.

Appliances in categories I_{2H}, I_{2E}, I_{3B/P}, I_{3P}, II_{1a2H}, II_{2H3B/P}, II_{2H3+}, II_{2H3P}, II_{2E+3B/P} and II_{2E+3P} shall be fitted with a gas regulator.

Appliances in categories I_{2L} and II_{2L3B/P} may be fitted with a gas regulator.

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

For appliances in categories II_{2H3+} and II_{2E+3+}, it shall be possible to put the regulator, 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 regulator partially out of service when they are supplied with second family gases, such

that the regulator is not operational in the range of the two normal pressures of the second family pressure couple (i.e. 20 mbar to 25 mbar).

Where a gas regulator 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 regulators for the main burner and the ignition burner are acceptable.

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

5.2.6 Multifunctional controls

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

5.2.7 Flame supervision devices

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

5.2.8 Automatic shut-off valves

5.2.8.1 General requirements

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

5.2.8.2 gives minimum valve requirements.

5.2.8.2 Application

5.2.8.2.1 Type B₁₄ and B₄₄ appliances

5.2.8.2.1.1 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	1x Class C plus 1x Class D ^{a)}	1x Class B plus 1x Class D ^{e)}	1x Class C ^{b)}	1x Class B ^{c)} plus 1x Class D ^{d)e)}
Between 135 kW and 300 kW	1x Class B plus 1x Class C	1x Class B plus 1x Class C	1x Class B ^{c)}	1x Class B ^{c)} plus 1x Class D ^{d)e)}
a) This Class D valve shall have a minimum sealing force of 1 N/m. The sealing force is calculated from the spring force in the closed position divided by the circumference or length of the seal. b) This valve may be replaced with a thermoelectric valve conforming to the requirements of EN 125 having a sealing force capability at least equivalent to a Class C valve conforming to the requirements of EN 161. c) This valve may be the Class B valve controlling the main gas supply. d) This Class D valve is not required if the start gas rate does not exceed, depending on the heat input of the appliance (see 5.6.1.1), 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. e) 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.

5.2.8.2.1.2 Appliances with direct main burner ignition

Such appliances (see 5.6.2) 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.

5.2.8.2.1.3 Appliances of Types B₁₂, B₂₂, B₄₂, B₅₂, 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 5.6; 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 c), are not met, a second valve shall be fitted as specified in Table 3.

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 requirements of 5.2.8.2.1.3 should be read in conjunction with 5.6.

Table 3 — Minimum valving requirements for outdoor and Type B₁₂, B₂₂, B₄₂, B₅₂, C₁₂, C₃₂ and C₆₂ appliances

Input	Main gas valves required for automatic systems	Start gas valves required for automatic systems
135 kW and below	1 x Class B plus 1 x Class D ^{b)}	1 x Class B ^{b)} plus 1 x Class D ^{a)c)}
Between 135 kW and 300 kW	2 x Class B	1 x Class B ^{b)} plus 1 x Class B ^{c)}
^{a)} If a Class D valve is used, 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. ^{b)} This valve may be the valve controlling the main gas supply. ^{c)} This valve is not required if: 1) the start gas rate is 10 % or below of the main gas rate; and 2) the appliance is not designed for burning third family gases; and 3) the appliance is not capable of being installed such that the combustion air inlet is higher than the exit from the combustion chamber; and 4) the pre-purge gives at least five 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.

5.2.8.2.2 Appliances of Types B₁₃, B₂₃, B₄₃, B₅₃, C₁₃, C₃₃ and C₆₃, and outdoor appliances incorporating a fan in the combustion circuit upstream of the combustion chamber/heat exchanger

5.2.8.2.2.1 Appliances having fully pre-mixed gas/air burners that are so designed that the gas pressure immediately downstream of the final gas valve is negative with respect to the atmospheric pressure

The requirements given in 5.2.8.2.1.3 shall apply.

5.2.8.2.2.2 Other appliances

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:

- a) 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 5.6; or
- b) 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 b), 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 1 The above requirements should be read in conjunction with 5.6.

Table 4 — Minimum valving requirements for Type B₁₃, B₂₃, B₄₃, B₅₃, C₁₃, C₃₃ and C₆₃ appliances and outdoor appliances

Input	Main gas valves required for automatic systems	Start gas valves required for automatic systems
135 kW and below	2 x Class B	1 x Class B ^{a)} plus 1 x Class B ^{b)}
Between 135 kW and 300 kW	1 x Class A plus 1 x Class B	1 x Class A ^{a)} plus 1 x Class B ^{b)}
a) This valve may be the valve controlling the main gas supply. b) This valve is not required if: 1) the start gas rate is 10 % or below of the main gas rate; and 2) the appliance is not designed for burning third family gases; and 3) the appliance is not capable of being installed such that the combustion air inlet is higher than the exit from the combustion chamber; and 4) the pre-purge gives at least five volume changes.		

NOTE 2 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.

5.2.8.3 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.

5.2.9 Burner control systems

5.2.9.1 Application

Type B₁₄ and B₄₄ appliances may have a non-automatic burner control system in which the start-gas flame is ignited manually. Alternatively, Type B₁₄ and B₄₄ appliances may have an automatic burner control system.

All other appliances shall have an automatic burner control system.

5.2.9.2 Automatic burner control systems

5.2.9.2.1 General

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

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.

5.2.9.2.2 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 7.2.1, the rapid (on and off) operation of any start switch shall not set up a hazardous condition.

5.2.10 Gas strainers

A strainer shall be fitted at the inlet of any system incorporating automatic shut-off valve(s) of Class A, B or C 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 Tables 2 and 3.

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

5.2.11 Air/gas ratio controls

Air/gas ratio controls shall be designed and constructed so that reasonably foreseeable damage does not give rise to a change capable of affecting safety, and shall comply with the requirements of EN 12067-1.

NOTE A standard for electronic air/gas ratio controls is under preparation in CEN/TC 58.

Control tubes may be of metal with suitable mechanical connections or other materials with at least equivalent properties and in this case are considered immune to breakage, accidental disconnection and leakage after initial soundness checks according to 6.1.1.1 and 7.3.1.1. As such they are not subject to the tests in 7.3.2.7.

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

5.3 Ignition devices

5.3.1 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.

5.3.2 Ignition device for the main burner

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

5.3.3 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 5.2.10).

5.4 Transportation of combustion air and/or flue gases

5.4.1 Type B₁₄ and B₄₄ appliances

5.4.1.1 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 6.1.4.1.4.2, 6.1.4.2.2.2, 6.1.5.1, 7.3.5.3.5 and 6.1.5.2.2).

5.4.1.2 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 will be proved. Failure to prove adequate flow of flue gases shall either cause a 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/m (see Table 2).

5.4.1.3 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.

5.4.2 All appliances except Type B₁₄ and B₄₄

5.4.2.1 Combustion air

5.4.2.1.1 Appliances having fully pre-mixed gas/air burners under the control of a zero governor system

The appliance shall be fitted with suitable means of ensuring that there is an adequate flow of combustion air during the pre-purge, ignition and operation of the burner.

This means shall ensure that ignition and operation of the burner is only possible when there is an adequate supply of combustion air (see 6.1.5.1 e) and 6.1.5.2).

Incorrect air flow during the pre-purge period shall either prevent start-up or cause safety shut-down or cause lock-out.

NOTE A device monitoring the rotational speed of the fan or its motor may be used for this purpose.

5.4.2.1.2 Appliances other than those having fully pre-mixed gas/air burners under the control of a zero governor system

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 6.1.4.1.4, 6.1.4.2.2, 6.1.5.1 e) and 6.1.5.2). 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.

5.4.2.2 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.

However, for burners fitted with air/gas ratio controls the purge air shall be proved either:

- a) at the rate corresponding to the minimum heat input providing that the pre-purge period is extended pro rata as described above; or
- b) at the full air rate corresponding to the nominal heat input providing that this air rate is proved by some means (e.g. damper position interlock or a differential air pressure switch).

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 6.1.8 and Tables 3 and 4).

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

- c) the burner shall go to safety shut-down; or
- d) 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.

5.5 Flame supervision system

5.5.1 Type B₁₄ and B₄₄ appliances

5.5.1.1 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 7.2.2.

Upon flame failure, the control system shall cause non-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 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 7.2.3.

Flame supervision devices shall be designed such that:

- a) failure of the sensor causes a safe shut down of the burner (e.g. thermoelectric type); or
- b) 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, the control system shall incorporate a restart interlock. For the purposes of this requirement, a piezo-electric ignition is not regarded as electric ignition.

5.5.1.2 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.

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 7.2.3.

5.5.2 All appliances except Type B₁₄ and B₄₄

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 s 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 re-ignition attempt by spark restoration, or permit automatic recycling.

Where re-ignition by spark restoration is used, the immediate re-ignition attempt shall commence within 1 s. If the re-ignition 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.

Table 5 — Flame supervision device de-energization times

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

5.6 Start-gas flame establishment

5.6.1 Type B₁₄ and B₄₄ appliances

5.6.1.1 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.

5.6.1.2 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:

- 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:

- 1) a means shall be provided to prove closure of the downstream main shut-off valve prior to ignition²⁾; or
 - 2) the requirement of 5.1.4.1.2 shall be met.
- b) 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:

- c) 30 s in case of start-gas burners having a heat input not exceeding 0,6 kW;
- d) 15 s in case of start-gas burners having a heat input greater than 0,6 kW and not exceeding 1,5 kW;
- e) 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 7.2.4.

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:

- f) 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;
- g) 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.

5.6.2 All appliances except Type B₁₄ and B₄₄

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) a means shall be provided to prove closure of the downstream main shut-off valve prior to ignition³⁾; or

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

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

- b) the requirement of 6.1.4.1.2 shall be met.

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:

- c) the start-gas flame ignition period, the duration of which shall not be more than:
- 1) 30 s in case of start-gas burners having a heat input not exceeding 0,6 kW; or
 - 2) 15 s in case of start-gas burners having a heat input greater than 0,6 kW and not exceeding 1,5 kW; or
 - 3) 5 s (and preferably not less than 2 s) for appliances where the start-gas rate exceeds 1,5 kW;
- d) 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 source 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 source 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 four 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 7.3.4.1.1.2.

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. 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.

5.7 Main flame establishment

5.7.1 Type B₁₄ and B₄₄ appliances

5.7.1.1 Establishment by means of a start-gas flame

5.7.1.1.1 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.

5.7.1.1.2 Automatic burner systems

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.

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

5.7.1.2 Direct establishment of the main flame

Direct ignition of the main flame (e.g. by spark ignition or a hot surface igniter) is permitted for appliances having a nominal heat input not exceeding 120 kW.

The ignition source shall not be energized before a safe-start check (see 5.5.1.2) has been made of the flame supervision system and shall be de-energized at, or before, the end of the 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.

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

This safety time shall not exceed 5 s and shall be verified under the test conditions of 7.2.4.

5.7.2 All appliances except Type B₁₄ and B₄₄

5.7.2.1 Establishment by means of a start-gas flame

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 established.

The main flame shall ignite reliably and smoothly from the start-gas flame.

For appliances with heat inputs of 135 kW and above, where a separate ignition burner flame remains in use during the main burner operation, separate flame detectors shall be fitted to monitor the ignition and main burner flames. The main flame detector shall be so positioned that it cannot in any circumstances detect the ignition burner flame. In addition, the safe-start check required by 5.5 shall continue to be carried out on the main flame detector during the start-gas ignition and proving periods.

If the start-gas flame is at a separate ignition burner, the flame detector shall, under the conditions of operation, detect the start-gas flame only at gas flow rates at which it will light the main flame reliably and smoothly (see 7.3.4.1.2). The need to protect against flame diminution, detector drift or maladjustment, gas pressure reduction and dimensional instability shall be taken into account.

5.7.2.2 Direct establishment of the main flame

Direct ignition of the main flame is permitted for appliances having a nominal heat input not exceeding 120 kW.

The ignition source shall not be energized before completion of the pre-purge period and shall be de-energized at, or before, the end of the 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.

If the flame has not been detected before the end of the safety time, this shall result in:

- a) a non-volatile lock-out; or
- b) a safety shut-down followed by automatic recycling. If this ignition attempt is not successful, lock-out shall result.

This safety time shall not exceed 5 s and shall be verified under the test conditions of 7.2.4.

5.8 Main burner

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

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

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

5.9 Facility for remote control

Where the appliance is capable of being controlled remotely by means of thermostats or a time control, electrical connections of these controls shall be possible without disturbing any internal connections in the appliance other than a link exclusively designed for this purpose. When the heater is installed in accordance with the manufacturer's instructions, no hazardous condition shall occur as a result of failure of the normal means of air temperature control.

5.10 Thermostats and air temperature control

5.10.1 General requirements

Integral mechanical thermostats shall comply with the requirements of EN 257.

Electrical thermostats shall comply with the requirements of EN 60730-2-9.

Overheat cut-off devices shall comply with Type 2K requirements of EN 60730-2-9:2002.

5.10.2 Overheat cut-off device

An overheat cut-off device shall be fitted to the appliance to cause shut-down and non-volatile lock-out in the event of an overheat condition occurring.

5.10.3 Overheat control device

An overheat control device may be fitted to cause shut-down of the main burner in the event of an overheat condition occurring (e.g. reduced air flow).

5.10.4 Overheat cut-off/control devices

The operating temperature of the overheat device shall be set and sealed by the manufacturer.

Where flame detection is achieved other than by means of a direct-acting thermo-electric heat sensitive type device, the non-volatile lock-out action shall not rely on the operation of the flame detection circuits. In particular, the device shall not be wired in series with either the flame sensor or the line supply from a programming unit to any automatic shut-off valve.

Such devices shall not operate during the normal operation of the appliance.

5.10.5 Fan delay controls

5.10.5.1 Delayed start

Where means are provided to delay the operation of the air delivery fan after ignition of the burner to prevent the discharge of cold air into the heated space, the fan start delay shall not be such as to cause the overheat device(s) to operate under normal conditions.

5.10.5.2 Delayed shut-down

Means shall be provided to delay the shut-down of the air delivery fan after shut-down of the burner(s).

5.10.6 Sensors

Control thermostats and overheat cut-off devices may have the same sensor if such controls are mechanical in operation and failure of the sensor results in non-volatile lock-out of the appliance.

With an electronic system, thermostats and overheat cut-off devices shall not have the same sensor unless it is break-safe.

5.11 Gas pressure test points

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

The test points shall have an external diameter of $\left(9 \frac{0}{-0,5}\right)$ mm and a useful length of at least 10 mm to enable a tube to be fitted. At the point of its minimum cross-section, the diameter of the test point bore shall not exceed 1,0 mm.

5.12 Combustion chamber pressure relief

Where a pressure relief device is fitted and it is on the same side of the appliance as any user-operated controls, means shall be provided to prevent hazard to personnel in the event of its operation. Any shields or deflectors shall not interfere with the operation of the relief, and the installation instructions shall draw attention to the location and free area required to provide safe operation. Any such pressure relief shall be capable of withstanding the temperature of the enclosed combustion products.

5.13 Facilities for commissioning and testing

To facilitate commissioning, permanent means shall be provided to prevent gas flowing at rates other than the start-gas flow rate. Compliance with this requirement may be achieved by adopting one of the approaches given in Annex E.

5.14 Additional requirements for appliances designed for outdoor installation

5.14.1 General

Appliances designed for outdoor installation shall be so constructed that they are fully protected against the rigours of the environmental conditions under which they are expected to operate.

5.14.2 Air inlets

Air inlets shall be provided such that their lowest edge is at least 500 mm above the base of the appliance, or will reach 500 mm above floor level when installed in accordance with the manufacturer's instructions.

5.14.3 Access panels and doors

Access panels and doors and such insulation as needs to be removed during normal servicing shall be so designed that repeated removal and replacement does not damage the insulation or impair the waterproofing of the appliance.

5.14.4 Dimensions of openings

No dimensions of any opening (e.g. electrical wiring points) from the inside of the appliance to the outside air shall permit the entry of a ball of diameter 16 mm applied with a force of 5 N.

5.14.5 Fixing screws

External panels intended to be removed for maintenance and servicing shall be fixed using only hexagon headed screws, except in the case of user access panels, which may be fixed by suitable hinges and door catches.

6 Operational requirements

6.1 Safety of operation

6.1.1 Soundness

6.1.1.1 Soundness of the gas circuit

The gas circuit shall be sound.

External soundness is assured if, under the conditions specified in 7.3.1.1 the air leakage rate does not exceed 100 cm³/h, regardless of the number of valves fitted in series or in parallel on the appliance.

6.1.1.2 Soundness of the combustion circuit and correct evacuation of combustion products

6.1.1.2.1 Type B₁₂, B₁₃, B₄₂ and B₄₃ appliances

When the appliance is tested under the conditions of 7.3.1.2.1 combustion products shall not escape except from the outlet:

- a) of the test flue in the case of Type B₁₂ and B₁₃ appliances; or
- b) of the POCED in the case of Type B₄₂ and B₄₃ appliances.

6.1.1.2.2 Type B₁₄ and B₄₄ appliances

When the appliance is tested under the conditions of 7.3.1.2.2 combustion products shall not escape except from the flue outlet:

- a) of the test flue in the case of Type B₁₄ appliances; or
- b) of the POCED in the case of Type B₄₄ appliances.

6.1.1.2.3 Type B₂₂, B₂₃, B₅₂ and B₅₃ appliances

When the appliance is tested under the conditions of 7.3.1.2.3 combustion products shall not escape except from the outlet:

- a) of the test flue in the case of Type B₂₂ and B₂₃ appliances; or
- b) of the POCED in the case of Type B₅₂ and B₅₃ appliances.

6.1.1.2.4 Type C₁₂, C₁₃, C₃₂ and C₃₃ appliances

When the appliance is tested under the conditions of 7.3.1.2.4 the air leakage rate shall not exceed 0,5 m³/h per kW of heat input, with a maximum of 25 m³/h.

6.1.1.2.5 Type C₆₂ and C₆₃ appliances

When the appliance is tested under the conditions of 7.3.1.2.5 the air leakage rate shall not exceed 0,5 m³/h per kW of heat input, with a maximum of 25 m³/h.

6.1.2 Heat inputs

6.1.2.1 Nominal heat input

When measured under the conditions of 7.3.2.2, the heat input obtained at the normal pressure shall be within ± 5 % of the nominal heat input.

6.1.2.2 Start gas heat input

When measured under the conditions of 7.3.2.3, the start gas heat input obtained at normal pressure shall be within ± 5 % of the start gas heat input declared by the manufacturer.

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

6.1.2.3 Effectiveness of gas rate adjusters

For appliances without a gas regulator but with a gas rate adjuster, the heat input obtained after adjustment of the device:

- a) shall not be less than the nominal heat input, under the conditions of Test 1 of 7.3.2.4;
- b) shall not exceed the nominal heat input, under the conditions of Test 2 of 7.3.2.4.

6.1.2.4 Effectiveness of the gas regulator

For appliances with an adjustable gas regulator, the heat input shall not differ by more than + 7,5 % and - 10 % for first, second and third family gases, from the rate obtained at the adjustment pressure specified in