



BSI Standards Publication

Domestic and non-domestic gas-fired forced convection air heaters for space heating not exceeding a net heat input of 300 kW

National foreword

This British Standard is the UK implementation of EN 17082:2019. It supersedes BS EN 621:2009, BS EN 1319:2009, BS EN 525:2009, BS EN 1196:2011, BS EN 1020:2009 and BS EN 778:2009, which are withdrawn.

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

Domestic and non-domestic gas-fired forced convection air heaters for space heating not exceeding a net heat input of 300 kW

Générateurs d'air chaud à convection forcée utilisant les combustibles gazeux pour le chauffage de locaux à usage domestique et non domestique, de débit calorifique inférieur ou égal à 300 kW, sur pouvoir calorifique inférieur (PCI)

Häusliche und nicht-häusliche gasbefeuerte Warmlufterzeuger mit erzwungener Konvektion zur Raumbeheizung deren Nennwärmebelastung 300 kW nicht übersteigt

This European Standard was approved by CEN on 5 June 2019.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Contents

Page

European foreword	3
1 Scope	4
2 Normative references	4
3 Terms and definitions	6
4 Classification	23
5 Construction and design requirement	24
6 Operational requirements	59
7 Efficiency	142
8 Risk assessment	148
9 Marking and instructions	148
Annex A (informative) National situations	160
Annex B (normative) Equivalence rules	163
Annex C (informative) Identification of gas types in use in various countries	165
Annex D (normative) Mode of air supply and evacuation of combustion products	167
Annex E (informative) NO _x Measurements	171
Annex F (informative) Derivation of Thermal Efficiency Equations	172
Annex G (informative) Facilities for commissioning and testing (see 5.12)	174
Annex H (normative) Requirements in EN 17082 which relate to the design and construction of forced draught burners covered in EN 676:2003+A2:2008	176
Annex I (normative) Tolerances of measurements	178
Annex J (informative) Guidance for limitations of application of direct-fired air heaters in buildings	181
Annex K (normative) Flue test probes	186
Annex ZA (informative) Relationship between this European Standard and the ecodesign requirements of Commission Regulation (EU) No 2016/2281 aimed to be covered	192
Bibliography	193

European foreword

This document (EN 17082:2019) has been prepared by Technical Committee CEN/TC 180 “Decentralized gas heating”, 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 April 2020, and conflicting national standards shall be withdrawn at the latest by April 2020.

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

This document supersedes EN 525:2009, EN 621:2009, EN 778:2009, EN 1196:2011, EN 1020:2009 and EN 1319:2009.

This document covers the safety and energy efficiency requirements of domestic and non-domestic warm air heaters previously covered by EN 525:2009, EN 621:2009, EN 778:2009, EN 1196:2011, EN 1020:2009 and EN 1319:2009. Additional technical requirements have been made compared to the superseded documents to take account the following:

- Specific requirements on risk analysis due to differences in the Essential Requirements for the Gas Appliance Regulation compared to those of the Gas Appliance Directive;
- Additional requirements on appliance efficiency, including the need to calculate the seasonal efficiency related to the requirements of the Eco-Design Regulation.

Changes have also been made to the document structure to improve its ease of use, for example requirements and associated test methods have been moved into the same clause.

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

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

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

1 Scope

This document specifies the requirements and test methods for the safety and efficiency of gas fired air heaters with or without a fan to assist the transportation of combustion air and/or flue gases, hereafter referred to as "appliances".

This document also applies to warm air heaters having forced draught burners.

This document applies to Type A₂, A₃ appliances, with an input not exceeding 300 kW (net CV basis), intended for non-domestic use.

This document also applies to Type B₁₁, B_{11AS}, B_{11BS}, B₁₂, B_{12AS}, B_{12BS}, B₁₃, B_{13AS}, B_{13BS}, B₁₄, B_{14AS}, B_{14BS}, B₂₂, B₂₃, B₄₁, B_{41AS}, B_{41BS}, B₄₂, B_{42AS}, B_{42BS}, B₄₃, B_{43AS}, B_{43BS}, B₄₄, B_{44AS}, B_{44BS}, B₅₂, B₅₃, C₁₁, C₁₂, C₁₃, C₂₁, C₃₁, C₃₂, C₃₃, C₄₁, C₆₂ and C₆₃ appliances with an input not exceeding 300 kW (net CV basis), intended for domestic and non-domestic use.

Provision of the heated air may be by means of ducting.

This document does not apply to:

- a) dual purpose air conditioning appliances (heating and cooling);
- b) appliances where the air is heated by an intermediate fluid;
- c) portable or transportable forced convection appliances;
- d) appliances fitted with manual or automatic means of adjusting the combustion products evacuation by means of flue dampers;
- e) appliances having multiple heating units with a single draught diverter;
- f) appliances fitted with more than one flue outlet;
- g) appliances fitted with gas boosters;
- h) C₂₁ and C₄₁ appliances for 3rd family gases.

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

This document is not intended to cover appliances projected for connection to gas grids where the quality of the distributed gas is likely to vary to a large extent over the lifetime of the appliance.

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

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 88-1:2011+A1 2016, *Pressure regulators and associated safety devices for gas appliances — Part 1: Pressure regulators for inlet pressures up to and including 50 kPa*

EN 125:2010+A1 2015, *Flame supervision devices for gas burning appliances — Thermoelectric flame supervision devices*

- EN 126:2012, *Multifunctional controls for gas burning appliances*
- EN 161:2011+A3:2013, *Automatic shut-off valves for gas burners and gas appliances*
- EN 257:2010, *Mechanical thermostats for gas-burning appliances*
- EN 298:2012, *Automatic burner control systems for burners and appliances burning gaseous or liquid fuels*
- EN 437:2003+A1:2009, *Test gases — Test pressures — Appliance categories*
- EN 676:2003+A2:2008, *Automatic forced draught burners for gaseous fuels*
- EN 682:2002, *Elastomeric seals — Materials requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids*
- EN 1859:2009+A1:2013, *Chimneys— Metal chimneys — Test methods*
- EN 10226-2:2005, *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 12067-2:2004, *Gas/air ratio controls for gas burners and gas burning appliances — Part 2: Electronic types*
- EN 50090 (all parts), *Home and Building Electronic Systems (HBES)*
- EN 60335-1:2012, *Household and similar electrical appliances — Safety — Part 1: General requirements (IEC 60335-1:2010, modified)*
- EN 60335-2-102:2016, *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 60584-1:2013, *Thermocouples — Part 1: EMF specifications and tolerances (IEC 60584-1:2013)*
- EN 60730-1:2016, *Automatic electrical controls — Part 1: General requirements (IEC 60730-1:2013, modified)*
- EN 60730-2-9:2010, *Automatic electrical controls for household and similar use — Part 2-9: Particular requirements for temperature sensing controls (IEC 60730-2-9:2008, modified)*
- EN 61058-1:2002, *Switches for appliances — Part 1: General requirements (IEC 61058-1:2000, modified)*
- EN 61558-2-6:2009, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V — Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers (IEC 61558-2-6:2009)*
- EN 61558-2-16:2009, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V — Part 2-16: Particular requirements and tests for switch mode power supply units and transformers for switch mode power supply units (IEC 61558-2-16:2009)*
- EN ISO 228-1:2003, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation (ISO 228-1:2000)*
- EN ISO 1182:2010, *Reaction to fire tests for products — Non-combustibility test (ISO 1182:2010)*
- EN ISO 3166-1:2014, *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes (ISO 3166-1:2013)*

EN ISO 5167-1:2003, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full — Part 1: General principles and requirements (ISO 5167-1:2003)*

EN ISO 5167-2:2003, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full — Part 2: Orifice plates (ISO 5167-2:2003)*

ISO 3966:2008, *Measurement of fluid flow in closed conduits – Velocity area method using Pitot static tubes*

ISO 7005-1:2011, *Pipe flanges — Part 1: Steel flanges for industrial and general service piping systems*

ISO 7005-2:1988, *Metallic flanges — Part 2: Cast iron flanges*

ISO 7005-3:1988, *Metallic flanges — Part 3: Copper alloy and composite flanges*

3 Terms and definitions

3.1 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1.1 Appliance and its constituent components

3.1.1.1

air heater

appliance designed for the heating by means of warm air and possibly ventilation of a building

3.1.1.2

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

3.1.1.3

direct fired forced convection air heater

forced convection air heater in which the products of combustion mix with the heated air being supplied to the space

3.1.1.4

high temperature direct fired forced convection air heater

direct fired forced convection air heater designed to operate with an air temperature rise through the appliance greater than 60 K

3.1.1.5

low temperature direct fired forced convection air heater

direct fired forced convection air heater designed to operate with a maximum air temperature rise through the appliance of 60 K or less

3.1.1.6**appliance with facility for downstream re circulation of air**

appliance in which a proportion of the heated air can be returned to the appliance at a point downstream of the burner and re distributed

3.1.1.7**appliance with facility for upstream re circulation of air**

appliance in which a proportion of the heated air can be returned to the appliance at a point upstream of the burner and re distributed

3.1.1.8**profile plates**

fixed or adjustable plates fitted for the purpose of setting the air flow velocity across the burner

3.1.1.9**gas inlet connection**

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

3.1.1.10**mechanical joint**

mechanical 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.

3.1.1.11**gas circuit**

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

3.1.1.12**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

3.1.1.13**gas rate adjuster**

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

Note 1 to entry: Adjustment may be progressive (screw adjuster) or in discrete steps (by changing restrictors).

Note 2 to entry: The adjusting screw of an adjustable regulator is regarded as a gas rate adjuster.

Note 3 to entry: The action of adjusting this device is called "adjusting the gas rate".

Note 4 to entry: A factory sealed gas rate adjuster is considered to be non-existent.

3.1.1.14

setting an adjuster

immobilizing of an adjuster ¹after the gas rate has been adjusted

Note 1 to entry: By means such as a screw

3.1.1.15

sealing an adjuster

arrangement² made to make evident any attempt to change its adjustment putting an adjuster or a control out of service

Note 1 to entry: Breakage of a device or of a sealing material.

3.1.1.16

injector

component that admits the gas into a burner

3.1.1.17

main burner

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

3.1.1.18

forced draught burner

burner in which the combustion air is introduced by means of a fan

3.1.1.19

ignition device

any 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 1 to entry: This device can operate intermittently or permanently.

3.1.1.20

ignition burner

burner whose flame is intended to ignite another burner

3.1.1.21

permanent ignition burner

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

3.1.1.22

intermittent ignition burner

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

¹ by means such as a screw.

² breakage of a device or of a sealing material.

3.1.1.23**alternating ignition burner**

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

3.1.1.24**interrupted ignition burner**

ignition burner that operates only during the ignition sequence

3.1.1.25**aeration adjuster**

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

Note 1 to entry: The action of adjusting this device is called "adjusting the aeration".

3.1.1.26**combustion circuit**

circuit from the air inlet to the combustion products outlet of the appliance

Note 1 to entry: This will include the combustion chamber and heat exchanger and depending on the type includes the air supply duct, the combustion products evacuation duct, the fitting piece, the connection to the terminal, the inlet terminal, the outlet terminal.

3.1.1.27**air supply duct**

means of transporting combustion air to the burner

3.1.1.28**combustion chamber**

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

3.1.1.29**flue outlet**

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

3.1.1.30**draught diverter**

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

3.1.1.31**flue damper**

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

3.1.1.32**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

3.1.1.33**C₆ flue terminal**

terminal which is specially approved for Type C₆ appliances

3.1.1.34

terminal guard

device that protects the terminal from mechanical damage from outside influences

3.1.1.35

flue adaptor box

means of adapting the appliance for connection to different duct systems

EXAMPLE From concentric to separate ducts.

3.1.1.36

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 manufacturer's instructions

3.1.1.37

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

3.1.1.38

gas/air ratio control

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

3.1.2 Adjustment, control and safety devices

3.1.2.1

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 in the installation instructions, to suit the actual heat requirements of the installation

Note 1 to entry: This adjustment may be progressive (e.g. by use of a screw adjuster) or in discrete steps (e.g. by changing restrictors).

3.1.2.2

automatic burner control system

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

Note 1 to entry: The various functions of an automatic burner control system may be in one or more housings.

[SOURCE EN 298:2012]

3.1.2.3

programming unit

device which executes the program reacting 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 1 to entry: The programming unit follows a predetermined sequence of actions and always operates in conjunction with a flame detector device.

[SOURCE EN 298:2012, Modified]

3.1.2.4

flame detector device

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

Note 1 to entry: 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.

[SOURCE EN 298:2012]

3.1.2.5

flame signal

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

[SOURCE EN 298:2012, modified]

3.1.2.6

pressure regulator

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

3.1.2.7

adjustable pressure regulator

regulator provided with means for changing the outlet pressure setting

3.1.2.8

volume regulator

device which maintains the gas rate constant within a given tolerance, independent of the upstream pressure

3.1.2.9

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

3.1.2.10

automatic shut-off valve

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

3.1.2.11

control thermostat / room temperature control thermostat

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

3.1.2.12

overheat cut-off device

device that causes safety shutdown and non-volatile lockout at a pre-set value before the appliance is damaged and/or before safety is put in question

3.1.2.13

overheat limit device

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

Note 1 to entry: The overheat limit device can be of the automatic or the manual reset type.

3.1.2.14

fan control / fan delay control

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

3.1.2.15

temperature sensing element / temperature sensor

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

3.1.2.16

combustion products discharge safety system

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

3.1.2.17

atmosphere sensing device

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

3.1.2.18

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

3.1.2.19

high/low control

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

3.1.2.20

vent valve

normally open automatic valve fitted between two automatic shut off valves and intended to vent any small leakages of gas

3.1.2.21

air flow proving device

device which monitors and proves the existence of an adequate flow of air for combustion and, where appropriate, for dilution

3.1.2.22

closed position indicator switch

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

3.1.2.23**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

3.1.2.24**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)

3.1.3 Operation of the appliance**3.1.3.1****volume flow rate**

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

Note 1 to entry 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).

[SOURCE EN 437:2003+A1:2009]

3.1.3.2**mass flow rate**

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

Note 1 to entry: The mass flow rate is expressed in kilograms per hour (kg/h) or grams per hour (g/h).

[SOURCE EN 437:2003+A1:2009]

3.1.3.3**heat input**

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 1 to entry: The heat input is expressed in kilowatts (kW).

[SOURCE EN 437:2003+A1:2009]

3.1.3.4**nominal heat input**

value of the heat input declared by in the installation instructions

Note 1 to entry: The nominal heat input is expressed in kilowatts (kW).

[SOURCE EN 437:2003+A1:2009, modified]

3.1.3.5**flame stability**

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

3.1.3.6

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

3.1.3.7

light-back

entry of a flame into the body of the burner

3.1.3.8

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

3.1.3.9

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

3.1.3.10

yellow tipping

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

3.1.3.11

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 1 to entry: Where there is no second safety time, this is called the safety time.

3.1.3.12

second safety time

where there is a first safety time to either an 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

3.1.3.13

waiting time

time between safety shut down any (re)start attempt

3.1.3.14

start gas

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

3.1.3.15

start gas rate

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

3.1.3.16**start gas flame**

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

3.1.3.17**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

3.1.3.18**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

[SOURCE EN 298:2012]

3.1.3.19**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 1 to entry: The resulting state of the system is defined by deactivated terminals for the gas shut-off valves and the ignition device.

[SOURCE EN 298:2012, Modified]

3.1.3.20**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

[SOURCE EN 298:2012]

3.1.3.21**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

[SOURCE EN 298:2012, modified]

3.1.3.22**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 1 to entry: 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.

[SOURCE EN 298:2012, modified]

3.1.3.23

automatic recycling

process by which, after a safety shut-down, loss of flame during the running condition or accidental interruption of the operation of the appliance, the gas supply is interrupted and a full start-up sequence is automatically repeated

Note 1 to entry: This process ends with the restoration of the running condition or, if there is no flame signal at the end of the safety time, or if the cause of the accidental interruption has not disappeared, with volatile or non-volatile lock-out.

3.1.3.24

ignition opening time

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

3.1.3.25

extinction safety time

time which elapses between the extinction of the supervised flame and when the burner control system initiates shut-down to the main burner and/or to the ignition burner

3.1.3.26

ignition interlock

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

3.1.3.27

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

3.1.3.28

no air condition

condition of the air proving device in which the device is checked for correct operation at zero air flow

3.1.3.29

proved air flow

minimum air flow at which the air proving device indicates the presence of air flow

3.1.3.30

safe-start check

check provided by a protective circuit on start-up leading to safety shut down or non-volatile lockout if a fault condition is present

3.1.3.31

purge

mechanical introduction of air into the combustion circuit in order to displace any fuel/air mixture which could remain there

Note 1 to entry: A distinction is made between:

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

3.1.4 Gases

3.1.4.1

test gas

gas intended for the verification of the operational characteristics of appliances using combustible gases

Note 1 to entry: Test gases comprise the reference and the limit gases.

[SOURCE EN 437:2003+A1:2009, modified]

3.1.4.2

reference gas

test gas with which appliances operate under nominal conditions when they are supplied at the corresponding normal pressure

[SOURCE EN 437:2003+A1:2009]

3.1.4.3

limit gas

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

[SOURCE EN 437:2003+A1:2009]

3.1.4.4

gas pressure

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

Note 1 to entry: Test pressures are expressed in millibars (mbar) or bars (bar).

3.1.4.5

test pressure

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

Note 1 to entry: Test pressures consist of normal and limit pressures.

Note 2 to entry: Test pressures are expressed in millibars (mbar). 1 mbar = 102 Pa. [EN 437:2003+A1:2009]

3.1.4.6

normal pressure

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

[SOURCE EN 437:2003+A1:2009]

3.1.4.7

limit pressure

pressure representative of the extreme variations in the appliance supply conditions

Note 1 to entry: Limit pressures consist of the maximum limit pressure $p_{\max}$ and the minimum limit pressure $p_{\min}$.

[SOURCE EN 437:2003+A1:2009, modified]

3.1.4.8

pressure couple

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

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

[SOURCE EN 437:2003+A1:2009]

3.1.4.9

relative density

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

3.1.4.10

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 to entry: A distinction is made between:

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

Note 2 to entry: The calorific value is expressed either in megajoules per cubic metre of dry gas at the reference conditions (MJ/m³) or in megajoules per kilogram of dry gas (MJ/kg).

[SOURCE EN 437:2003+A1:2009]

3.1.4.11

Wobbe index

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 to entry: 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 to entry: The Wobbe index is expressed either in megajoules per cubic metre of dry gas at the reference conditions (MJ/m³) or in megajoules per kilogram of dry gas (MJ/kg).

[SOURCE EN 437:2003+A1:2009, modified]

3.1.5 Conditions of operation and measurement

3.1.5.1

reference conditions

conditions that are

for calorific values, temperature: 15 °C, pressure 1 013,25 mbar;

for gas and air volumes dry, brought to 15 °C and to an absolute pressure of 1 013,25 mbar

3.1.5.2

cold condition

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

3.1.5.3

hot condition

condition of the installation required for some tests and obtained by heating to thermal equilibrium at nominal heat input specified in the installation instructions, any thermostat remaining fully open

3.1.5.4

thermal equilibrium

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

3.1.5.5

maximum allowable pressure drop

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

3.1.5.6

equivalent length

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

Note 1 to entry: The equivalent length is expressed in metres (m).

3.1.5.7

equivalent resistance

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

3.1.6 Condensing appliances

3.1.6.1

condensing air heater

air heater in which, under normal operating conditions, the water vapour in the combustion products is totally or partially condensed in order to make use of the latent heat in this water vapour for heating purposes

3.1.6.2

condensate

liquid formed from the combustion products during the condensation process

3.1.6.3

condensate collecting device

part of the appliance designed to collect the condensate in order that it can be drained

3.2 Symbols

The symbols shown in Table 1 are used in this standard.

Table 1 — Main symbols and abbreviations

Symbol	Dimension	Explanation
A_e	V/V	excess air
A_s	V/V	stoichiometric air requirement for fuel
AF_{min}	m ³ /h	air flow at minimum load
AF_{nom}	m ³ /h	air flow at nominal load
C_1	MJ/(m ³ .K)	mean specific heat of dry products of combustion
C_L	X10 ⁻⁶ or %	limiting concentration of oxides of carbon or nitrogen
C_m	X10 ⁻⁶ or %	measured concentration of oxides of carbon or nitrogen
d_h		relative density of wet gas relative to dry air
d_r		relative density of reference gas to dry air
D	mm	nominal diameter of appliance outlet
el	kW	electrical power consumption
el_{max}	kW	electrical power consumption at nominal heat input
el_{min}	kW	electrical power consumption minimum heat input
el_{sb}	kW	electrical power consumption in standby mode
E_Q	X10 ⁻⁶ or %	concentrations of oxides of carbon and nitrogen
E_{Qmin}	X10 ⁻⁶ or %	emission value at minimum heat input
E_{Qn}	X10 ⁻⁶ or %	emission value at nominal heat input
E_{Qw}	X10 ⁻⁶ or %	weighted emission value
F_{env}	%	envelope loss factor
h_m	g/kg	humidity during the measurement of NOx

Symbol	Dimension	Explanation
H_i	MJ/m ³ (or MJ/kg)	Net calorific value of gas
H_s	MJ/m ³ (or MJ/kg)	Gross calorific value of gas
K	V/V	ratio total volume wet products to total volume gas and air supplied
m_{cond}	kg/m ³	quantity of condensate produced
M_{meas}	kg/h	mass flow rate obtained under test conditions
M_o	kg/h (or g/h)	mass flow rate of gas under reference conditions
NOx_o	mg/kWh	NOx corrected to reference conditions
NOx_m	mg/kWh	NOx measured at h_M and t_M
NOx_{min}	mg/kWh	measured NOx at minimum heat input
NOx_{nom}	mg/kWh	measured NOx at nominal heat input
NOx_{seas}	mg/kWh	seasonal NOx
p	mbar	burner unit inlet pressure
p_a	mbar	atmospheric pressure
p_g	mbar	gas supply pressure at the gas meter
p_n	mbar	normal pressure
p_{max}	mbar	maximum limit pressure
p_{min}	mbar	minimum limit pressure
p'_{max}	mbar	corrected maximum test pressure
p'_{min}	mbar	corrected minimum test pressure
p_w	mbar	saturation vapour pressure of test gas
P	kW	power
P_{ign}	kW	permanent pilot flame power consumption
P_{min}	kW	power consumption at minimum load
P_{nom}	kW	power consumption at nominal load
q_1	%	heat of dry products of combustion (% heat released/m ³ gas)
q_2	%	heat of water vapour contained in products of combustion (% heat released/m ³ gas)
Q	kW	heat
$Q_{in,nom}$	kW	nominal heat inputs
$Q_{in,min}$	kW	minimum heat input
Q_o	kW	corrected heat input

Symbol	Dimension	Explanation
rh	%	relative humidity
R_1	Ω	fan motor winding resistance at start of test
S_A	MJ/m ³ gas	heat of condensation recovered from condensate
S_B	MJ/m ³ gas	sensible heat of water vapour condensed
S_C	MJ/m ³ gas	sensible heat loss of condensate liquid
t_a	°C	ambient temperature
$t_{a,comb}$	°C	temperature of combustion air
t_1	°C	average temperature of combustion air
t_2	°C	average flue gas temperature
$t_{comp, max}$	°C	maximum component temperature
$t_{comp, meas}$	°C	measured component temperature
t_{flue}	°C	flue gas temperature
t_g	°C	gas temperature
t_m	°C	maximum component temperature measured in test
t_s	°C	maximum component temperature specified by component manufacturer
T_p	s	pre-purge time
T_r	s	response time of combustion products safety device
V_{15oC}	m ³ /h	equivalent air flow at 15° C
V_{corr}	m ³ /s	corrected volumetric flow rate
V	m ³ /s	measured volumetric gas rate expressed under conditions at the meter
V_{act}	m ³ /hr	actual delivered air flow
V_c	m ³	volume of air available for combustion
V_a	m ³ /s	maximum volume flow fresh air through appliance at maximum heat input
V_s	m ³ /s	minimum volume flow fresh air through appliance at maximum heat input
V_g	m ³ /h	gas rate
V_f	m ³ /m ³	quantity of dry flue gas
V_{af}	m ³ /m ³	quantity of wet flue gas
$V_{CO, M}$	%	measured CO concentration
$V_{CO, N}$	%	CO concentration (dry, air free)
$V_{CO2, M}$	%	measured CO ₂ concentration
$V_{CO2, N}$	%	CO ₂ concentration (dry, air free)

Symbol	Dimension	Explanation
V_o	m ³ /s (or l/min, dm ³ /min, dm ³ /s)	volumetric flow rate of gas under reference conditions
$V_{O_2, M}$	%	measured oxygen concentration (dry, air free)
$V_{CO_2, m}$	V/V	measured carbon dioxide concentration
$V_{CO_2, p}$	V/V	volume carbon dioxide produced from 1m ³ of reference gas
$V_{H_2O, p}$	V/V	volume water produced from 1m ³ of reference gas
V_f	m ³	Volume of dry products of combustion per unit volume of gas in m ³
V_{meas}	m ³ /s	volumetric flow rate under test conditions
V_{nom}	m ³ /s	gas flow rate at nominal heat input
V_t	m ³ /s	quantity of dry flue gas
W_i	MJ/m ³ (or MJ/kg)	Net Wobbe index
W_s	MJ/m ³ (or MJ/kg)	Gross Wobbe index
η_{Qmin}	%	efficiency at minimum heat input
η_{Qn}	%	efficiency at nominal heat input
η_{ref}	%	reference efficiency
η_{th}	%	thermal efficiency
$\eta_{th, min}$	%	thermal efficiency at minimum heat input
$\eta_{th, nom}$	%	thermal efficiency at nominal heat input
$\eta_{th, GCV}$	%	combustion efficiency GCV
$\eta_{th, NCV}$	%	combustion efficiency NCV
η_s	%	seasonal space heating energy efficiency
$\eta_{s, th}$	%	seasonal thermal efficiency
$\eta_{s, flow}$	%	emission efficiency for a specific air flow
$\eta_{s, on}$	%	seasonal space heating energy efficiency in active mode

4 Classification

4.1 Gases and categories

Appliances are classified into categories in accordance with EN 437:2003+A1:2009.

4.2 Mode of air supply and 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:

Type A appliances, A₁, A₂, A₃

Type B appliances, B₁₁, B_{11AS}, B_{11BS}, B₁₂, B_{12AS}, B_{12BS}, B₁₃, B_{13AS}, B_{13BS}, B₁₄, B_{14AS}, B_{14BS}, B₂₂, B₂₃, B₄₁, B_{41AS}, B_{41BS}, B₄₂, B_{42AS}, B_{42BS}, B₄₃, B_{43AS}, B_{43BS}, B₄₄, B_{44AS}, B_{44BS}, B_{52AS}, B_{52BS}, B_{53AS}, B_{53BS}

Type C appliances, C₁₁, C₁₂, C₁₃, C₂₁, C₃₁, C₃₂, C₃₃, C₄₁, C₆₂, C₆₃

Further details are given in Annex D.

5 Construction and design requirement

5.1 General

5.1.1 Conversion to different gases

5.1.1.1 General

When an appliance is installed, the following operations are allowed in order to convert 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.

These operations shall be possible without having to interfere with the connections of the appliance to its pipework (gas and duct system).

For each of the operations mentioned the appliance shall be tested with each of the gases.

Any appliance belonging to one category may be categorized as an appliance belonging to another category if the requirements of Annex B are met.

5.1.1.2 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 the appliance relative to a change of gas. For a change of pressure, replacement of injectors and adjustment of gas rates.

5.1.1.3 Category II

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

- a) Adjustment of the gas rate with, if necessary, a change of injector(s), restrictor(s) or regulator.
- b) Adjustment of the gas rate of ignition burner(s), either by using an adjuster or by a change of injector(s) or restrictor(s) and, if necessary, a change of complete ignition burner(s) or of some of its/their parts.
- c) A change, if necessary, of the automatic shut-off valve(s) to increase the rating.

- d) Putting the regulator out of service under the conditions of 5.2.6.
- e) Putting the gas rate adjuster(s) out of service under the conditions of 5.2.2.1.

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.

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

- a) Adjustment of the gas rate with, if necessary, a change of injector(s), restrictor(s) or regulator.
- b) Adjustment of the gas rate of ignition burner(s), either by using an adjuster or by a change of injector(s) or restrictor(s) and, if necessary, a change of complete ignition burner(s) or of some of its/their parts.
- c) A change, if necessary, of the automatic shut-off valve(s) to increase the rating.
- d) Putting the regulator out of service under the conditions of 5.2.6.
- e) Putting the gas rate adjuster(s) out of service under the conditions of 5.2.2.1

These adjustments or component changes are only acceptable when:

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

5.1.1.4 Category III

Category III appliances admitted in certain countries are given in EN437:2003+A1:2009.

5.1.2 Materials and method of construction

5.1.2.1 General

The quality and thickness of the materials used in the construction of the appliances, and the method of assembling the various parts, shall be such that the constructional and operational characteristics are not significantly altered during a reasonable life and when installed according to the installation instructions and used in accordance with the users instructions. Except where otherwise stated, the constructional requirements are verified by inspection of the appliance and its technical documents. Following the tests outlined in Clause 6, a further inspection of the appliance shall be carried out to ensure no changes have occurred to the appliance that may affect safety.

For appliances which may be installed external to the heated space all the materials used, including seals and gaskets shall function properly in the environmental conditions under which they are expected to operate.

5.1.2.2 Material selection

The quality and thickness of materials used in the construction of the appliance shall be appropriate for their duty and envisaged use. The method of assembling the various parts shall be such that the constructional and performance characteristics do not alter significantly during a reasonable life under the conditions of installation and use detailed in the installation and users instructions.

When the appliance is installed in accordance with the installation instructions, all components, including the heat exchanger and its POCED in the case of Type B₄, B₅, C₁, C₂, C₃ and C₄ appliances, shall withstand the mechanical, chemical and thermal conditions to which they may be subjected when used in accordance with the users instructions.

The design documentation shall provide evidence of evaluation, tests undertaken and/or experience gained to support the claim that the materials used and the construction methods adopted are suitable for the purpose intended.

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

Asbestos or materials containing asbestos shall not be used.

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

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

5.1.2.3 Resistance to fire

Where appropriate, materials used on the appliance shall be non-combustible in accordance with the requirements of EN ISO 1182:2010.

5.1.2.4 Appliances not intended to handle condensate during normal operation

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

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

5.1.2.5 Appliances intended to handle condensate during normal operation

All parts of the heat exchanger(s) and other parts of the appliance likely to come into contact with condensate under normal operating conditions at thermal equilibrium, shall be constructed from sufficiently corrosion resistant material or shall be sufficiently protected against corrosion, in order to ensure a reasonable life for an appliance that is installed, used and serviced in accordance with the installation and user instructions. Connections at points where condensation can occur or condensate can be present, shall not give rise to corrosion.

Copper and copper based alloys shall not be used for condensate carrying components.

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 installation instructions without using special tools unless these are supplied as necessary accessories with the appliance.

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

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

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

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

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

5.1.5.1 Leakage

The gas connection shall be designed such that there will be no inappropriate passage of gas from or the entry of air to the gas circuit.

5.1.5.2 Connections

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

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.

If the appliance has a threaded connection, this thread shall comply with EN ISO 228-1:2003, EN10226-2:2005. In the first case (EN ISO 228-1:2003), 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 7005-1:2011, ISO 7005-2:1988 or ISO 7005-3:1988, as appropriate, and the manufacturer shall provide the counter-flanges and sealing gaskets.

The conditions of connections shall be compatible with those used in individual countries, a summary is given in A.2.

5.1.6 Soundness

5.1.6.1 Soundness of the gas circuit

Appliances shall be designed such that when used normally there will be no inappropriate passage of gas from, or the entry of air to, 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. This does not apply to orifices for measurement purposes.

The soundness of components and assemblies connected to the gas circuit and likely to be dismantled in situ according to the instructions for use and servicing shall be assured by means of mechanical joints e.g. metal to metal joints, toroidal (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. The joints shall meet the requirements of the appropriate standard. If the appliance has a threaded connection, this thread shall comply with EN ISO 228-1:2003, EN10226-2:2005. If flanges are used, they shall comply with ISO 7005-1:2011, ISO 7005-2:1988 or ISO 7005-3:1988, as appropriate, and the manufacturer shall provide the counter-flanges and sealing gaskets. If toroidal seals are used they shall comply with EN 682:2002.

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 Appliance combustion air inlet

5.1.7.1.1 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 in the installation instructions.

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

5.1.7.1.2 Type B₁₁, B₁₄, B₄₄, C₁₁, C₂₁, C₃₁ and C₄₁ appliances

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

5.1.7.1.3 Other appliances of type B and C

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

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

Appliances shall be fitted with a suitable means to prove adequate combustion air during the pre-purge period and burner operation.

5.1.7.2 Appliance flue gas outlet

5.1.7.2.1 General

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

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

If the appliance has a POCED that is capable of being installed in accordance with the appliance instructions such that its outlet, when fitted with any terminal supplied with the appliance, or specified in the appliance 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 1859:2009+A1:2013.

The flue gas outlet connections shall be compatible with those used in individual countries, a summary is set out in A.3 for information.

5.1.7.2.2 Type B₁ appliances

5.1.7.2.2.1 General

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.2).

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 $D/4$ (where D is the internal diameter of the flue outlet) but not so far that the evacuation of the combustion products is impaired.

5.1.7.2.2.2 Type B₁₁, B_{11AS}, B_{11BS}, B₁₂, B_{12AS}, B_{12BS}, B₁₃, B_{13AS}, B_{13BS}, B₁₄, B_{14AS} and B_{14BS} appliances

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

Appliances shall be constructed to prevent release of combustion products in a dangerous quantity into the installation room under abnormal draught condition (see 6.11.1 and 6.11.2). To meet this requirement, type B₁₁, B₁₂, B₁₃ and B₁₄ appliances shall be factory fitted with a suitable device; in this case the appliance is designated as a type B_{11AS}, B_{11BS}, B_{12AS}, B_{12BS}, B_{13AS}, B_{13BS}, B_{14AS} or B_{14BS} appliance, according to the device.

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

However, appliances intended to be installed in a place separated from living rooms (including those not intended for use in single unit residential dwellings) and provided with appropriate ventilation directly to the outside need not carry such a device, but in this case, appropriate warnings on the packaging and in the instructions shall clearly indicate the limit on the use of this type of appliance; in this case the appliance is designated as a type B₁₁, B₁₂, B₁₃ or B₁₄ appliance.

5.1.7.2.2.3 Additional requirements for appliances of Type B₁₄, B_{14AS} and B_{14BS}

The appliance instructions shall state the minimum and maximum pressure drop or equivalent resistance in the flue system. The appliance instructions shall give details for calculating the pressure drop or equivalent resistance (e.g. the allowance to be made for bends).

Where the appliance is intended to be connected to a vertical flue, the installation instructions 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 installation instructions 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.

5.1.7.2.3 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.2).

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 $D/4$ (where D is the internal diameter of the flue outlet) but not so far that the evacuation of the combustion products is impaired. The appliance instructions shall state the minimum and maximum pressure drop or equivalent resistance. The appliance instructions shall give details for calculating the pressure drop or 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.

5.1.7.2.4 Type B₄₁, B_{41AS}, B_{41BS}, B₄₂, B_{42AS}, B_{42BS}, B₄₃, B_{43AS}, B_{43BS}, B₄₄, B_{44AS} and B_{44BS} appliances

The POCED shall either be supplied with the appliance by the manufacturer or specified in the appliance 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 draught diverter shall either be integral with the appliance or be supplied with the appliance by the manufacturer.

The installation instructions shall state the minimum and maximum pressure drop or equivalent resistance. The appliance instructions shall give details for calculating the pressure drop or equivalent resistance (e.g. the allowance to be made for bends).

Appliances shall be constructed to prevent release of combustion products in a dangerous quantity into the installation room under abnormal draught condition (see 6.11.1 and 6.11.2). To meet this requirement, type B₄₁, B₄₂, B₄₃ and B₄₄ appliances shall be factory fitted with a suitable device; in this case the appliance is designated as a type B_{41AS}, B_{41BS}, B_{42AS}, B_{42BS}, B_{43AS}, B_{43BS}, B_{44AS} or B_{44BS} appliance, according to the device.

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

However, appliances intended to be installed in a place separated from living rooms (including non-domestic properties) and provided with appropriate ventilation directly to the outside need not carry such a device, but in this case, appropriate warnings on the packaging and in the instructions shall clearly indicate the limit on the use of this type of appliance; in this case the appliance is designated as a type B₄₁, B₄₂, B₄₃ or B₄₄ appliance.

5.1.7.2.5 Additional requirements for appliances of Type B₄₄, B_{44AS}, B_{44BS}

Where the appliance is intended to be connected to a vertical flue, the installation instructions 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 installation instructions 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.

5.1.7.2.6 Type B₅₂ and B₅₃ appliances

The POCED shall either be supplied with the appliance by the manufacturer or specified in the installation 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 installation instructions shall state the minimum and maximum pressure drop or equivalent resistance in the POCED. The installation instructions shall give details for calculating the pressure drop or equivalent resistance in the POCED, for example 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.

5.1.7.2.7 Type C₁₁, C₁₂, C₁₃, C₃₁, C₃₂ and C₃₃ appliances

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

The installation instructions shall state the minimum and maximum lengths or equivalent resistance 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 of C₁ appliances shall not permit the entry of a ball of 16 mm diameter, and for C₃ appliances 35mm 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.

For appliances not designed as condensing appliances, any condensate formed when operating the appliance from cold shall either be retained and subsequently re-evaporated or discharged clear of the wall.

5.1.7.2.8 Type C₂₁ and C₄₁

The combustion air and combustion products ducts shall be supplied by the manufacturer to the test house or shall be described in the installation instructions. The installation instructions shall state the minimum and maximum lengths or equivalent resistance of ducts which can be used.

The flue outlet shall allow, if necessary by means of an adaptor supplied with the appliance, connection to a common flue duct whose diameter complies with the rules in force where the appliance is to be installed.

5.1.7.2.9 Type C₆₂ and C₆₃ appliances

The installation instructions shall state that the appliance can only be installed with a flue terminal approved for use with type C₆ appliances.

In addition, the installation instructions 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.

5.1.7.2.10 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.

5.1.7.2.11 Terminal guard

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

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 appliance, 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

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.

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

For type A₂ and A₃ appliances, where a ductless appliance is fitted with directional louvers, the louvers shall be supplied by the manufacturer and shall be capable of adjustment between horizontal discharge and discharge at an angle of at least 45° downwards from the horizontal.

5.1.8.3 Position of the combustion chamber and heat exchanger

For type B and C appliances, intended for domestic use, the combustion chamber and heat exchanger shall be positioned on the pressure side of the heated air delivery fan so that the combustion products are at a lower pressure than the surrounding air. Products of combustion shall not be drawn into the air distribution system, even when user access panels are removed.

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 not be used to indicate any other fault.

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, provided that the evacuation of the combustion products (in Type B appliances) is not disturbed and that the soundness of the combustion circuit (in Type C appliances) is not altered.

5.1.10 Electrical equipment

The electrical equipment of the appliance shall comply with the relevant requirements of EN 60335-2-102:2016, EN 60730-1:2016 and EN 61058-1:2002.

If the appliance is fitted with electronic components or electronic systems providing a safety function, these shall comply with the relevant requirements of EN 298:2012.

If the manufacturer specifies on the data plate the nature of the electrical protection of the appliance, this specification shall comply with EN 60529:1991 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.

For type A₂ and A₃ appliances, safety isolating transformers and switch contact elements in switches shall comply with the requirements of EN 61558-2-6:2009 and EN 61558-2-16:2009.

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

5.1.11.1 Operational safety in the event of a normal fluctuation of the auxiliary energy

In the event of a normal fluctuation of auxiliary energy the appliance CO and NO_x emission levels shall remain below acceptable limits. The specific requirements and test methods relating to the continued and safe operation of the appliance in the event of normal fluctuation of auxiliary energy are specified in 6.7.3.1.4, 6.7.3.1.5 and 6.8.2.3.3.

5.1.11.2 Operational safety in the event of an abnormal fluctuation, interruption and restoration of the auxiliary energy

An abnormal fluctuation, 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) volatile or non-volatile lock-out.

Interruption and subsequent restoration of the electrical supply to the appliance shall not override any lock-out condition except where the appliance is intended to be reset by means of switching off and on the electricity supply to the appliance.

Requirements and test methods relating to the continued and safe operation of the appliance in the event of an abnormal fluctuation of auxiliary energy are specified in 6.7.3.1.4 and 6.8.3.2.3.

5.1.12 Motors and fans

The direction of rotation of motors and fans shall be clearly marked.

Access to motors and fans shall not be possible without the use of commonly available tools. Belt drives, where used, shall be so designed or positioned as to afford protection to the operator.

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. The guard shall comply with IP 20 as a minimum as defined in EN 60529:1991. 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.

For type A₂ and A₃ appliances, means shall be provided to prevent large objects from entering the fan, to minimize the risk of blockage and to prevent accidental injury to personnel. This requirement shall be deemed to be met if entry of the standard test fingers specified in EN 60335-1:2012 is prevented.

5.2 Adjusting, control and safety devices

5.2.1 General

The failure of a safety, controlling or regulating device shall not lead to an unsafe situation. The functioning of a safety device shall not be affected by that of a control device.

All the following devices or the multifunctional control in which they may 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 can result in confusion.

When there are several control knobs (e.g. taps and thermostats), they shall not be interchangeable if this can 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.

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

For appliances 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 General

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 for the installer to seal them (e.g. with paint) after adjustment; the sealing shall resist the heat to which it is subjected during normal operation of the appliance. The adjusting screws of the gas rate adjusters and range-rating devices shall be located so that they cannot fall into the gas-ways.

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

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.

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 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. This also applies to 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 5.2.6) when these appliances are supplied with a second family gas.

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

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 Profile plate

For type A₂ and A₃ appliances, where a profile plate is fitted the air proving device(s) required by 5.2.12.1 shall cause safety shut-down if the air flow across the burner, as declared by the manufacturer, is not achieved.

Where an adjustable profile plate is used, it shall be capable of being locked in position to avoid inadvertent movement.

5.2.4 Aeration adjusters

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

For appliances with fan assisted burners, 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 installation instructions, it is capable of being set and sealed.

5.2.5 Manual controls

5.2.5.1 External controls

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 appliance installation instructions.

5.2.5.2 Manual valves

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

Manual valves shall be so designed or positioned as to prevent inadvertent operation but shall be easy to operate when required. They shall be so designed that in operation the "OPEN" and "CLOSED" positions are readily distinguishable.

When an appliance isolating valve is provided as an integral part of the appliance, it shall be capable of operating at a pressure equal to 1,5 times the maximum supply pressure and shall be readily accessible.

Manual valves used solely for OPEN/CLOSED operation shall be provided with positive stops at the "OPEN" and "CLOSED" positions.

5.2.6 Pressure Regulators

Regulators shall comply with the requirements of EN 88-1:2011+A1:2016.

Appliances in categories I_{2H}, I_{2E}, I_{3B/P}, I_{3P}, II_{1a2H}, II_{2H3B/P}, II_{2H3+}, II_{2H3P}, II_{2E3B/P} and II_{2E+3P} shall be fitted with a gas regulator. Appliances in categories I_{2L} and II_{2L3B/P}, may be fitted with a gas regulator. In addition, appliances in categories I_{2E+}, and II_{2E+3+} may be fitted with a gas regulator. However, the 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.

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 pressure corresponding to the appliance category.

5.2.7 Multifunctional controls

Any multifunctional control shall comply with the requirements of EN 126:2012.

In addition multifunctional controls shall comprise as a minimum the appropriate valving requirements of 5.2.9. For permanent ignition burner systems it shall be possible to operate directly manually the upstream automatic shut-off valve in the gas line to both the ignition and main burners.

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

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

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

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

5.2.8 Flame supervision devices

Heat sensitive flame supervision devices shall comply with the requirements of EN 125:2010+A1:2015. Other flame supervision devices shall comply with EN 298:2012.

5.2.9 Automatic shut-off valves

5.2.9.1 General

Automatic shut-off valves shall comply with EN 161:2011+A3:2013.

The minimum valve requirements are given in 5.2.9.2 to 5.2.9.5 Class D valves as specified in these clauses may be replaced by Class C, B or A valves, Class C valves may be replaced by Class B or A valves, and Class B valves may be replaced by Class A valves.

5.2.9.2 Natural draught appliances with a net heat input ≤ 70 kW

5.2.9.2.1 Appliances with separate ignition burner

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

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

System	Main gas valves	Start gas valves
Non-automatic with ignition burner	1 Class C + 1 Class D	1 Class C ^a
Automatic with waiting time ^b	1 Class C + 1 Class D	1 Class C ^{c, d}
Automatic without waiting time	1 Class C + 1 Class C, or 1 Class B + 1 Class D	1 Class C ^{c, d}
^a This valve may be the start-gas component integral with a thermoelectric valve or multifunctional control conforming to the requirements of EN 125:2010+A1 2015 or EN 126:2012, as appropriate. This valve need not be in addition to the Class C valve required for main gas control. ^b The waiting time shall be at least 300 s. ^c This valve may be the Class B or C valve controlling the main gas supply. ^d If the ignition burner rate exceeds 0,6 kW, then an additional Class D valve shall be incorporated in the ignition burner supply.		

5.2.9.2.2 Appliances with direct ignition of the main burner

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

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

System	Gas valves
Type B and C with waiting time ^a	1 Class C + 1 Class D
Type C without waiting time	1 Class C + 1 Class C or 1 Class B + 1 Class D
^a The waiting time shall be at least 300 s.	

5.2.9.2.3 Valve action in case of shut down

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

5.2.9.3 Appliances with fan assisted burners and a net heat input ≤ 70 kW

5.2.9.3.1 All appliances

The gas supply/supplies shall be under the control of automatic shut-off valves connected to the gas line in series as given in Figure 1 and of a capability not less than that specified in Table 4.

Table 4 — Valving requirements

System	Valving		Pre-purge ^a	Pre-purge ^b
	V1	V2		
Permanent or alternating ignition burner	C ^c	D	NO	YES
Intermittent or interrupted ignition burner or direct ignition of main burner	C	D	YES	YES
	C	C	NO	YES
	B	D	NO	YES
^a Normal start of the appliance; i.e. preceded by controlled shut-down. ^b Restart of the appliance; i.e. preceded by safety shut-down, lock-out or maintenance shut-down. ^c A permanent flame supervision system (pilot) is only permitted if it acts via a reliable shut-down device (e.g. a thermo-electric shut-off valve) of the required class (EN 161:2011+A3:2013).				

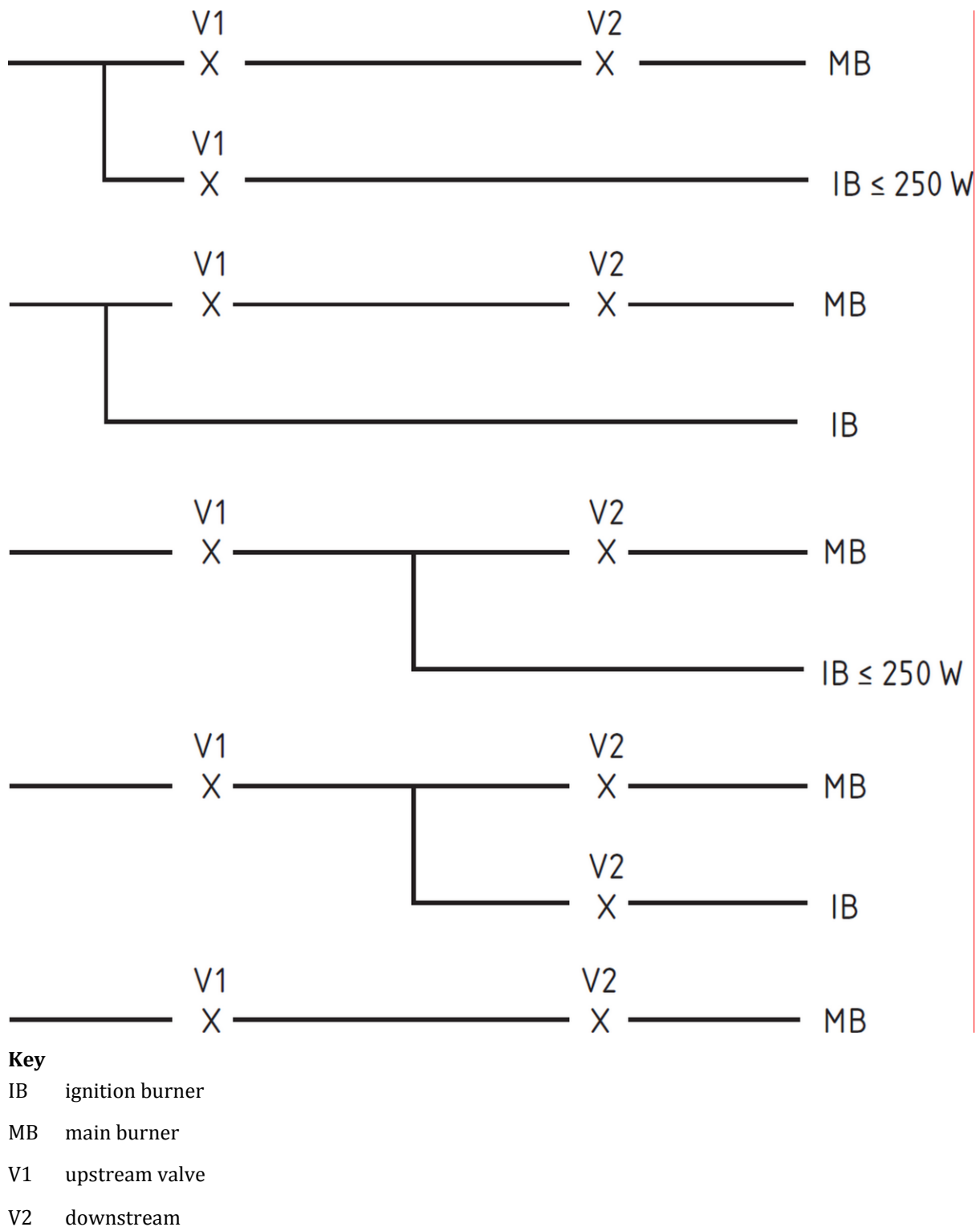


Figure 1 — Examples of typical valve systems

5.2.9.3.2 Shut-down

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

5.2.9.4 Appliances with a net heat input >70kW

5.2.9.4.1 Type B₁₁, B₁₄, B₄₁ and B₄₄ appliances

5.2.9.4.1.1 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 5.

However, for type B₁₁ and B₄₁ appliances with non-automatic systems and heat inputs of 135 kW and below only, the Class C start-gas valve may be replaced by a thermoelectric flame supervision device complying with EN 125:2010+A1:2015 having a sealing force capability at least equivalent to a Class C valve complying with EN 161:2011+A3:2013.

Table 5 — Minimum valve requirements for Type B₁₁, B₁₄, B₄₁ and B₄₄ 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 125:2010+A1:2015 having a sealing force capability at least equivalent to a Class C valve conforming to the requirements of EN 161:2011+A3:2013. 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 5.6.2.1), 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.

5.2.9.4.1.2 Appliances with direct main burner ignition

Such appliances (see 5.6.2.1.2, 5.6.2.2.2, 5.6.3.2) 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. For type B₁₁ and B₄₁ appliances one of the valves shall be Class A or B and the other of Class A, B, C or D.

5.2.9.4.2 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 6). 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 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:

- 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 5.5; or
- b) under the control of at least one Class B automatic shut-off valve (see Table 6). If, however, the conditions specified in Table 6, footnote c), are not met, a second valve shall be fitted as specified in Table 6.

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 5.2.9.4.2 should be read in conjunction with 5.5.

Table 6 — Minimum valve 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.

5.2.9.4.3 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

5.2.9.4.3.1 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 5.2.9.4.2 shall apply.

5.2.9.4.3.2 Other type B and type C appliances

Each main gas supply shall be under the control of two automatic shut-off valves in series (see Table 7). 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 5.5; 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 7). Irrespective of the heat input, if the conditions specified in Table 5, 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.

The above requirements should be read in conjunction with 5.5.

Table 7 — Minimum valve 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: 1.1. the start gas rate is 10 % or below of the main gas rate; and 1.2. the appliance is not designed for burning third family gases; and 1.3. the appliance is not capable of being installed such that the combustion air inlet is higher than the exit from the combustion chamber; and 1.4. 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.

5.2.9.4.4 Action of the flame supervision system and overheat cut-off device to cause shut-down

The flame supervision system and the overheat cut-off device shall effect closure of all 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 5, in which instance the overheat cut-off device shall effect closure of the Class C valve as a minimum requirement.

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

5.2.9.5 Type A₂ and A₃ appliances

5.2.9.5.1 General

Each main gas supply shall be under the control of two automatic shut off valves in series. For appliances ≤135 kW one valve shall be at least of Class B capability and the other valve of at least of Class C capability. For appliances >135 kW both valves shall be at least of Class B capability.

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

- a) be under the control of the downstream main gas automatic shut off valve incorporating a start gas rate control and 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 values given in 5.5.3; or,

- b) be under the control of two automatic shut off valves of which one shall be at least of Class A capability.

Where the downstream 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 automatic shut off valves shall be at least of the same class as the main gas automatic shut off valves.

These requirements should be read in conjunction with 5.5.3.

5.2.9.5.2 Shut down

The flame supervision system and the overheat cut off device shall effect closure of all automatic shut off valves in all systems specified. On shut down the air fan shall not be switched off before the start gas and main gas automatic shut off valves have been de energized.

5.2.9.5.3 Restart

Following safety shut down due to the operation of any overheat cut off device, restart shall be possible only after manual intervention.

5.2.10 Burner control systems

5.2.10.1 General

Type B₁₄ and B₄₄ appliances with a net heat input >70kW 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.

5.2.10.2 Automatic burner control systems

Automatic burner control systems shall comply with the requirements of EN 298:2012.

5.2.10.3 Manually operated devices

a) Requirement

The operation of manually operated devices (e.g. push buttons and switches) incorrectly or out of sequence shall not adversely affect the safety of the automatic burner control system. This shall be verified by the test given in 5.2.10.3. b)

b) Test procedure

When the appliance is installed as described in 6.1.5 and supplied with an appropriate reference gas at the nominal heat input in accordance with the requirements of 6.1.3.2.1., the start device is manually operated ten times (i.e. once every 5 s). The rapid (on and off) operation of any start switch shall not set up a hazardous condition.

5.2.11 Strainers and filters

5.2.11.1 Gas strainers

A strainer shall be fitted at the inlet of any system incorporating (an) automatic shut-off valve(s) to prevent the ingress of foreign matter. The strainer may be integral with the upstream automatic shut-off valve. The maximum strainer hole dimension shall be not greater than 1,5 mm and the mesh shall not permit the passage of a 1 mm diameter pin gauge.

For natural draught type B and C appliances, the maximum strainer hole dimension shall comply with the requirements as laid down in EN 161:2011+A3:2013 or shall not exceed 0,20 mm when a Class D valve is used.

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

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

5.2.11.2 Air strainers and filters

For type A₂ and A₃ appliances, an air filter if fitted shall be placed upstream of the heat exchanger/combustion chamber in the appliance air stream.

A fixed strainer shall be fitted on the air inlet to the appliance. The strainer hole shall not permit the entry of a ball of diameter 16 mm applied with a force of 5 N.

Where an air filter is fitted it shall be readily accessible for cleaning or replacement and may be of the cleanable or throw away type.

5.2.12 Transportation of combustion air and/or flue gases

5.2.12.1 Type A₂ and A₃ appliances

The appliance shall be fitted with a device(s) for proving adequate combustion and dilution air flow during pre-purge, ignition and operation.

Where separate fans provide combustion and/or dilution air an air proving device for each fan shall be fitted.

Air flow failure at any time during the pre-purge, ignition or operation of the appliance shall cause safety shut down or non-volatile lock out.

If safety shut down occurs there shall be a maximum of 5 automatic re start attempts after which non-volatile lock out shall occur.

The air proving device(s) shall be proved in the "no air" condition prior to start up. Failure to prove the device(s) in the "no air" condition shall prevent start up or cause non-volatile lock out. Proof of adequate air flow may be achieved by differential pressure sensing, where it can be shown that it provides satisfactory and reliable proof of air flow during the pre-purge, ignition and operation of the appliance; or flow sensing.

Where the setting of the air proving device is not essential to the commissioning of the appliance, the device shall be pre-set by the manufacturer and factory sealed.

Any means of locking or sealing the set position of the air proving device shall be such as to ensure that unauthorized interference cannot occur, or is evident.

Immediately before any attempt at ignition or the opening of gas shut off valves, the appliance shall be purged. The pre purge period shall be either:

- a) a minimum of 20 s at the full air rate, or pro rata longer periods at lower air rates; or,
- b) at least 5 volume changes of the appliance and its ductwork.

NOTE For the purposes of this requirement "ductwork" is taken to be a length of ducting equal to three times the major dimension of the appliance outlet connection.

The flame safeguard safe-start check shall continue throughout the pre purge period.

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

- c) the burner shall go to non-volatile lock out; or
- d) the burner shall go to safety shut down; or
- e) the purge may be continued on restoration of the required air rate provided that the air flow does not fall below 25 % of the full air rate and that the total purge time at the required air rate is not reduced.

Post purge is optional.

5.2.12.2 Type B₁₄ and B₄₄ appliances

5.2.12.2.1 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.

5.2.12.2.2 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 shall 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, in the case of non-domestic appliances, 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 5).

5.2.12.2.3 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.

5.2.12.3 All type B and type C appliances except Type B₁₄ and B₄₄

5.2.12.3.1 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 (where provided), 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.

Incorrect air flow during the pre-purge period (where provided) 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 can be used for this purpose.

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

5.2.12.3.2.1 General

Appliances shall be fitted with a suitable device for proving adequate flow of combustion air during the pre- purge (where applicable), ignition and over the whole range of possible heat inputs during operation.

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

5.2.12.3.2.2 Appliances without pre-purge

For appliances with a net heat input ≤ 70 kW pre-purge is optional. Where there is no pre-purge, the air proving device shall be proved in the "no flow" state prior to start-up of the main burner. Failure to prove "no flow" shall prevent start-up of the main burner or cause lock-out.

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

5.2.12.3.2.3 Appliances with pre-purge and post-purge

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

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

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

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 6.12 and Tables 6 and 7).