BS EN 1020:2009

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

ICS 97.100.20

National foreword

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 It supersedes BS EN 1020:1998 which is withdrawn.

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

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

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

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English Version

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

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

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

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

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Foreword

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

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of an identical text or by endorsement, at the latest by May 2010, and conflicting national standards shall be withdrawn at the latest by May 2010.

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

This document supersedes EN 1020:1997.

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

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

This revision modifies EN 1020:1997. It has been prepared to incorporate requirements for combustion products evacuation ducts, POCEDs, supplied as an integral part of the system to support the EU Directive 89/106/EEC on construction products under mandate M105. To this end it extends the scope of the standard to cover type B_4 and type B_5 appliances.

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

NOTE For countries requesting special categories (specified in EN 437:2003), the absence of specific information concerning A.3.3 and A.3.4 implies that the general requirements described in the body of the standard (see 4.1.1, 4.2.2, 4.2.3 and 4.2.5) also apply to these special categories.

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

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1 Scope

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

This European Standard applies to Type B_{12}, B_{13}, B_{14}, B_{22}, B_{23}, B_{42}, B_{43}, B_{44}, B_{52}, B_{53}, C_{12}, C_{13}, C_{32}, C_{33}, C_{62} and C_{63} appliances with a heat input not exceeding 300 kW (based on net calorific value) intended for use in other than single unit residential dwellings. It also applies to appliances intended for outdoor installation. Provision of the heated air may be by means of ducting or may be directly into the heated space.

For Type C_{62} and C_{63} appliances, this European Standard only applies when such appliances are intended for final installation in a similar manner to Type C_3 appliances.

This standard does not apply to:

a) appliances intended for use in a single unit residential dwelling;

b) appliances of the condensing type;

c) appliances with atmospheric burners without a fan to assist the transportation of combustion air and/or flue gases;

d) dual purpose air conditioning appliances (heating and cooling);

e) appliances where the air is heated by an intermediate fluid;

f) appliances fitted with manual or automatic flue dampers;

g) portable or transportable forced convection appliances;

h) appliances having multiple heating units with a single draught diverter;

i) appliances fitted with more than one flue outlet;

j) appliances that are designed for continuous condensation within the flue system under normal operating conditions;

k) appliances having combustion products evacuation ducts, POCEDs, that are non-metallic.

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

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

2 Normative references

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

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

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EN 125, *Flame supervision devices for gas burning appliances — Thermo-electric flame supervision devices*

EN 126, *Multifunctional controls for gas burning appliances*

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

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

EN 298:2003, *Automatic burner control systems for gas burners and gas burning appliances with or without fans*

EN 437:2003, *Test gases — Test pressures — Appliance categories*

EN 1859:2000, *Chimneys — Metal Chimneys — Test methods*

EN 10226-1, *Pipe threads where pressure tight joints are made on the threads — Part 1: Taper external threads and parallel internal threads — Dimensions, tolerances and designation*

EN 10226-2, *Pipe threads where pressure tight joints are made on the threads — Part 2: Taper external threads and taper internal threads — Dimensions, tolerances and designation*

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

EN 60335-1:2002, *Household and similar electrical appliances — Safety — Part 1: General requirements (IEC 60335-1:2001, modified)*

EN 60335-2-102, *Household and similar electrical appliances — Safety — Part 2-102: Particular requirements for gas, oil and solid-fuel burning appliances having electrical connections (IEC 60335-2-102:2004, modified)*

EN 60529:1991, *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)*

EN 60584-1, *Thermocouples — Part 1: Reference tables (IEC 60584-1:1995)*

EN 60584-2, *Thermocouples — Part 2: Tolerances (IEC 60584- 2:1982 + A1:1989)*

EN 60730-1,*Automatic electrical controls for household and similar use — Part 1: General requirements (IEC 60730-1:1999, modified)*

EN 60730-2-9:2002, *Automatic electrical controls for household and similar use — Part 2-9: Particular requirements for temperature sensing controls (IEC 60730-2-9:2000, modified)*

EN 61058-1, *Switches for appliances — Part 1: General requirements (IEC 61058-1:2000 + A1:2001, modified)*

EN ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation (ISO 228-1:2000)*

EN ISO 3166-1, *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes (ISO 3166-1:2006)*

EN ISO 6976, *Natural gas — Calculation of the calorific values, density, relative density and Wobbe index from composition (ISO 6976:1995 including Corrigendum 1:1997, Corrigendum 2:1997 and Corrigendum 3:1999)*

ISO 7-1, *Pipe threads where pressure-tight joints are made on the threads - Part 1: Dimensions, tolerances and designation*

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ISO 228-1:1994, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 1182:1990, *Reaction to fire tests for building products — Non-combustibility test*

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

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

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

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

3 Terms and definitions

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

3.1 Appliance and its constituent parts

3.1.1
non-domestic air heater
appliance designed for the heating and possibly ventilation of a building other than a single unit residential dwelling

3.1.2
forced convection air heater
appliance designed to provide space heating from a central source by distributing heated air, by means of an air moving device, either through ducting or directly into the heated space

3.1.3
gas inlet connection
part of the appliance intended to be connected to the gas supply

3.1.4
mechanical joint
mechanical means of obtaining soundness
means of ensuring the soundness of an assembly of several (generally metallic) parts without the use of liquids (e.g. pastes and tapes)

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

3.1.5
gas circuit
part of the burner unit that conveys or contains the gas between the burner unit gas inlet connection and the burners

3.1.6
restrictor
device with an orifice, which is placed in the gas circuit so as to create a pressure drop and thus reduce the gas pressure at the burner to a predetermined value for a given supply pressure and rate

3.1.7
gas rate adjuster
component allowing an authorised person to set the gas rate of the burner to a predetermined value according to the supply conditions

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

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

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

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

3.1.8
setting an adjuster
immobilizing a gas rate adjuster (e.g. by turning a screw), after the gas rate has been adjusted by the manufacturer or installer

3.1.9
setting of an adjuster using a material such that any attempt to change the adjustment breaks the sealing material and makes the interference with the adjuster apparent

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

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

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

3.1.10
putting an adjuster or a control out of service
putting an adjuster or a control (of temperature, pressure, etc.) out of action and sealing it in this position

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

3.1.11
injector
component that admits the gas into a burner

3.1.12
main burner
burner that is intended to assure the thermal function of the appliance

3.1.13
ignition device
means (e.g. flame, electrical ignition device or other device) used to ignite the gas at the ignition burner or at the main burner

NOTE This device can operate intermittently or permanently.

3.1.14
ignition burner
burner whose flame is intended to ignite another burner

3.1.15
aeration adjuster
device enabling the air to be set at the desired value according to the supply conditions

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

3.1.16 combustion products circuit

3.1.16.1
combustion chamber
enclosure inside which combustion of the air-gas mixture takes place

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3.1.16.2
flue outlet
part of a Type B appliance that connects with a flue to evacuate the products of combustion

3.1.16.3
draught diverter
device placed in the combustion products circuit to reduce the influence of flue-pull and that of down-draught on the burner performance and combustion

3.1.16.4
flue damper
manual or automatic device placed in the combustion products circuit intended to restrict or fully close off the passageways for the evacuation of products of combustion when the appliance is not in use

3.1.16.5
flue terminal
device fitted at the end of the duct system which enables the discharge of flue gases and may, at the same time, allow entry of combustion air

3.1.16.6
C_6 flue terminal
terminal which is specially approved for Type C_6 appliances

3.1.16.7
flue adaptor box
means of adapting the appliance for connection to different duct systems

EXAMPLE From concentric to separate ducts.

3.1.16.8
POCED
combustion products evacuation duct that is intended to be used only with a specific appliance/system, this duct being either supplied with the appliance/system or specified in the manufacturers instructions

3.1.17
fully premixed burner
pre-aerated burner system in which gas is mixed in a pre-determined and adjustable ratio with all of the air necessary for combustion

3.1.18
gas/air ratio control
device that automatically adapts the combustion air rate to the gas rate and vice versa

3.2 Adjustment, control and safety devices

3.2.1
range rating device
component on the appliance intended to be used by the installer to adjust the heat input of the appliance, within a range of heat inputs stated by the manufacturer, to suit the actual heat requirements of the installation

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

3.2.2
automatic burner control system
system comprising at least a programming unit and all the elements of a flame detector device

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

3.2.3
programming unit
device which reacts to signals from control and safety devices, gives control commands, controls the start-up sequence, supervises the burner operation and causes controlled shut-down, and if necessary safety shut-down and lock-out

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

3.2.4
programme
sequence of control operations determined by the programming unit involving switching on, starting up, supervising and switching off the burner

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

3.2.5
flame detector device
device by which the presence of a flame is detected and signalled

NOTE A flame detector device can consist of a flame sensor, an amplifier and a relay for signal transmission. These parts, with the possible exception of the actual flame sensor, may be assembled in a single housing for use in conjunction with a programming unit [EN 298:2003].

3.2.6
flame signal
signal given by the flame detector device, normally when the flame sensor senses a flame [EN 298:2003]

3.2.7
flame simulation
condition which occurs when the flame signal indicates the presence of a flame when in reality no flame is present [EN 298:2003]

3.2.8
pressure regulator[1)]
device which maintains the outlet pressure constant independent of the variations in inlet pressure and/or flow rate within defined limits

3.2.9
adjustable pressure regulator
regulator provided with means for changing the outlet pressure setting

3.2.10
flame supervision device
device that, in response to a signal from the flame detector, keeps the gas supply open and shuts it off in the absence of the supervised flame

3.2.11
automatic shut-off valve
valve designed to open when energized and to close automatically when de-energized

3.2.12
control thermostat
device controlling the operation of the appliance (by on/off, high/low or modulating control) and enabling the temperature to be kept automatically, within a given tolerance, at a predetermined value

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

3.2.13
overheat cut-off device
device that shuts off and locks out the gas supply before the appliance is damaged and/or before safety is compromised and which requires manual intervention to restore the gas supply

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

3.2.14
overheat control device
automatic reset device that shuts down the gas supply to the burner when the temperature of the delivered air exceeds a certain preset value during abnormal operating conditions

3.2.15
fan delay control
control that starts and/or stops the air delivery fan when the temperature of the delivered air reaches a certain predetermined value

3.2.16
temperature sensing element
temperature sensor
component that detects the temperature of the environment to be supervised or controlled

3.2.17
modulating control
automatic control by which the heat input of the appliance can be varied in a continuous manner between the nominal heat input and a minimum value

3.2.18
high/low control
automatic control which permits an appliance to operate either at the nominal heat input or at a fixed reduced heat input

3.2.19
closed position indicator switch
switch fitted to an automatic shut-off valve which indicates when the closure member is in the closed position

3.2.20
proof of closure switch
switch fitted to an automatic shut-off valve with mechanical overtravel which indicates when the closure member is in the closed position

3.2.21
valve proving system
system to check the effective closure of the start gas or main gas safety shut-off valves, and which is capable of detecting small gas leakage rates (e.g. by means of a pressure or vacuum proving system)

3.3 Operation of the appliance

3.3.1
volume flow rate
V
volume of gas consumed by the appliance in unit time during continuous operation

NOTE The volume flow rate is expressed in cubic metres per hour (m^3/h), litres per minute (l/min), cubic decimetres per hour (dm^3/h) or cubic decimetres per second (dm^3/s) [EN 437:2003].

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3.3.2
mass flow rate
M
mass of gas consumed by the appliance in unit time during continuous operation

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

3.3.3
heat input
Q
quantity of energy used in unit time corresponding to the volumetric or mass flow rates, the calorific value used being the net or gross calorific value

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

3.3.4
nominal heat input
Q_n
value of the heat input (kW) declared by the manufacturer

3.3.5
flame stability
characteristic of flames which remain on the flame ports or in the flame reception zone intended by the construction

3.3.6
flame lift
total or partial lifting of the base of the flame away from the burner port or the flame reception zone provided by the design

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

3.3.7
light-back
entry of a flame into the body of the burner

3.3.8
light-back at the injector
ignition of the gas at the injector, either as a result of light-back into the burner or by the propagation of a flame outside the burner

3.3.9
sooting
phenomenon appearing during incomplete combustion and characterized by deposits of soot on the surfaces or parts in contact with the combustion products or with the flame

3.3.10
yellow tipping
yellowing of the tip of the blue cone of an aerated flame

3.3.11
first safety time
interval between the ignition burner gas valve, the start gas valve or main gas valve, as applicable, being energized and the ignition burner gas valve, start gas valve or main gas valve, as applicable, being de-energized if the flame detector signals the absence of a flame at the end of this interval

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

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3.3.12
second safety time
where there is a first safety time to either a ignition burner or start gas flame only, the interval between the main gas valve being energized and the main gas valve being de-energized if the flame detector signals the absence of a flame

3.3.13
start gas
gas that is supplied at the start gas rate to establish the start gas flame

3.3.14
start gas rate
restricted gas flow rate admitted either to a separate ignition burner or to the main burner during the first safety time

3.3.15
start gas flame
flame established at the start gas rate either at the main burner or at a separate ignition burner

3.3.16
running condition of the system
running condition in which the burner is in normal operation under the supervision of the programming unit and its flame detector device

3.3.17
automatic burner system
burner system in which, when starting from the completely shut-down condition, the gas is ignited and the flame is detected and proved without manual intervention

3.3.18
non-automatic burner system
burner system with an ignition burner which is ignited under manual supervision

3.3.19
controlled shut-down
process by which the power to the gas shut-off valve(s) is removed immediately, e.g. as a result of the action of a controlling function [EN 298:2003]

3.3.20
safety shut-down
process which is effected immediately following the response of a protection device or a fault in the automatic burner control system and puts the burner out of operation

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

3.3.21 Lock-out

3.3.21.1
non-volatile lock-out
safety shut-down condition of the system, such that a restart can only be accomplished by a manual reset of the system and by no other means [EN 298:2003]

3.3.21.2
volatile lock-out
safety shut-down condition of the system, such that a restart can only be accomplished by either the manual reset of the system or an interruption of the electrical supply and its subsequent restoration [EN 298:2003]

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3.3.22
spark restoration
process by which, after disappearance of the flame signal, the ignition device is energized again without the gas supply having been totally interrupted

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

3.3.23
automatic recycling
process by which, after loss of flame during the running condition or accidental interruption of the operation of the appliance, the gas supply is interrupted and the complete start sequence is automatically re-initiated

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

3.3.24
ignition opening time
time interval between ignition of the supervised flame and the moment when the valve is held open

3.3.25
extinction safety time
time interval between extinction of the supervised flame and the gas supply being shut off:

a) to the main burner; and/or

b) to the ignition burner.

3.3.26
ignition interlock
part which prevents the operation of the igniter as long as the main gasway is open

3.3.27
re-start interlock
mechanism which prevents the re-opening of the gasway to the main burner or the main burner and the ignition burner until the armature plate has separated from the magnetic element

3.4 Gases

3.4.1
test gases
gases intended for the verification of the operational characteristics of appliances using combustible gases.

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

3.4.2
reference gases
test gases with which appliances operate under nominal conditions when they are supplied at the corresponding normal pressure [EN 437:2003]

3.4.3
limit gases
test gases representative of the extreme variations in the characteristics of the gases for which appliances have been designed [EN 437:2003]

3.4.4
gas pressure
static pressure, relative to the atmospheric pressure, measured at right angles to the direction of flow of the gas

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

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3.4.5
test pressure
gas pressures used to verify the operational characteristics of appliances using combustible gases

NOTE 1 Test pressures consist of normal and limit pressures.

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

3.4.6
normal pressure
***p*n**
pressure under which the appliances operate in nominal conditions when they are supplied with the corresponding reference gas [EN 437:2003]

3.4.7
limit pressure
(maximum limit pressure p_{max} and minimum limit pressure p_{min})

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

3.4.8
pressure couple
combination of two distinct gas distribution pressures applied by reason of the significant difference existing between the Wobbe indices within a single family or group in which:

a) the higher pressure corresponds only to gases of low Wobbe index;

b) the lower pressure corresponds to gases of high Wobbe index [EN 437:2003]

3.4.9
relative density
d
ratio of the masses of equal volumes of dry gas and dry air under the same conditions of temperature and pressure

3.4.10
calorific value
quantity of heat produced by the complete combustion, at a constant pressure equal to 1 013,25 mbar, of a unit volume or mass of gas, the constituents of the combustible mixture being taken at reference conditions and the products of combustion being brought back to the same conditions

NOTE 1 A distinction is made between:

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

b) the net calorific value H_i in which the water produced by combustion is assumed to be in the vapour state.

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

3.4.11
Wobbe index
gross Wobbe index: W_s; net Wobbe index: W_i.
ratio of the calorific value of a gas per unit volume and the square root of its relative density under the same reference conditions

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

NOTE 2 The Wobbe index is expressed either in megajoules per cubic metre of dry gas at the reference conditions (MJ/m^3) or in megajoules per kilogram of dry gas (MJ/kg) [EN437:2003].

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3.5 Conditions of operation and measurement

3.5.1
reference conditions:

— for calorific values, temperature: 15 °C;

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

3.5.2
cold condition
condition of the appliance required for some tests and obtained by allowing the unlit appliance to attain thermal equilibrium at room temperature

3.5.3
hot condition
condition of the installation required for some tests and obtained by heating to thermal equilibrium at nominal heat input

3.5.4
equivalent resistance
resistance to flow (in mbar) measured at the outlet of the appliance, which is equivalent to that of the actual flue

3.5.5
thermal equilibrium
operating state of the system corresponding to a particular setting of the input in which the flue gas temperature does not change by more than ± 2 % (in °C) over a period of 10 min

3.6 Country of destination

3.6.1
direct country of destination
country for which the appliance has been certified and which is specified by the manufacturer as the intended country of destination

NOTE 1 At the time of putting the appliance on the market and/or of installation, the appliance shall be capable of operating, without adjustment or modification, with one of the gases distributed in the country concerned, at the appropriate supply pressure.

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

3.6.2
indirect country of destination
country for which the appliance has been certified, but for which, in its present state of adjustment, it is not suitable

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

4 Classification of systems

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

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

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Table 1 — Gas classification

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

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

4.2.1 Category I

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

a) Appliances designed for use on first family gases only

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

b) Appliances designed for use on second family gases only

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

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

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

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

c) Appliances designed for use on third family gases only

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

Category I_{3+}: Appliances capable of using the third family (propane and butane) and operating with a pressure couple without adjustment of the appliance other than a possible adjustment of the primary air in order to change from butane to propane and vice versa. No operational pressure regulating device is permitted on the appliance.

Category I_{3P}: Appliances using only gases of Group P of the third family (propane) at the prescribed supply pressure.

4.2.2 Category II

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

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

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

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

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

Category II_{2H3+}: Appliances capable of using gases of Group H of the second family and gases of the third family. The second family gases are used under the same conditions as for category I_{2H}. The third family gases are used under the same conditions as for category I_{3+}.

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

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

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

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

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

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

4.2.3 Category III

Category III appliances are designed for use on the three families.

This category is not in general use.

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

4.3 Classification of appliances according to the mode of evacuation of the combustion products

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

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This standard applies to:

a) **Type B**: An appliance intended to be connected to a flue which evacuates the products of combustion to the outside of the room containing the appliance. The combustion air is drawn directly from the room.

1) **Type B_1**: Type B appliance incorporating a draught diverter;

2) **Type B_2**: Type B appliance without a draught diverter;

3) **Type B_4**: Type B appliance, incorporating a draught diverter, that is designed for connection via its flue duct to its flue terminal;

4) **Type B_5**: Type B appliance, without a draught diverter, that is designed for connection via its flue duct to its flue terminal;

5) **Type B_{12}**: Type B_1 appliance designed for a natural draught flue incorporating a fan downstream of the combustion chamber/heat exchanger and upstream of the draught diverter;

6) **Type B_{13}**: Type B_1 appliance designed for a natural draught flue incorporating a fan upstream of the combustion chamber/heat exchanger;

7) **Type B_{14}**: Type B_1 appliance having an integral fan downstream of both the combustion chamber/heat exchanger and the draught diverter;

8) **Type B_{22}**: Type B_2 appliance incorporating a fan downstream of the combustion chamber/heat exchanger;

9) **Type B_{23}**: Type B_2 appliance incorporating a fan upstream of the combustion chamber/heat exchanger;

10) **Type B_{42}**: Type B_4 appliance designed for a natural draught flue incorporating a fan downstream of the combustion chamber/heat exchanger and upstream of the draught diverter;

11) **Type B_{43}**: Type B_4 appliance designed for a natural draught flue incorporating a fan upstream of the combustion chamber/heat exchanger;

12) **Type B_{44}**: Type B_4 appliance having an integral fan downstream of both the combustion chamber/heat exchanger and the draught diverter;

13) **Type B_{52}**: Type B_5 appliance incorporating a fan downstream of the combustion chamber/heat exchanger;

14) **Type B_{53}**: Type B_5 appliance incorporating a fan upstream of the combustion chamber/heat exchanger.

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

b) **Type C**: An appliance in which the combustion circuit (air supply, combustion chamber, heat exchanger, evacuation of the combustion products) is sealed with respect to the room in which the appliance is installed.

This standard applies to:

1) **Type C_1**: Type C appliance that is designed for connection via its ducts to a horizontal terminal, which at the same time admits fresh air to the burner and discharges the products of combustion to the outside through orifices that are either concentric or close enough to come under similar wind conditions;

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2) **Type C_3**: Type C appliance that is designed for connection via its ducts to a vertical terminal, which at the same time admits fresh air to the burner and discharges the products of combustion to the outside through orifices that are either concentric or close enough to come under similar wind conditions;

3) **Type C_6**: Type C appliance intended to be connected to a separately approved and marketed system for the supply of combustion air and discharge of the combustion products;

4) **Type C_{12}**: Type C_1 appliance incorporating a fan downstream of the combustion chamber/heat exchanger;

5) **Type C_{13}**: Type C_1 appliance incorporating a fan upstream of the combustion chamber/heat exchanger;

6) **Type C_{32}**: Type C_3 appliance incorporating a fan downstream of the combustion chamber/heat exchanger;

7) **Type C_{33}**: Type C_3 appliance incorporating a fan upstream of the combustion chamber/heat exchanger;

8) **Type C_{62}**: Type C_6 appliance incorporating a fan downstream of the combustion chamber/heat exchanger;

9) **Type C_{63}**: Type C_6 appliance incorporating a fan upstream of the combustion chamber/heat exchanger.

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

5 Constructional requirements

5.1 General

5.1.1 Conversion to different gases

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

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

5.1.1.1 Category I

a) **Category I_{2H}, I_{2L}, I_{2E}, I_{2E+}**: no modification to the appliance.

b) **Category $I_{3B/P}$**: no modification to the appliance.

c) **Category I_{3+}**: replacement of injectors or calibrated orifices but only in order to convert from one pressure couple to another (e.g. 28-30/37 mbar to 50/67 mbar or vice versa). In addition, it is permissible to adjust the primary air in order to change from butane to propane and vice versa.

d) **Category I_{3P}**: no modification to appliance relative to a change of gas. For a change of pressure, replacement of injectors and adjustment of gas rates.

5.1.1.2 Category II

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

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

Adjustment of the gas rate of ignition burners, either by using an adjuster or by a change of injectors or restrictors and, if necessary, a change of complete ignition burners or of some of their parts.

Putting the regulator out of service under the conditions of 5.2.5.

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

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

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

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

Adjustment of the gas rate of ignition burners, either by using an adjuster or by a change of injectors or restrictors and, if necessary, a change of complete ignition burners or of some of their parts.

Putting the regulator out of service under the conditions of 5.2.5.

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

These adjustments or component changes are only acceptable when:

a) converting from a gas of the second family to a gas of the third family or vice versa;

b) converting from one butane/propane pressure couple to another (e.g. 28-30/37 mbar to 50/67 mbar or vice versa).

5.1.1.3 Category III

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

5.1.2 Materials and method of construction

When the appliance is installed in accordance with the manufacturer's instructions, all components, including the heat exchanger and its POCED in the case of Type B_4 and B_5 appliances, shall withstand the mechanical, chemical and thermal conditions to which they may be subjected in the course of normal use.

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

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

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

Asbestos or materials containing asbestos shall not be used.

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

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

5.1.3 Accessibility for maintenance and use

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

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

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

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

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

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

5.1.4 Thermal insulation

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

5.1.5 Gas connection

The appliance gas connection shall be accessible.

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

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

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

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

The conditions of connections prevailing in the various countries are given in A.6.

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5.1.6 Soundness

5.1.6.1 Soundness of the gas circuit

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

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

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

5.1.6.2 Soundness of the combustion circuit

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

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

5.1.7 Supply of combustion air and evacuation of combustion products

5.1.7.1 General

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

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

5.1.7.2 Appliance combustion air inlet

5.1.7.2.1 Type B_{14} and B_{44} appliances

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

5.1.7.2.2 Other appliances of Type B and Type C

All such appliances shall be fitted with an air proving device to prove adequate combustion air during the pre-purge period and burner operation. The adjustment of the combustion air is permitted by manual or automatic means. The method of adjusting any damper, or other combustion air controlling device, shall be clearly defined in the manufacturer's instructions for installation and adjustment.

5.1.7.3 Appliance flue gas outlet

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

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

If the appliance has a POCED (Type B_4, B_5, C_1 and C_3 appliances) that is capable of being installed in accordance with the manufacturer’s instructions such that its outlet, when fitted with any terminal supplied with the appliance, or specified in the manufacturer’s instructions, extends beyond the external surface of a building by more than 1,5 m, this duct, together with any associated air supply duct (Type C_1 and C_3

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

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

5.1.7.3.1.1 All appliances

The flue outlet shall be female and shall allow, if necessary by means of an adaptor supplied with the appliance, connection to a flue pipe whose diameter complies with the standards in force where the appliance is to be installed (see A.7).

The internal diameter of the flue outlet shall be such as to ensure compliance with requirements concerning operation.

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

NOTE *D* is the outside diameter of the duct.

5.1.7.3.1.2 Additional requirements for appliances of Type B_{14}

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

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

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

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

The flue outlet shall be female and shall allow, if necessary by means of an adaptor supplied with the appliance, connection to a flue pipe whose diameter complies with the rules in force where the appliance is to be installed (see A.7).

The internal diameter of the flue outlet shall be such as to ensure compliance with requirements concerning operation.

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

NOTE *D* is the outside diameter of the duct.

The manufacturer shall state the minimum and maximum equivalent resistance. The manufacturer's instructions shall give details for calculating the equivalent resistance (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

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it will not allow entry of a ball of 16 mm diameter applied with a force of 5 N. The design of the flue system shall be such that any condensate formed when operating the appliance from cold shall either be retained and subsequently re-evaporated or discharged clear of the wall.

5.1.7.3.3 Type B_{42}, B_{43} and B_{44} appliances

5.1.7.3.3.1 All appliances

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

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

5.1.7.3.3.2 Additional requirements for appliances of Type B_{44}

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

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

5.1.7.3.4 Type B_{52} and B_{53} appliances

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

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

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

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

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

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

The terminal shall be designed to prevent the penetration of rain or snow to the appliance or to the fabric of the building. All openings in the external surfaces of the terminal shall not permit the entry of a ball of 16 mm diameter when applied with a force of 5 N. If the terminal performance is dependent on a chamber within the wall, a chamber lining shall be provided with the appliance.

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

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

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

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

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

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

5.1.7.3.7 Appliances designed for outdoor installation

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

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

5.1.8 Supply and distribution of air for space heating

5.1.8.1 Air inlets

Where the air inlet is intended to be ducted to the heater, the appliance shall be provided with flanged or spigot connections on the air inlet.

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

5.1.8.2 Air outlets

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

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

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

5.1.9 Checking the state of operation

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

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

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

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

5.1.10 Electrical equipment

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

If the appliance is fitted with electronic components or electronic systems providing a safety function, these shall comply with the relevant requirements of EN 298 with regard to electromagnetic compatibility immunity levels.

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

a) give the degree of personal protection against contact with dangerous electrical components inside the appliance case;

b) give the degree of electrical protection, inside the appliance case, against harmful actions due to water penetration.

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

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

a) continued safe operation; or

b) safety shut-down; or

c) lock-out.

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

NOTE Requirements and test methods relating to the continued and safe operation of the appliance in the event of normal and abnormal fluctuation of auxiliary energy are specified in 6.1.5.1 and 7.3.5.3.4.

5.1.12 Motors and fans

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

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

Means shall be provided to facilitate the adjustment of the belt tension by the use of commonly available tools.

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

Lubrication points, if provided, shall be readily accessible.

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5.2 Adjusting, control and safety devices

5.2.1 General

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

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

All devices described in 5.2 or the multifunctional control in which they might be fitted shall be removable or exchangeable if this is necessary for cleaning or replacement of the device. Adjusters for the devices shall not be interchangeable if this could result in confusion.

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

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

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

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

The vent shall be so sited that it cannot be obstructed by foreign matter (e.g. birds).

5.2.2 Gas rate adjusters and range-rating devices

5.2.2.1 Common requirements

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

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

5.2.2.2 Gas rate adjusters

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

Appliances in category II_{1a2H} shall have a gas rate adjuster for the first family gases.

For appliances in categories II_{2H3+} and II_{2E+3+} having a gas rate adjuster, it shall be possible to put these devices out of service when these appliances are supplied with a third family gas, and the same applies for appliances in category II_{1a2H} when they are supplied with a second family gas. For appliances in category II_{2E+3P} having a gas rate adjuster, it shall be possible to put these devices out of service fully or partially (see 5.2.5) when these appliances are supplied with a second family gas.

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

5.2.2.3 Range-rating devices

A range-rating device on an appliance is optional.

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

5.2.3 Aeration adjusters

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

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

5.2.4 Manual controls

5.2.4.1 Application

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

5.2.4.2 Manual valves (other than those incorporated in a multifunctional control)

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

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

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

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

5.2.5 Regulators

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

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

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

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

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

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

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

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

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

5.2.6 Multifunctional controls

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

5.2.7 Flame supervision devices

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

5.2.8 Automatic shut-off valves

5.2.8.1 General requirements

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

5.2.8.2 gives minimum valve requirements.

5.2.8.2 Application

5.2.8.2.1 Type B_{14} and B_{44} appliances

####### 5.2.8.2.1.1 Appliances with a start gas flame

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

Table 2 — Minimum valving requirements for Type B_{14} appliances

Input	Main gas valves required		Start gas valves required	
	non-automatic systems	automatic systems	non-automatic systems	automatic systems
135 kW and below	1x Class C plus 1x Class D[a)]	1x Class B plus 1x Class D[e)]	1x Class C[b)]	1x Class B[c)] plus 1x Class D[d)e)]
Between 135 kW and 300 kW	1x Class B plus 1x Class C	1x Class B plus 1x Class C	1x Class B[c)]	1x Class B[c)] plus 1x Class D[d) e)]

a) This Class D valve shall have a minimum sealing force of 1 N/m. The sealing force is calculated from the spring force in the closed position divided by the circumference or length of the seal.

b) This valve may be replaced with a thermoelectric valve conforming to the requirements of EN 125 having a sealing force capability at least equivalent to a Class C valve conforming to the requirements of EN 161.

c) This valve may be the Class B valve controlling the main gas supply.

d) This Class D valve is not required if the start gas rate does not exceed, depending on the heat input of the appliance (see 5.6.1.1), either 0,6 kW or 1 % of the nominal heat input of the main burner up to a maximum of 1,5 kW, as applicable.

e) If a Class D valve is used for automatic systems, a strainer shall be used such that it does not pass a 0,2 mm pin gauge. This strainer shall be fitted upstream of the valve.

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

5.2.8.2.1.2 Appliances with direct main burner ignition

Such appliances (see 5.6.2) shall be fitted with two automatic shut-off valves in series. One of these shall be of at least Class B and the other of at least Class D.

5.2.8.2.1.3 Appliances of Types B_{12}, B_{22}, B_{42}, B_{52}, C_{12}, C_{32} and C_{62}, and outdoor appliances incorporating a fan in the combustion circuit downstream of the combustion chamber/heat exchanger

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

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

a) under the control of the downstream main gas automatic shut-off valve incorporating a start-gas rate control. The valve shall incorporate a device to enable the start-gas rate to be set such that the energy available during the start-gas flame ignition period cannot exceed the value given in 5.6; or

b) under the control of at least one Class B automatic shut-off valve (see Table 3). If, however, the conditions specified in Table 3, footnote c), are not met, a second valve shall be fitted as specified in Table 3.

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

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

NOTE The requirements of 5.2.8.2.1.3 should be read in conjunction with 5.6.

Table 3 — Minimum valving requirements for outdoor and Type B_{12}, B_{22}, B_{42}, B_{52}, C_{12}, C_{32} and C_{62} appliances

Input	Main gas valves required for automatic systems	Start gas valves required for automatic systems
135 kW and below	1 x Class B plus 1 x Class D[b)]	1 x Class B[b)] plus 1 x Class D[a)c)]
Between 135 kW and 300 kW	2 x Class B	1 x Class B[b)] plus 1 x Class B[c)]

[a)] If a Class D valve is used, a strainer shall be used such that it does not pass a 0,2 mm pin gauge. This strainer shall be fitted upstream of the valve.

[b)] This valve may be the valve controlling the main gas supply.

[c)] This valve is not required if:

1) the start gas rate is 10 % or below of the main gas rate; and

2) the appliance is not designed for burning third family gases; and

3) the appliance is not capable of being installed such that the combustion air inlet is higher than the exit from the combustion chamber; and

4) the pre-purge gives at least five volume changes.

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

5.2.8.2.2 Appliances of Types B_{13}, B_{23}, B_{43}, B_{53}, C_{13}, C_{33} and C_{63}, and outdoor appliances incorporating a fan in the combustion circuit upstream of the combustion chamber/heat exchanger

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

The requirements given in 5.2.8.2.1.3 shall apply.

5.2.8.2.2.2 Other appliances

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

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

a) under the control of the downstream main gas automatic shut-off valve incorporating a start-gas rate control. The valve shall incorporate a device to enable the start-gas rate to be set such that the energy available during the start-gas flame ignition period cannot exceed the value given in 5.6; or

b) under the control of at least one Class A automatic shut-off valve if the appliance heat input is greater than 135 kW, or at least a Class B automatic shut-off valve if the appliance heat input does not exceed 135 kW (see Table 4). Irrespective of the heat input, if the conditions specified in Table 4, footnote b), are not met, a second valve shall be fitted as specified in this table.

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

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

NOTE 1 The above requirements should be read in conjunction with 5.6.

Table 4 — Minimum valving requirements for Type B_{13}, B_{23}, B_{43}, B_{53}, C_{13}, C_{33} and C_{63} appliances and outdoor appliances

Input	Main gas valves required for automatic systems	Start gas valves required for automatic systems
135 kW and below	2 x Class B	1 x Class B[a)] plus 1 x Class B[b)]
Between 135 kW and 300 kW	1 x Class A plus 1 x Class B	1 x Class A[a)] plus 1 x Class B[b)]

a) This valve may be the valve controlling the main gas supply.

b) This valve is not required if:

1) the start gas rate is 10 % or below of the main gas rate; and

2) the appliance is not designed for burning third family gases; and

3) the appliance is not capable of being installed such that the combustion air inlet is higher than the exit from the combustion chamber; and

4) the pre-purge gives at least five volume changes.

NOTE 2 At the present time, this document has been drafted for appliances which will be type tested. For larger appliances, not intended for type testing, the valving requirements would need further consideration.

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

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

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

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

5.2.9 Burner control systems

5.2.9.1 Application

Type B_{14} and B_{44} appliances may have a non-automatic burner control system in which the start-gas flame is ignited manually. Alternatively, Type B_{14} and B_{44} appliances may have an automatic burner control system.

All other appliances shall have an automatic burner control system.

5.2.9.2 Automatic burner control systems

5.2.9.2.1 General

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

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

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

5.2.9.2.2 Manually operated devices

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

In particular, under the test conditions described in 7.2.1, the rapid (on and off) operation of any start switch shall not set up a hazardous condition.

5.2.10 Gas strainers

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

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

NOTE For systems incorporating a Class D valve, see Tables 2 and 3.

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

5.2.11 Air/gas ratio controls

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

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

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

Control tubes for air or combustion products shall have a minimum cross-sectional area of 12 mm^2 with a minimum internal dimension of 1mm. Provided that evidence is given and precautions are taken to avoid condensation in the control tubes, the minimum cross-sectional area of air control tubes may be 5 mm^2. All control tubes shall be located and fixed so that any stagnation of condensate is avoided and positioned such that creasing, leakage or breakage is prevented. Where more than one control tube is used the relevant connection position for each shall be obvious.

5.3 Ignition devices

5.3.1 General

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

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

Ignition burners, ignition devices and their mountings shall be so designed that they can only be located rigidly and correctly in relation to every component and burner with which they are designed to operate.

5.3.2 Ignition device for the main burner

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

5.3.3 Ignition burners

If different ignition burners are used for the different gases, they shall be marked, easy to substitute for one another and easy to fit. The same applies to injectors where only they have to be changed. Injectors shall carry an indelible means of identification and shall only be removable with the aid of a tool.

Ignition burners shall be protected against blockage by gas-borne particulate matter (see 5.2.10).

5.4 Transportation of combustion air and/or flue gases

5.4.1 Type B_{14} and B_{44} appliances

5.4.1.1 General

Appliances shall be fitted with a suitable device for proving adequate flow of flue gases prior to and during ignition and operation of the burner (see 6.1.4.1.4.2, 6.1.4.2.2.2, 6.1.5.1, 7.3.5.3.5 and 6.1.5.2.2).

5.4.1.2 Appliances with permanent ignition burners

The proving device shall be proved in the "no flow" state prior to start-up of the main burner. Failure to prove "no flow" shall prevent start-up of the main burner.

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

a) a Class A or B valve, for appliances having heat inputs exceeding 135 kW; or

b) a Class A, B, C or D valve where the appliance heat input does not exceed 135 kW.

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

5.4.1.3 Appliances fitted with automatic burner control systems

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

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

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

5.4.2 All appliances except Type B_{14} and B_{44}

5.4.2.1 Combustion air

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

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

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

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

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

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

Appliances shall be fitted with a suitable device for proving adequate combustion air flow during the pre-purge, ignition and operation of the burner (see 6.1.4.1.4, 6.1.4.2.2, 6.1.5.1 e) and 6.1.5.2). Combustion air flow failure at any time during the pre-purge, ignition or operation of the main burner shall cause safety shut-down. The air proving device shall be proved in the "no air" position prior to start-up. Failure to prove "no air" shall prevent start-up or cause lock-out.

5.4.2.2 Pre-purge and post-purge

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

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

a) at the rate corresponding to the minimum heat input providing that the pre-purge period is extended pro rata as described above; or

b) at the full air rate corresponding to the nominal heat input providing that this air rate is proved by some means (e.g. damper position interlock or a differential air pressure switch).

Unless any start-gas supply is under the control of two automatic shut-off valves having classes at least equivalent to those of the main gas supply, the pre-purge shall be such as to give at least five volume changes of the combustion chamber and gas passages up to the flue exit from the appliance (see 6.1.8 and Tables 3 and 4).

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

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

d) the purge shall be continued upon restoration of the required rate provided that the combustion air flow does not fall below 25 % of the combustion air rate appropriate to the maximum rated input and that the total purge time at the required combustion air rate is not reduced.

Post-purge is optional.

5.5 Flame supervision system

5.5.1 Type B_{14} and B_{44} appliances

5.5.1.1 Non-automatic burner systems

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

The ignition opening time of heat sensitive flame supervision devices shall not exceed 20 s. This is verified under the test conditions of 7.2.2.

Upon flame failure, the control system shall cause non-volatile lock-out. The extinction safety time for the flame supervision system to shut down the burner shall not be more than 60 s for appliances with permanent ignition burners protected by a heat sensitive flame supervision system. However, for appliances with a heat input greater than 135 kW, the extinction safety time shall not exceed 3 s. The extinction safety time is verified under the test conditions of 7.2.3.

Flame supervision devices shall be designed such that:

a) failure of the sensor causes a safe shut down of the burner (e.g. thermoelectric type); or

b) to prevent any automatic shut-off valve opening and/or any ignition attempt occurring if a flame or flame-simulating condition is signalled when the burner is started from the completely shut-down condition.

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

Where thermoelectric flame supervision devices are used in conjunction with electric ignition, the control system shall incorporate a restart interlock. For the purposes of this requirement, a piezo-electric ignition is not regarded as electric ignition.

5.5.1.2 Automatic burner systems

The burner shall be fitted with a flame supervision device.

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

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

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

The extinction safety time for the flame supervision system to detect the absence of flame and shut down the burner(s) shall not be more than 3 s. This is verified under the test conditions of 7.2.3.

5.5.2 All appliances except Type B_{14} and B_{44}

The burner shall be fitted with a flame supervision device.

The flame supervision device shall incorporate a suitable means to provide safety shut-down or lock-out if the flame detector signals flame presence at any time during the pre-purge. This is the safe-start check. The safe-start check may cease during the 5 s preceding an attempt at ignition. If a flame-simulating condition lasts for 5 s or more, lock-out shall occur.

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

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

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

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

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

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Table 5 — Flame supervision device de-energization times

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

5.6 Start-gas flame establishment

5.6.1 Type B_{14} and B_{44} appliances

5.6.1.1 Non-automatic burner systems

For an appliance of heat input not exceeding 60 kW, the gas rate of a start-gas burner shall not exceed 0,6 kW.

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

Provision shall be made to establish the start-gas flame safely and easily, either manually or by means of an ignition device incorporated in the appliance.

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

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

5.6.1.2 Automatic burner systems

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

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

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

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

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

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

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1) a means shall be provided to prove closure of the downstream main shut-off valve prior to ignition[2]; or

2) the requirement of 5.1.4.1.2 shall be met.

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

The ignition source shall not be energized before a safe-start check has been made of the flame supervision system and shall be de-energized at, or before, the end of the first safety time. Where a hot surface ignition system is used, the ignition system shall be so energized that the ignition source is capable of igniting incoming gas before the gas valves are opened.

The first safety time shall not exceed:

c) 30 s in case of start-gas burners having a heat input not exceeding 0,6 kW;

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

e) 5 s (and preferably not less than 2 s) for appliances where the start-gas rate exceeds 1,5 kW.

The safety time shall be verified under the test conditions of 7.2.4.

In the event of start-gas flame failure after establishment of the start-gas flame, but before the main gas automatic shut-off valves have been signalled to open, either safety shut-down shall occur or a single immediate attempt at re-ignition by direct spark restoration may occur. This single re-ignition attempt within 1 s shall only be permitted:

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

g) for appliances with heat inputs of more than 135 kW and where the start-gas rate, established on a separate burner, is less than 1 kW plus 1 % of the main burner rating.

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

For appliances where the start-gas rate exceeds the values given above, safety shut-down and non-volatile lock-out shall occur in the event of start-gas flame failure after its establishment and before the main gas automatic shut-off valves have been signalled to open.

5.6.2 All appliances except Type B_{14} and B_{44}

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

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

a) a means shall be provided to prove closure of the downstream main shut-off valve prior to ignition[3]; or

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

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

b) the requirement of 6.1.4.1.2 shall be met.

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

The start-gas flame establishment shall consist of:

c) the start-gas flame ignition period, the duration of which shall not be more than:

   1) 30 s in case of start-gas burners having a heat input not exceeding 0,6 kW; or

   2) 15 s in case of start-gas burners having a heat input greater than 0,6 kW and not exceeding 1,5 kW; or

   3) 5 s (and preferably not less than 2 s) for appliances where the start-gas rate exceeds 1,5 kW;

d) in the case of appliances having a nominal heat input of more than 135 kW, a start-gas flame proving period, the duration of which shall not be less than 5 s.

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

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

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

If the start-gas flame is established at a separate ignition burner, the flame detector, under all conditions of operation, shall detect the ignition burner flame only at rates which will ignite the main gas reliably and smoothly. This requirement is verified in 7.3.4.1.1.2.

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

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

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

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

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

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5.7 Main flame establishment

5.7.1 Type B_{14} and B_{44} appliances

5.7.1.1 Establishment by means of a start-gas flame

5.7.1.1.1 Non-automatic burner systems

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

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

5.7.1.1.2 Automatic burner systems

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

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

5.7.1.2 Direct establishment of the main flame

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

The ignition source shall not be energized before a safe-start check (see 5.5.1.2) has been made of the flame supervision system and shall be de-energized at, or before, the end of the safety time. Where a hot surface ignition system is used, the ignition system shall be so energized that the ignition source is capable of igniting incoming gas before the gas valves are opened.

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

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

5.7.2 All appliances except Type B_{14} and B_{44}

5.7.2.1 Establishment by means of a start-gas flame

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

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

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

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

5.7.2.2 Direct establishment of the main flame

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

The ignition source shall not be energized before completion of the pre-purge period and shall be de-energized at, or before, the end of the safety time. Where a hot surface ignition system is used, the ignition system shall be so energized that the ignition source is capable of igniting incoming gas before the gas valves are opened.

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

a) a non-volatile lock-out; or

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

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

5.8 Main burner

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

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

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

5.9 Facility for remote control

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

5.10 Thermostats and air temperature control

5.10.1 General requirements

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

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

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

5.10.2 Overheat cut-off device

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

5.10.3 Overheat control device

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

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5.10.4 Overheat cut-off/control devices

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

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

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

5.10.5 Fan delay controls

5.10.5.1 Delayed start

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

5.10.5.2 Delayed shut-down

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

5.10.6 Sensors

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

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

5.11 Gas pressure test points

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

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

5.12 Combustion chamber pressure relief

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

5.13 Facilities for commissioning and testing

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

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5.14 Additional requirements for appliances designed for outdoor installation

5.14.1 General

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

5.14.2 Air inlets

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

5.14.3 Access panels and doors

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

5.14.4 Dimensions of openings

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

5.14.5 Fixing screws

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

6 Operational requirements

6.1 Safety of operation

6.1.1 Soundness

6.1.1.1 Soundness of the gas circuit

The gas circuit shall be sound.

External soundness is assured if, under the conditions specified in 7.3.1.1 the air leakage rate does not exceed 100 cm^3/h, regardless of the number of valves fitted in series or in parallel on the appliance.

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

6.1.1.2.1 Type B_{12}, B_{13}, B_{42} and B_{43} appliances

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

a) of the test flue in the case of Type B_{12} and B_{13} appliances; or

b) of the POCED in the case of Type B_{42} and B_{43} appliances.

6.1.1.2.2 Type B_{14} and B_{44} appliances

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

a) of the test flue in the case of Type B_{14} appliances; or

b) of the POCED in the case of Type B_{44} appliances.

6.1.1.2.3 Type B_{22}, B_{23}, B_{52} and B_{53} appliances

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

a) of the test flue in the case of Type B_{22} and B_{23} appliances; or

b) of the POCED in the case of Type B_{52} and B_{53} appliances.

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

When the appliance is tested under the conditions of 7.3.1.2.4 the air leakage rate shall not exceed 0,5 m^3/h per kW of heat input, with a maximum of 25 m^3/h.

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

When the appliance is tested under the conditions of 7.3.1.2.5 the air leakage rate shall not exceed 0,5 m^3/h per kW of heat input, with a maximum of 25 m^3/h.

6.1.2 Heat inputs

6.1.2.1 Nominal heat input

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

6.1.2.2 Start gas heat input

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

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

6.1.2.3 Effectiveness of gas rate adjusters

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

a) shall not be less than the nominal heat input, under the conditions of Test 1 of 7.3.2.4;

b) shall not exceed the nominal heat input, under the conditions of Test 2 of 7.3.2.4.

6.1.2.4 Effectiveness of the gas regulator

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

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7.3.2.5, when the upstream pressure is varied between the minimum and maximum values stated in 7.1.4 for the reference gases of the category concerned.

6.1.2.5 Effectiveness of the range-rating device

For appliances fitted with a range-rating device, as distinct from a gas rate adjuster, and under the conditions specified in 7.3.2.6:

a) the nominal heat input shall be obtained to within ± 5 % of the nominal heat input stated by the manufacturer with the range-rating device in the position giving the maximum rate;

b) the minimum heat input shall be obtained to within ± 5 % of the minimum heat input stated by the manufacturer with the range-rating device in the position giving the minimum rate.

For appliances of categories I_{2L} and I_{2H} fitted with a range-rating device not distinct from a gas rate adjuster, the minimum and maximum of the manufacturer's declared range of heat input shall be obtained to within ± 5 %.

6.1.2.6 Air/gas ratio controls

6.1.2.6.1 Leakage of non-metallic control tubes

When control tubes are not made of metal or other materials of at least equivalent properties, their disconnection, breakage or leakage shall not lead to an unsafe situation. This implies either locking out or safe operation with no leakage of gas outside the appliance. This requirement is verified under the conditions of 7.3.2.7.1

6.1.2.6.2 Gas/air pressure ratio adjustment

If the gas/air pressure ratio is adjustable, the control shall function when the adjustment is at its extreme limits and the range of pressure ratios achieved shall cover the declared adjustment range when tested in accordance with the requirements of 7.3.2.7.2.

6.1.3 Limiting temperatures

6.1.3.1 The temperature of parts of the appliance which have to be touched during normal use

The surface temperatures of the control knobs and of all the parts to be touched during normal use of the appliance, measured only in the zones intended to be gripped, and under the conditions stated in 7.3.3.1 and 7.3.3.2 shall not exceed the ambient temperature by more than:

a) 35 K for metals;

b) 45 K for porcelain or similar materials;

c) 60 K for plastics.

6.1.3.2 Temperatures of the side walls, the front and the top of the appliance

The temperature of the side walls, front and top of the appliance, except for the surfaces of the draught diverter and of any flue pipe between the case and the draught diverter, shall not exceed the ambient temperature by more than 80 K when measured under the conditions of 7.3.3.1 and 7.3.3.3. This requirement does not apply to those parts of the case within 150 mm of the flue pipe. It also does not apply to those parts of the appliance instrumental in the transmission of heat or parts which are higher than 1,8 m above the level of the floor when the appliance is installed.

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6.1.3.3 Component temperatures

When the appliance is tested under the conditions of 7.3.3.1 and 7.3.3.4 the maximum temperature of the appliance components shall not exceed the maximum temperature specified by the individual component manufacturer.

6.1.3.4 Fan motor winding temperatures

When tested under the conditions of 7.3.3.1 and 7.3.3.5 the maximum temperature rise of the motor windings shall not exceed the maximum temperature rise stated by the motor manufacturer.

6.1.3.5 POCED (Type B_{42}, B_{43}, B_{44}, B_{52}, B_{53}, C_{12} , C_{13} , C_{32} and C_{33} appliances)

When the appliance is tested under the conditions of 7.3.3.6.1, the external temperature of any part of the POCED, which when installed in accordance with the manufacturer's instructions is capable of being less than 25 mm from combustible parts of the fabric of a building, shall not exceed the ambient temperature by more than 50 K.

If, in accordance with the manufacturer's installation instructions, the POCED is required to be enclosed within another duct, a sleeve or insulation when it passes through a combustible wall or ceiling, the external temperatures of this duct, sleeve or insulation shall not exceed the ambient temperature by more than 50 K under the conditions of 7.3.3.6.2.

6.1.4 Ignition, cross-lighting, flame stability

6.1.4.1 Ignition and cross-lighting

6.1.4.1.1 All appliances (still air conditions)

Under the test conditions described in 7.3.4.1.1.1, correct and smooth ignition and cross-lighting shall be assured.

When, under the test conditions described in 7.3.4.1.1.2, the gas rate of any ignition burner is reduced to the minimum required to hold open the gas supply to the main burner, correct and smooth ignition of the main burner shall be assured.

6.1.4.1.2 Appliances where the start gas is taken from between the two main burner gas valves

Where the gas line is designed such that the gas supply to the start-gas burner is taken from between the two main gas valves, and means is not provided to prove closure of the downstream main shut-off valve prior to ignition, then under the conditions of test described in 7.3.4.1.2, it shall be verified that ignition of the start gas does not give rise to a hazardous situation.

6.1.4.1.3 Appliances with automatic ignition

Under the test conditions described in 7.3.4.1.3, the system shall be safe on ignition. In addition, the appliance shall not sustain any damage likely to affect its safe operation.

6.1.4.1.4 Special conditions

6.1.4.1.4.1 Type B_{12}, B_{13}, B_{42} and B_{43} appliances

Under the conditions of 7.3.4.1.4.1, ignition of any ignition burner, ignition of the main burner and complete cross-lighting of the main burner shall be correct.

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6.1.4.1.4.2 Type B_{14} and B_{44} appliances

When an appliance having a manually ignited ignition burner is tested under the conditions of 7.3.4.1.4.2, ignition of the ignition burner shall be correct even when the outlet of the flue system is completely blocked. Ignition and cross-lighting of the main burner shall be assured up until the gas supply to the main burner is shut off by the air proving device.

When an appliance having automatic ignition is tested under the conditions of 7.3.4.1.4.2, ignition of the ignition burner, ignition and cross-lighting of the main burner shall be assured up until the gas supply to the main burner, and ignition burner, is shut off by the air proving device.

6.1.4.1.4.3 Type C_{12} and C_{13} appliances

Under the conditions of 7.3.4.1.4.3, ignition of any ignition burner, ignition of the main burner and complete cross-lighting of the main burner shall be correct.

6.1.4.1.4.4 Type C_{32} and C_{33} appliances

Under the conditions of 7.3.4.1.4.4, ignition of any ignition burner, ignition of the main burner and complete cross-lighting of the main burner shall be correct.

6.1.4.2 Flame stability

6.1.4.2.1 All appliances (still air conditions)

Under the test conditions described in 7.3.4.2.1, the flames shall be stable. A slight tendency to lift at the moment of ignition is acceptable but the flames shall be stable during normal operation.

6.1.4.2.2 Special conditions

6.1.4.2.2.1 Type B_{12}, B_{13}, B_{42} and B_{43} appliances

Under the conditions of 7.3.4.1.4.1 and 7.3.4.2.2, the main burner and any ignition burner flames shall remain stable and any flame supervision device shall continue to function normally.

6.1.4.2.2.2 Type B_{14} and B_{44} appliances

Under the conditions of 7.3.4.1.4.2, the main burner and any ignition burner flames shall remain stable up until the gas supply to the main burner, and where appropriate the ignition burner, is shut off by the air proving device.

6.1.4.2.2.3 Type C_{12} and C_{13} appliances

Under the conditions of 7.3.4.1.4.3, the main burner and any ignition burner flames shall remain stable and any flame supervision device shall continue to function normally.

6.1.4.2.2.4 Type C_{32} and C_{33} appliances

Under the conditions of 7.3.4.1.4.4, the main burner and any ignition burner flames shall remain stable and any flame supervision device shall continue to function normally.

6.1.4.2.2.5 Appliances designed for outdoor installation

Under the conditions of 7.3.4.2.3.1, the main burner and any ignition burner flames shall remain stable and any flame supervision device shall continue to function normally.

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For appliances which may be installed other than with a vertical flue, under the conditions of 7.3.4.2.3.2, flame lift or light back shall not occur at the main burner and any ignition burner.

6.1.5 Combustion

6.1.5.1 All appliances (still air conditions)

The CO concentration in the dry air-free combustion products shall not exceed:

a) 0,10 % when the appliance is supplied with the reference gas under the conditions of 7.3.5.3 a);

b) 0,20 % when the appliance is supplied with the reference gas under the conditions of 7.3.5.3 b);

c) 0,20 % when the appliance is supplied with the incomplete combustion gas under the conditions of 7.3.5.3 c);

d) 0,20 % when the appliance is supplied with the reference gas under the conditions of 7.3.5.3 d); in addition, the appliance shall ignite and continue to operate;

e) 0,20 % when the appliance is supplied with the reference gas under the conditions of 7.3.5.3 e).

The test methods are specified in 7.3.5.1 and 7.3.5.2 respectively.

6.1.5.2 Special conditions

6.1.5.2.1 Type B_{12}, B_{13}, B_{42} and B_{43} appliances

The CO concentration of the dry air-free combustion products shall not exceed 0,10 % when the appliance is supplied with reference gas under the conditions of 7.3.5.4.1.

6.1.5.2.2 Type B_{14} and B_{44} appliances

The CO concentration of the dry air-free combustion products shall not exceed 0,10 % when the appliance is supplied with reference gas under the conditions of 7.3.5.4.2.

6.1.5.2.3 Type B_{22}, B_{23}, B_{52} B_{53} , C_{12} , C_{13} , C_{32} , C_{33} , C_{62} and C_{63} appliances

The CO concentration of the dry air-free combustion products shall not exceed 0,10 % when the appliance is supplied with reference gas under the conditions of 7.3.5.4.3.

6.1.5.2.4 Type B_{22}, B_{23}, B_{52} and B_{53} appliances

The CO concentration of the dry air-free combustion products shall not exceed 0,20 % when the appliance is supplied with reference gas under the conditions of 7.3.5.4.4.

In addition, under the conditions described in 7.3.5.4.4 a) and 7.3.5.4.4 c) at the point of shut-off, the increase in pressure at the outlet of the installation shall not be less than 0,75 mbar and 0,5 mbar respectively.

6.1.5.2.5 Type C_{12} and C_{13} appliances

The CO concentration of the dry air-free combustion products shall not exceed 0,20 % when the appliance is supplied with reference gas under the conditions of 7.3.5.4.5.

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6.1.5.2.6 Type C_{32} and C_{33} appliances

The CO concentration of the dry air-free combustion products shall not exceed 0,20 % when the appliance is supplied with reference gas under the conditions of 7.3.5.4.6.

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

6.1.5.2.7.1 Operation under recirculation of combustion products

The CO concentration of the dry air-free combustion products shall not exceed 0,20 % when the appliance is supplied with reference gas under the conditions of 7.3.5.4.7.1.

6.1.5.2.7.2 Operation at minimum combustion air flow

When the appliance is supplied with reference gas under the conditions of 7.3.5.4.7.2:

a) the CO concentration of the dry air-free combustion products shall not exceed 0,20 %;

b) the pressure drop between the combustion air inlet duct and the drop specified by the manufacturer which corresponds to the maximum resistance of the duct system.

6.1.5.2.7.3 Operation under suction

When the appliance is supplied with reference gas under the conditions of 7.3.5.4.7.3, the CO concentration of the dry air-free combustion products shall not exceed 0,20 %.

6.1.5.2.8 Appliances designed for outdoor installation

When the appliance is supplied with reference gas under the conditions of 7.3.5.4.8, the CO concentration of the dry air-free combustion products shall not exceed 0,20 %.

6.1.5.3 Other pollutants

Under the test and calculation conditions of 7.3.5.5 the NO_x concentration in the dry air-free products of combustion shall not exceed 260 mg/kWh or the manufacturer's declared maximum concentration, whichever is the lower. However, for appliances intended to use only third family gases, the limit value is multiplied by a factor of 1,60.

For appliances intended to use propane only, the limit value is multiplied by a factor of 1,50.

6.1.6 Overheat cut-off device

Under the conditions of 7.3.6.1:

a) the gas supply to the burner shall be cut off to prevent:

   1) a hazardous condition;

   2) any damage to the appliance;

   3) either:

      i) the average temperature of the air at the appliance outlet exceeding 100 °C; or

ii) for appliances with multiple outlets and those intended to be installed with the base of the appliance more than 2,5 m from the floor level, whether or not they are fitted with multiple outlets, the average temperature at any one outlet exceeding 125 °C;

b) the overheat control shall not operate during the normal cyclic action of the appliance (e.g. as a consequence of the operation of a room thermostat or other control);

c) flame stability shall be satisfactory throughout the test.

In addition, when tested in accordance with the method described in 7.3.6.2, the gas supply to the burner shall be cut off to prevent:

d) a hazardous condition;

e) any damage to the appliance.

6.1.7 Heat exchanger thermal cycling

When tested in accordance with the requirements of 7.3.7:

a) at the end of each 2 000 cycles of operation, the burner shall operate correctly when the air distribution fan is operating and, on visual examination of the heat exchanger (without removing it from the appliance) there shall be no split, opening or perforation in the heat exchanger which is visible to the naked eye;

b) at the end of 5 000 cycles of operation, there shall be no split, opening or perforation in the heat exchanger which is visible to the naked eye;

c) at the end of the test there shall be no signs of corrosion that will adversely affect the life of any POCED.

6.1.8 Effectiveness of the pre-purge

When tested under still air conditions as specified in 7.3.8, the pre-purge (see 5.4.2.2) shall be such that the volume of air available for combustion be at least five times greater than the volume of the combustion circuit.

6.1.9 Weather resistance

When tested under the conditions of 7.3.9, an appliance designed for outdoor installation shall continue to function normally, with the main burner and ignition burner(s) operating normally.

In addition, with access doors or panels in place, no water shall accumulate in any part of the appliance such that normal functioning is affected.

6.2 Efficiency

The efficiency based on the net calorific value determined at the nominal heat input shall not be less than 84 % when measured in accordance with the requirements of 7.4.1 to 7.4.5.

If the appliance has a modulating or high/low control, when measured in accordance with the requirements of 7.4.6, the efficiency based on the net calorific value with the appliance adjusted to give the minimum rate shall be such that:

$$\eta_{\min} \geq \frac{(84+\eta_n)}{2} - \frac{10(Q_n - Q_{\min})}{Q_n} \quad \%$$

where

η_{min} is the net calorific value with the appliance adjusted to give the minimum rate;

η_n is the net calorific value determined at the nominal heat input;

Q_n is the heat input at nominal rate;

Q_{min} is the heat input at minimum rate.

Under no circumstances shall η_{min} be < 79 %.

7 Test methods

7.1 General

7.1.1 Characteristics of test gases: reference and limit gases

Appliances are intended for use with gases of different qualities. One of the aims of this standard is to check that the performance of an appliance is satisfactory for each family or group of gases for which it is designed and for the pressures for which it is designed, if necessary using the adjusting devices.

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

The characteristics of the reference and limit gases are given in Tables 6 and 7. The values in Table 3, measured and expressed at 15 °C, are derived from EN ISO 6976.

7.1.2 Conditions for preparation of the test gases

The composition of gases used for the tests shall be as near as possible to those given in Table 6.

For the constitution of the gases:

a) the Wobbe number of the gas used shall be within ± 2 % of the value in Table 6 (this tolerance includes the errors of the measuring equipment);

b) the gases used to constitute the mixtures shall have minimum degrees of purity as:

— nitrogen N_2 99 %;

— hydrogen H_2 99 %;

— methane CH_4 95 % with a total concentration of H_2, CO and O_2 below 1 %;

— propene C_3H_6 95 % and a total concentration of N_2 and CO_2 below 2 %;

— propane C_3H_8 95 %;

— butane[4)] C_4H_{10} 95 %.

4) Any mixture of iso-butane and n-butane can be used.

However, these conditions are not obligatory for each of the components if the final mixture has a composition identical to that of a mixture which would have been made from components satisfying the preceding conditions. It is acceptable, in order to make up a mixture, to start with a gas already containing, in suitable proportions, several components of the final mixture.

For gases of the second family:

c) for the tests carried out with reference gases G 20 or G 25, a gas belonging respectively to either Group H or Group L or Group E, may be used even if its composition does not satisfy the above conditions, provided that after the addition of either propane or nitrogen as appropriate, the final mixture has a Wobbe index within ± 2 % of the value given in Table 6 for the corresponding reference gas;

d) for preparation of the limit gases, another gas may be used as the base gas instead of methane:

   1) for limit gases G 21, G 222, and G 23, a natural gas of Group H may be used;

   2) for limit gases G 27 and G 231, a natural gas of Group H or of Group L or of Group E may be used;

   3) for the limit gas G 26, a natural gas of Group L may be used.

In all cases the final mixture obtained by adding propane or nitrogen shall have a Wobbe index within ± 2 % of the value given in Table 6 for the corresponding limit gas and the hydrogen concentration of the final mixture shall be as given in Table 6.

Table 6 — Test gas characteristics[a] (gas dry at 15 °C and 1 013,25 mbar)

Gas family and group	Test gases	Designation	Composition volume % [e]	W_i MJ/m^3	H_i MJ/m^3	W_s MJ/m^3	H_s MJ/m^3	d
Gases of the first family[b]								
Group a	Reference gas Incomplete, combustion flame lift and Sooting limit gases	G 110	CH_4 = 26 H_2 = 50 N_2 = 24	21,76	13,95	24,75	15,87	0,411
	Light back limit gas	G 112	CH_4 = 17 H_2 = 59 N_2 = 24	19,48	11,81	22,36	13,56	0,367
Gases of the second family								
Group H	Reference gas	G 20	CH_4 = 100	45,67	34,02	50,72	37,78	0,555
	Incomplete combustion Sooting limit gas	G 21	CH_4 = 87 C_3H_8 = 13	49,60	41,01	54,76	45,28	0,684
	Light back limit gas	G 222	CH_4 = 77 H_2 = 23	42,87	28,53	47,87	31,86	0,443
	Flame lift limit gas	G 23	CH_4 = 92,5 N_2 = 7,5	41,11	31,46	45,66	34,95	0,586
Group L	Reference gas and Light back limit gas	G 25	CH_4 = 86 N_2 = 14	37,38	29,25	41,52	32,49	0,612
	Incomplete combustion and Sooting limit gas	G 26	CH_4 = 80 C_3H_8 = 7 N_2 = 13	40,52	33,36	44,83	36,91	0,678
	Flame lift limit gas	G 27	CH_4 = 82 N_2 = 18	35,17	27,89	39,06	30,98	0,629
Group E	Reference gas	G 20	CH_4 = 100	45,67	34,02	50,72	37,78	0,555
	Incomplete combustion and Sooting limit gas	G 21	CH_4 = 87 C_3H_8 = 13	49,60	41,01	54,76	45,28	0,684
	Light back limit gas	G 222	CH_4 = 77 H_2 = 23	42,87	28,53	47,87	31,86	0,443
	Flame lift limit gas	G 231	CH_4 = 85 N_2 = 15	36,82	28,91	40,90	32,11	0,617
Gases of the third family[c]								
Third family and Groups 3B/P and 3B	Reference gas, Incomplete combustion and Sooting limit gas	G 30	nC_4H_{10} = 50 iC_4H_{10} = 50	80,58	116,09	87,33	125,81	2,075
	Flame lift limit gas	G 31	C_3H_8 = 100	70,69	88,00	76,84	95,65	1,550
	Light back limit gas	G 32	C_3H_6 = 100	68,14	82,78	72,86	88,52	1,476
Group 3P	Reference gas, Incomplete combustion Sooting[d] and flame lift limit gas	G 31	C_3H_8 = 100	70,69	88,00	76,84	95,65	1,550
	Light back and Sooting limit gas[d]	G 32	C_3H_6 = 100	68,14	82,78	72,86	88,52	1,476

[a] For gases used nationally or locally, see A.4.

[b] For other groups, see A.4.

[c] Also see Table 7.

[d] See 7.1.2, footnote 4).

[e] Also see Annex A.

Table 7 — Calorific values of third family test gases

Test gas designation	H_i MJ/kg	H_s MJ/kg
G 30	45,65	49,47
G 31	46,34	50,37
G 32	45,77	48,94

7.1.3 Practical application of test gases

7.1.3.1 Choice of test gases

Gases required for the tests described in 7.3.2, 7.3.4 and 7.3.5 shall be as specified in 7.1.1 and made up in accordance with the requirements of 7.1.2.

For the tests described in other clauses, it is permissible, in order to facilitate testing, to replace the reference gas by a gas actually distributed, provided that its Wobbe index is within ± 5 % of that of the reference gas.

When an appliance can use gases of several groups or families, test gases selected from those listed in Table 3 and in accordance with the requirements of 7.1.5.1, are used. The selected gases, for each appliance category, are listed in Table 8.

Table 8 — Test gases corresponding to the appliance categories

Category	Reference gas	Incomplete combustion limit gas	Light back limit gas	Lift limit gas	Sooting limit gas
I_{2H}	G 20	G 21	G 222	G 23	G 21
I_{2L}	G 25	G 26	G 25	G 27	G 26
I_{2E}, I_{2E+}	G 20	G 21	G 222	G 231	G 21
$I_{3B/P}$, I_{3+}	G 30	G 30	G 32	G 31	G 30
I_{3P}	G 31	G 31	G 32	G 31	G 31, G 32
II_{1a2H}	G 110, G 20	G 21	G 112	G 23	G 21
$II_{2H3B/P}$, II_{2H3+}	G 20, G 30	G 21	G 222, G 32	G 23, G 31	G 30
II_{2H3P}	G 20, G 31	G 21	G 222, G 32	G 23, G 31	G 31, G 32
$II_{2L3B/P}$	G 25, G 30	G 26	G 32	G 27, G 31	G 30
II_{2L3P}	G 25, G 31	G 26	G 32	G 27, G 31	G 31, G 32
$II_{2E3B/P}$, II_{2E+3+}	G 20, G 30	G 21	G 222, G 32	G 231, G 31	G 30
II_{2E+3P}	G 20, G 31	G 21	G 222, G 32	G 231, G 31	G 31, G 32
NOTE Tests with the limit gases are carried out with the injector and adjustment corresponding to the reference gas of the group to which the limit gas used for the test belongs.					

7.1.3.2 Conditions of supply and adjustment of the burners

7.1.3.2.1 Initial adjustment of appliance

Before all tests that are required to be carried out, the appliance shall be fitted with the appropriate equipment (e.g. injector(s)) corresponding to the gas family or gas group to which the specified test gas belongs (see Table 5)). Any gas rate adjusters are set in accordance with the manufacturer's instructions using the appropriate reference gas(es) (see 7.1.5.1) and the corresponding normal pressure(s) given in 7.1.4.

This initial adjustment of the appliance is subject to the limitations given in 5.1.1.

7.1.3.2.2 Supply pressures

Except where an adjustment of the supply pressure is necessary (as described in 7.1.3.2.3 and 7.1.3.2.4) the normal, minimum and maximum supply pressures to be used for testing purposes shall be in accordance with the requirements given in 7.1.4.

Unless otherwise specified, the initial adjustment of the appliance is not altered.

7.1.3.2.3 Adjustment of heat inputs

For tests requiring adjustment of the burner to the nominal or another specified heat input, it shall be ensured that the pressure upstream of the injectors is such that the heat input obtained is within ± 2 % of that specified (by altering the preset adjusters or the appliance regulator, if adjustable, or the appliance supply pressure).

The specified heat input shall be calculated in accordance with the requirements of 7.3.2 and with the appliance supplied with the appropriate reference gas(es).

7.1.3.2.4 Corrected pressures

Where, in order to obtain the nominal heat input within ± 2 %, it is necessary to use a supply pressure, p, different from the normal pressure p_n, then those tests normally carried out at the minimum or maximum pressures p_{min} and p_{max} shall be carried out at the corrected pressures p' and p''.

The corrected test pressures are calculated using Equation (1).

$$\frac{p'_{\min}}{p_{\min}} = \frac{p'_{\max}}{p_{\max}} = \frac{p}{p_n} \tag{1}$$

7.1.4 Test pressures

The test pressures (i.e. the pressures required at the gas inlet connection of the appliance) are given in Tables 9 and 10.

These pressures and the corresponding injectors are used in accordance with the special national conditions given in Annex A, for the country in which the appliance is to be installed.

Table 9 — Test pressures where no pressure couple exists [a)]

Appliance categories having as index	Test gas	p_n mbar	p_{min} mbar	p_{max} mbar
first family: 1a	G 110, G 112	8	6	15
second family: 2H	G 20, G 21, G 222, G 23	20	17	25
second family: 2L	G 25, G 26, G 27	25	20	30
second family: 2E	G 20, G 21, G 222, G 231	20	17	25
third family: 3B/P	G 30, G 31, G 32	29[b]	25	35
	G 30, G 31, G 32	50	42,5	57,5
third family: 3P	G 31, G 32	37	25	45
	G 31, G 32	50	42,5	57,5

a) For test pressures corresponding to gases distributed nationally or locally, refer to Table A.5.

b) Appliances of this category may be used, without adjustment, at the specified supply pressures of 28 mbar to 30 mbar.

Table 10 — Test pressures where a pressure couple exists

Appliance categories carrying as index	Test gas	p_n mbar	p_{min} mbar	p_{max} mbar
second family: 2E+	G 20, G 21, G 222	20	17 [b]	25
	G 231	(25) [a]	17 [b]	30
third family: 3+ (28-30/37 couple)	G 30	29 [c]	20	35
	G 31, G 32	37	25	45
third family: 3+ (50-67 couple)	G 30	50	42,5	57,5
	G 31, G 32	67	50	80

a This pressure corresponds to the use of low Wobbe index gas but in principle no test is carried out at this pressure.
b See Annex I.
c Appliances of this category may be used, without adjustment, at the specified supply pressures of 28 mbar to 30 mbar.

7.1.5 Test procedures

7.1.5.1 Tests requiring the use of reference gases

The tests, specified in 7.3.2, 7.3.4 and 7.3.5 shall be carried out with each of the reference gases appropriate to the country in which the appliance is to be installed, according to the information given in A.1.

The other tests are carried out with only one of the reference gases of the appliance category (see 7.1.1) at one of the normal test pressures required in 7.1.4 for the selected reference gas, hereafter referred to as the reference gas.

However, the test pressure shall be one of those stated by the manufacturer and the appliance shall be fitted with the appropriate injector(s).

7.1.5.2 Tests requiring the use of limit gases

These tests shall be carried out with the limit gases appropriate to the appliance category (see Table 8) and with the injector(s) and the adjustments corresponding to the reference gas of the group, or family, to which each limit gas belongs.

7.1.6 General test conditions

7.1.6.1 to 7.1.6.7 are generally applicable except where otherwise specified.

7.1.6.1 Test room

The appliance is installed in a well-ventilated, draught-free room which has an ambient temperature of 20 °C ± 5 °C. A wider temperature range is permissible provided that the effect on the test results can be taken into account.

7.1.6.2 Evacuation of the products of combustion

7.1.6.2.1 Type B_{12} , B_{13} , B_{42} and B_{43} appliances

Appliances with a vertical flue outlet shall be tested with:

a) a 1 m vertical secondary flue of the same nominal diameter of the flue outlet in the case of Type B_{12} and B_{13} appliances; or

b) in the case of Type B_{42} and B_{43} appliances, with a vertical POCED as supplied or specified by the appliance manufacturer, having the maximum equivalent resistance specified in the manufacturer's instructions.

Appliances with a horizontal flue outlet shall be fitted in accordance with the manufacturer's instructions; these shall include the maximum length of horizontal run and the method of adaptation to a vertical flue; thereafter, the vertical flue shall be fitted in accordance with the requirements of 7.1.6.2.1 a).

In the case of Type B_{12} and B_{13} appliances the vertical flue shall be made from sheet metal having a metal thickness not less than 1 mm. Unless otherwise stated in the test method, the flue shall be uninsulated.

7.1.6.2.2 Type B_{14}, B_{22} and B_{23} appliances

Appliances intended to be fitted to a flue having a wall termination shall be tested with a flue having the same diameter as the flue outlet and of the manufacturer's maximum equivalent resistance.

Appliances intended to be fitted to a vertical flue:

a) with a vertical flue outlet shall be fitted with 1 m of vertical flue, or the minimum length specified by the manufacturer, having the same diameter as the flue outlet;

b) with a horizontal flue outlet shall be fitted in accordance with the manufacturer's instructions; these shall include the maximum length of horizontal run and the method of adaptation to a vertical flue; thereafter the vertical flue shall be fitted in accordance with the requirements of 7.1.6.2.2 a).

The flue shall be made from sheet metal having a metal thickness not exceeding 1 mm. Unless otherwise stated, the flue shall be uninsulated.

7.1.6.2.3 Type B_{44}, B_{52} and B_{53} appliances

Appliances shall be tested with the POCED as supplied or specified in the appliance manufacturer, having the maximum equivalent resistance specified in the manufacturer's instructions.

7.1.6.2.4 Type C_{12} and C_{13} appliances

Except where otherwise stated, the tests are carried out using the air supply duct and combustion products duct (POCED) arrangement having the maximum equivalent resistance specified in the manufacturer's instructions. These shall be supplied by the manufacturer. Any terminal guard is not fitted. If necessary, an external telescopic duct may be sealed in accordance with the manufacturer's instructions.

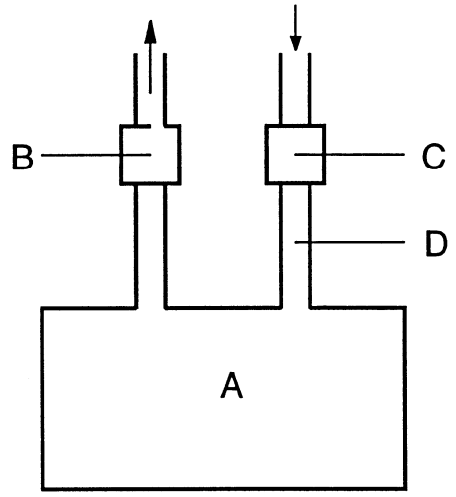
7.1.6.2.5 Type C_{32} and C_{33} appliances

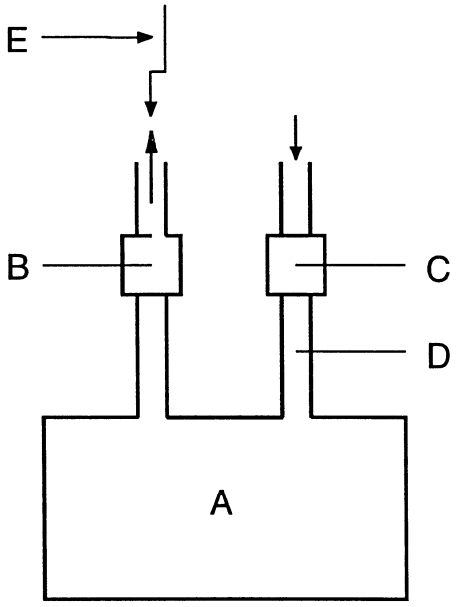
Except where otherwise stated, the tests are carried out using air supply duct and combustion products duct (POCED) arrangements having the minimum and maximum equivalent resistance specified in the manufacturer's instructions. These shall be supplied by the manufacturer.

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

Except where otherwise stated, the tests are carried out with the appliance connected to a test duct system for the combustion air inlet and the combustion products outlet, each test duct length is 1 m (see Figure 1).

The combustion products outlet shall be equipped with an adjustable restrictor (see Figure 2) at the outlet (see Figure 1).



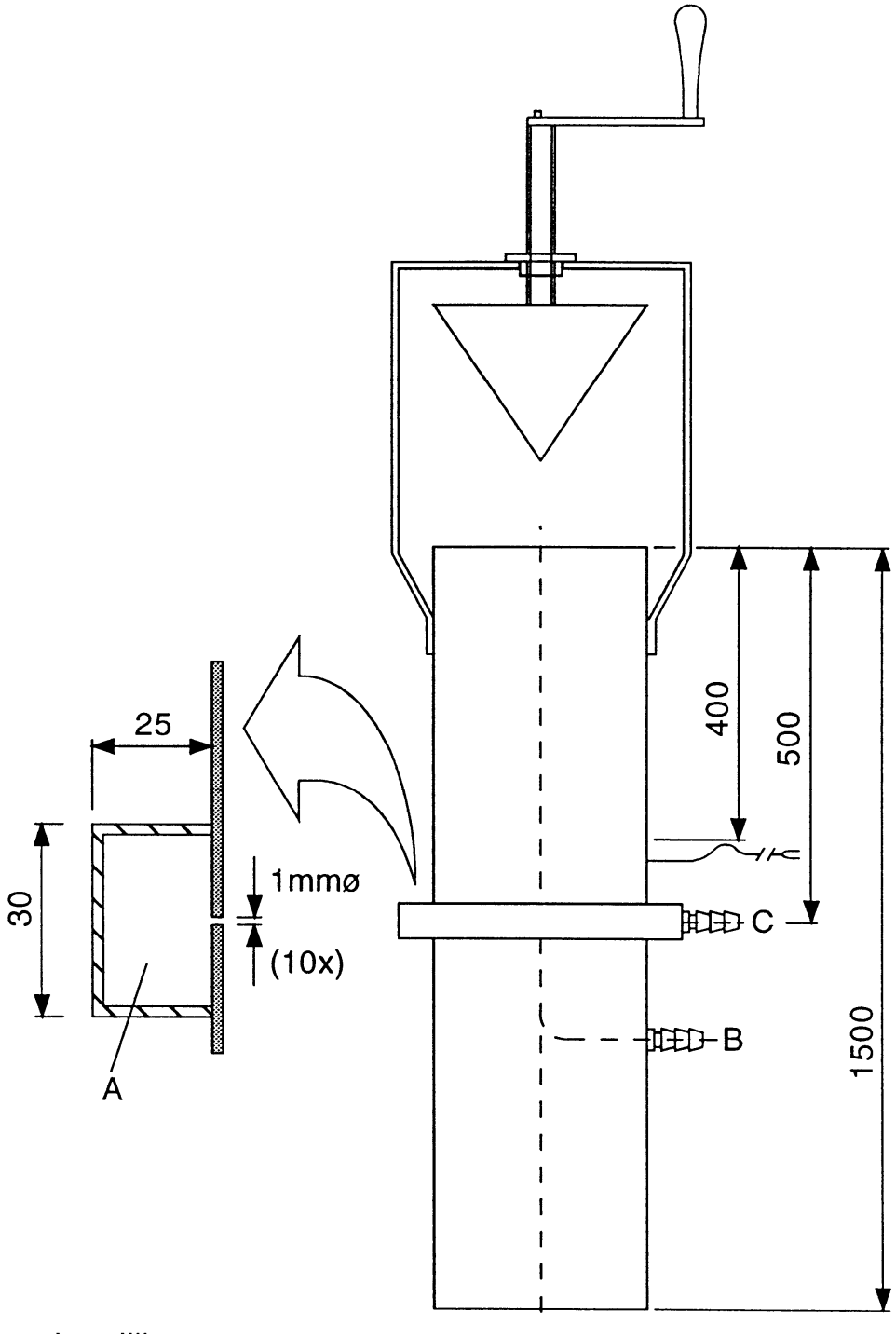


Key

A Appliance
B Pressure test point
C Pressure test point
D CO_2 probe
E Restrictor

Figure 1 — C_6 test duct system

All dimensions in millimetres



Key

A Ring chamber for static pressure measurement with 10 holes of Ø 1 mm
B Flue gas sample point
C Static pressure test point

Figure 2 — C_6 test duct system — Restrictor detail

7.1.6.3 Test installation

The appliance shall be installed in accordance with the manufacturer's instructions, with particular reference to minimum declared clearances around the appliance.

7.1.6.4 Influence of thermostats

Precautions shall be taken to prevent thermostats or other controls from operating and affecting the gas rate, unless this is necessary for the test.

7.1.6.5 Electrical supply

The appliance is connected to an electrical supply at the nominal voltage, except where otherwise stated in the clause concerned.

7.1.6.6 Range rated appliances

For appliances that are designed to be range rated, all tests are carried out at their maximum and minimum nominal heat inputs.

7.1.6.7 Modulating and high/low operation

For appliances with modulating or high/low operation, the tests are carried out at the nominal heat input unless otherwise stated in the particular test.

7.2 Construction and design

7.2.1 Automatic burner control systems (manually operated devices)

The appliance is installed as described in 7.1.6 and supplied with an appropriate reference gas (see Table 8) at the nominal heat input in accordance with the requirements of 7.1.3.2.1. The start device is manually operated ten times (i.e. once every 5 s).

It is checked that the requirements of 5.2.9.2.2 are met.

7.2.2 Ignition opening time

With the appliance in the cold condition, the gas supply is turned on and the ignition burner is lit 20 s after ignition of the ignition burner, manual intervention is withdrawn and it is checked that the ignition burner remains alight.

It is checked that the requirements of 5.5.1.1 are met.

7.2.3 Extinction safety time

With the appliance in the running condition, isolate the gas supply to the main burner. Measure the time between when the main burner is extinguished and the signal for valve closure is given.

It is checked that the requirements of 5.5.1 and 5.5.2 are met.

7.2.4 Safety time

Isolate the gas supply to the appliance. Attempt to light the appliance in accordance with the manufacturer's instructions, and measure the time between the signals for valve opening and closure. Compare this time with the manufacturer's specified safety time.

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For appliances with automatic control systems which allow recycling, the automatic control shall go to non-volatile lock-out after the number of recycling attempts specified by the manufacturer.

It shall be checked that the requirements of 5.6.1.2, 5.6.2, 5.7.1.2 and 5.7.2.2 are met.

7.3 Safety of operation

7.3.1 Soundness

7.3.1.1 Soundness of the gas circuit

For appliances using first and/or second family gases only, the tests are carried out with an air inlet pressure of 50 mbar; the inlet valve is however tested with an air pressure of 150 mbar. For appliances using third family gases, all the tests are carried out with an air pressure of 150 mbar.

Any regulator may be locked in its maximum open position to avoid damage.

Compliance with the requirements of 6.1.1.1 is checked with:

a) each valve in the main gas supply is tested in turn for soundness in its closed position, all other valves being open; and

b) with all gas valves open and the injectors for any ignition burner and main burner sealed, or, alternatively, with the injector(s) removed and the hole(s) sealed.

Where the design of any ignition burner is such that its gas outlet cannot be sealed, this test is carried out with the gasway to the ignition burner sealed at a convenient place. In this case an additional test is also carried out, using soap solution, to verify that there is no leakage from the gasway downstream of the previously tested section when the ignition burner is operating at its normal working pressure.

For the determination of the leakage rate a volumetric method is used which gives a direct reading of the leakage rate and which is of such accuracy that the error in its determination does not exceed 0,01 dm^3/h.

These tests are carried out first with the appliance as delivered and again, on completion of all the tests in the standard, after any assembly in the gas circuit that has a gas-tight joint whose removal is provided for in the manufacturer's instructions has been removed and replaced five times.

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

7.3.1.2.1 Type B_{12}, B_{13}, B_{42} and B_{43} appliances

The appliance is installed as described in 7.1.6 and connected to a flue as described in 7.1.6.2. The test is carried out with one of the reference gases for the category concerned at the nominal heat input under still air and draught free conditions.

Possible leaks are looked for with a dew-point plate. This is carried out as described in 7.3.1.2.1.1 and 7.3.1.2.1.2 below.

7.3.1.2.1.1 Apparatus

Suitable dew-point plates are:

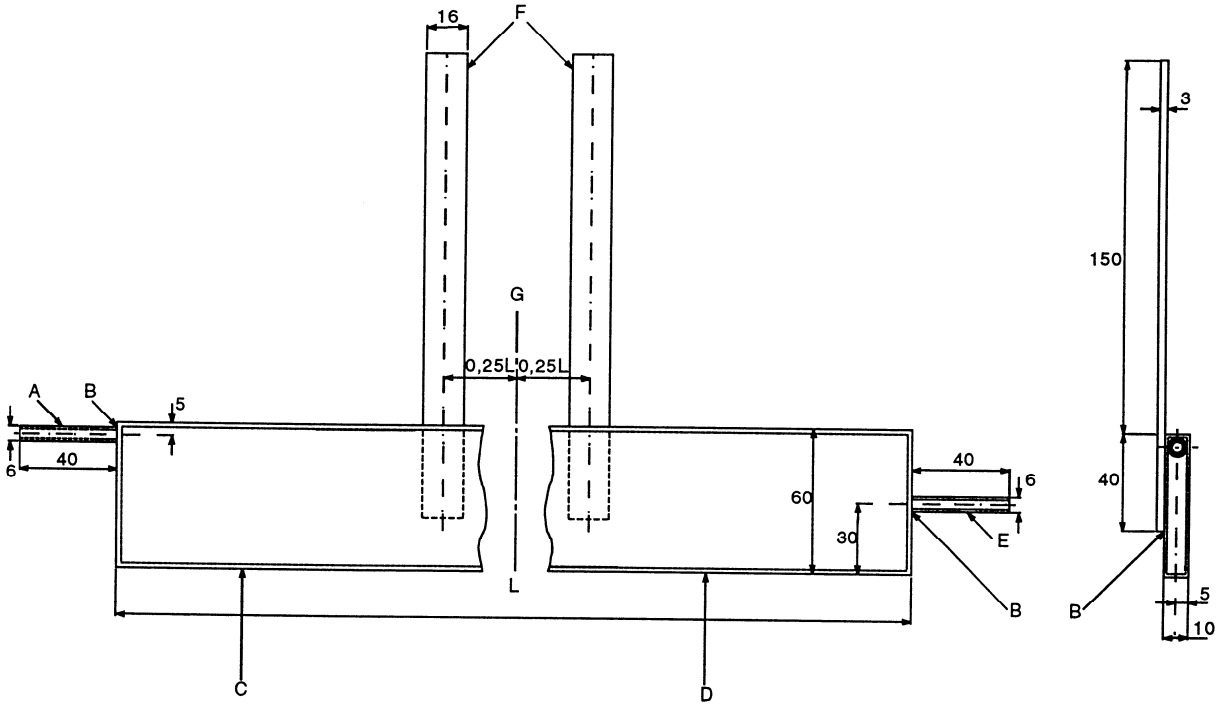
a) a chromium or rhodium plated, water cooled plate of rectangular cross section (see Figure 3). The overall length of the plate required is dependent upon the appliance design; or

b) a chromium or rhodium plated, water cooled tube of circular or other similar suitable cross section, approximately 12 mm diameter.

An essential characteristic of the detector is that it shall not affect the appliance in any way so as to cause leakage when it is in position; it may, therefore, have to be formed to match the shape of the area under consideration. Another requirement is that it shall not be placed so that it effectively extends the surface under test.

The detector shall be polished, but not with metal polishes containing anti-misting materials, and its surface shall be chemically degreased.

All dimensions in millimetres



Key

A Water outlet
B Braze
C 1 mm thick hard brass rhodium plated
D This surface is to be highly polished and free from wrinkles
E Water inlet
F Brass, dull nickel plated

Figure 3 — Leakage indicator

7.3.1.2.1.2 Method

Position the detector such that it will detect any leakage from the surface under test, and fix it in that position.

Allow water to flow from a constant head device through the spillage detector at approximately 90 l/h and adjust the inlet temperature of the water to 11 °C ± 0,5 °C above the dew point of the surrounding air. Turn the appliance on under the conditions specified in 7.3.1.2.1 above. After operating the appliance for 10 min starting from the cold condition, check the surface of the detector for condensation. Condensation on the detector indicates leakage of products. However, short duration "puffs" of condensation, provided that there are at least 5 s intervals between each "puff", shall be ignored.

The condensation is best seen by illuminating the underside of the detector with a bright lamp and making observations from one side at glancing incidence along the length of the detector. It is advantageous to position a black surface so that it is reflected in the polished surface of the detector.

In doubtful cases, however, it is recommended that leaks should be found with a sampling probe connected to a CO_2 analyzer. Any instrument used shall be sensitive to a concentration of 0,01 % CO_2. An increase in the CO_2 level above the ambient of more than 0,05 % shall be regarded as unsatisfactory. The method of sampling used shall not disturb the normal flow of products of combustion.

7.3.1.2.2 Type B_{14} and B_{44} appliances

The appliance is installed as described in 7.1.6 and connected to a flue as described in 7.1.6.2. The test is carried out with one of the reference gases for the category concerned at the nominal heat input after operating the appliance for 10 min, starting from the cold condition, under still air and draught free conditions.

Under these test conditions, the flue outlet is progressively restricted until the main burner and, where appropriate, the ignition burner is shut off by the action of the air proving device. At the point of shut off, the increase in static pressure, measured immediately before the flue outlet, shall not be less than:

a) 0,5 mbar for an appliance connected to a vertical flue; or

b) 0,75 mbar for an appliance connected to a flue having a wall termination.

Possible leaks are searched for using a dew-point plate (see 7.3.1.2.1.1 and 7.3.1.2.1.2).

7.3.1.2.3 Type B_{22}, B_{23} , B_{52} and B_{53} appliances

The appliance is installed as described in 7.1.6 and connected to a flue having the maximum equivalent resistance. The test is carried out with one of the reference gases for the category concerned at the nominal heat input after operating the appliance for 10 min, starting from the cold condition, under still air and draught free conditions.

Possible leaks are looked for with a dew-point plate (see 7.3.1.2.1.1 and 7.3.1.2.1.2).

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

The appliance is installed as described in 7.1.6 and connected to a flue as described in 7.1.6.2. The terminal is sealed, any lighting door is closed and the gas inlet to the main burner and any ignition burner is blocked.

Air is passed into the appliance and the air flow rate is noted when the pressure inside the appliance is steady at 0,5 mbar above the atmospheric pressure.

NOTE A convenient method of testing the appliance is to enclose the terminal in a plastic bag into which an air entry pipe and tube connected to a pressure gauge can be fitted.

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

The appliance is tested as described in 7.3.1.2.4 but without the combustion air supply and combustion products evacuation ducts fitted.

7.3.2 Heat inputs

7.3.2.1 General

For the purposes of this standard all heat inputs are determined from the volumetric rate (V_o) or mass rate (M_o) which relate to the rate obtained with reference gas under reference test conditions (dry gas, 15 °C, 1 013,25 mbar). The heat input (Q_o) in kW is given by:

Q_o = 0,278 M_o x H_s; or

Q_o = 0,278 M_o x H_i; or

Q_o = 0,278 V_o x H_s; or

Q_o = 0,278 V_o x H_i.

where

M_o is the mass input in kg/h obtained at reference conditions;

V_o is the volume input in m^3/h obtained at reference conditions;

H_i is the net calorific value of the reference gas in MJ/kg or in MJ/m^3 (dry gas, 15 °C, 1 013,25 mbar), as appropriate;

H_s is the gross calorific value of the reference gas MJ/kg or MJ/m^3 (dry gas, 15 °C, 1 013,25 mbar), as appropriate.

The mass and volumetric flow rates correspond to a measurement and to a flow of reference gas, under reference conditions, in other words assuming the gas to be dry, at 15 °C and under a pressure of 1 013,25 mbar. In practice, the values obtained during the tests do not correspond to these reference conditions so they shall then be corrected so as to bring them to the values that would actually have been obtained if these reference conditions had existed at the injector outlet during the test.

If the corrected mass flow rate (M_o) is determined using the mass flow rate (M), Equation (2) is used.

$$M_0 = M\sqrt{\frac{1013{,}25+p}{p_a+p}\times\frac{273+t_g}{288}\times\frac{d_r}{d}} \tag{2}$$

where

M_o is the corrected mass flow rate (kg/h), obtained under test conditions;

M is the mass flow rate (kg/h), obtained under test conditions;

p_a is the atmospheric pressure (mbar);

p is the gas supply pressure (mbar);

t_g is the temperature of the gas at the measuring point (°C);

d is the density of dry gas relative to dry air;

d_r is the density of the reference gas relative to dry air.

If the corrected volumetric flow rate (V_o) is determined using the volumetric flow rate (V), Equation (3) is used:

$$V_0 = V\sqrt{\frac{1013{,}25+p}{1013{,}25}\times\frac{p_a+p}{1013{,}25}\times\frac{288}{273+t_g}\times\frac{d}{d_r}} \tag{3}$$

where

V_o is the corrected volumetric flow rate (m^3/h), under reference conditions;

V is the volumetric flow rate (m^3/h), obtained under test conditions;

p_a is the atmospheric pressure (mbar);

p is the gas supply pressure (mbar);

t_g is the temperature of the gas at the measuring point (°C);

d is the density of dry gas relative to dry air;

d_r is the density of the reference gas relative to dry air.

The corrected mass flow rate (M_o), under reference conditions is calculated using Equation (4):

$$M_0 = 1{,}226\ V_0 \times d \tag{4}$$

where

M_o is the corrected mass flow rate (kg/h), obtained under test conditions;

V_o is the corrected volumetric flow rate (m^3/h), under reference conditions;

d is the density of dry gas relative to dry air.

Equations (5) and (6) are used to calculate, from the mass flow rate (M) or volumetric flow rate (V) measured during the test, the corresponding corrected flow rates M_o or V_o which would have been obtained under the reference conditions.

Equations (5) and (6) are applicable if the test gas used is dry.

If a wet meter is used or if the gas used is saturated, the value d is replaced by the value of the density of the wet gas (d_h) and is given by Equation (5):

$$d_h = \frac{d\left(p_a + p - p_w\right) + 0{,}622 + p_w}{p_a + p} \tag{5}$$

where

d_h is the density of the wet gas relative to dry air;

d is the density of dry gas relative to dry air;

p is the gas supply pressure (mbar);

p_a is the atmospheric pressure (mbar);

p_w is the saturation vapour pressure of the test gas (mbar) at temperature t_g.

7.3.2.2 Nominal heat input

The test is carried out at the pressure specified by the manufacturer in accordance with the requirements of 7.1.4.

The appliance is fitted successively with each of the prescribed injectors and adjusted in accordance with the requirements of 7.1.3.2.1. The heat input is determined as described in 7.3.2.1 for each reference gas.

The measurements are taken with the appliance at thermal equilibrium and with any thermostat put out of action.

The heat input obtained Q_o is compared with the nominal heat input Q_n in order to verify the requirement of 6.1.2.1.

7.3.2.3 Start gas heat input

The test is carried out at the pressure specified by the manufacturer in accordance with the requirements of 7.1.4, using an arrangement which allows operation of the start gas flame on its own.

The appliance is fitted successively with each of the prescribed injectors and adjusted in accordance with the requirements of 7.1.3.2.1. The heat input is determined as described in 7.3.2.1 for each reference gas.

The measurements are taken immediately after ignition of the start gas flame.

The heat input obtained is compared with the start gas heat input declared by the manufacturer in order to verify the requirement of 6.1.2.2.

7.3.2.4 Effectiveness of the gas rate adjusters

These tests are carried out on appliances fitted with gas rate adjusters which are not put out of action.

a) Test 1: the heat input is measured with the adjuster fully open and with the minimum supply pressure given in 7.1.4 for the particular reference gas;

b) Test 2: the heat input is measured with the adjuster fully closed and with the maximum supply pressure given in 7.1.4 for the particular reference gas.

The tests are carried out for each reference gas for the appliance category with the exception of cases where the adjuster has been set and sealed by the manufacturer in a given position. In this case, the adjuster is regarded as non-existent.

7.3.2.5 Effectiveness of the gas regulator

If the appliance has an adjustable regulator, this is adjusted if necessary to give the volumetric rate corresponding to the nominal heat input with reference gas at the normal pressure given in 7.1.4 and corresponding to this gas. Keeping the initial adjustment, the supply pressure is varied between the corresponding minimum and maximum values. This test is carried out for all the reference gases for which the regulator is not put out of action. However, for first family gases, this check is made between the normal pressure and the maximum pressure.

7.3.2.6 Effectiveness of the range-rating device

The appliance is adjusted in accordance with the installation instructions. The tests are carried out as described in 7.3.2.2 for the two extreme positions of the range-rating device.

7.3.2.7 Air/gas ratio controls

7.3.2.7.1 Leakage of non-metallic control tubes

The appliance is installed as described in 7.1.6. It is supplied with reference gas at its nominal heat input. The requirements of 6.1.2.6.1 are checked under the various situations which could occur and in particular:

a) simulated leakage from the air pressure tube;

b) simulated leakage from the combustion chamber pressure tube;

c) simulated leakage from the gas pressure tube.

7.3.2.7.2 Gas/air pressure ratio adjustment

Adjustable air/gas ratio controls are operated at the maximum and minimum gas/air pressure ratio settings. It is checked that the requirements of 6.1.2.6.2 are met.

7.3.3 Limiting temperatures

7.3.3.1 General

The appliance shall be operated with a typically distributed gas (see 7.1.3.1) or an appropriate corresponding to its appliance category and operated within ± 2 % of the nominal heat input, using the minimum circulated air rate specified by the manufacturer and any adjustable thermostat at maximum setting.

NOTE For ductless heaters, the discharge louvres shall be set at the position of maximum closure as marked and specified by the manufacturer.

7.3.3.2 Temperature of parts of the appliance which have to be touched during normal use

The temperatures of the parts specified in 6.1.3.1 shall be measured at thermal equilibrium using an instrument with an accuracy of ± 2 K (e.g. contact thermocouples) and compliance with the requirements of 6.1.3.1 is verified.

7.3.3.3 Temperatures of the side walls, front and top of the appliance

The test is carried out when the appliance has reached thermal equilibrium.

The temperatures of the hottest parts of the side walls, front and top of the appliance are measured by a suitable means having an accuracy of ± 2 K (e.g. contact thermocouples) and compliance with the requirements of 6.1.3.2 is verified.

7.3.3.4 Component temperatures

Component temperatures are measured when thermal equilibrium has been reached in the test described in 7.3.3.2 and after the appliance has been turned off at the end of the test, and compliance with the requirements of 6.1.3.3 is verified.

The component temperatures are measured by means of attached thermocouples having thermoelectric junctions with an accuracy of ± 2 K. Alternative devices of equivalent accuracy may by used.

However, if an electrical component is itself likely to cause a rise in temperature (e.g. automatic shut-off valves) the temperature of the component is not measured. In this case, thermocouples or alternative devices, are placed so as to measure the air temperature around the device.

The temperature measurements of the components are deemed to be satisfactory if the requirements of Equation (6) are met.

$$t_m \leq t_s + t_a - 25\ °C \quad (6)$$

where

t_m is the maximum temperature measured in the test in °C;

t_s is the maximum temperature specified by the component manufacturer in °C;

t_a is the ambient room temperature in °C.

If the maximum temperature of the component was specified for an ambient temperature other than 25 °C, this shall be used.

7.3.3.5 Fan motor winding temperatures

The appliance is installed according to the conditions of 7.1.6 and supplied with electricity by means of a device that enables the voltage to be varied from 85 % of the minimum to 110 % of the maximum of the voltage range declared by the manufacturer (e.g. a variable voltage transformer).

The test is carried out in still air and with the appliance adjusted to its nominal heat input, using an appropriate reference gas (see Table 8). The voltage is adjusted to the most unfavourable value between the above limits.

Temperature measurements are made when the appliance has reached thermal equilibrium and after the appliance has been switched off by the normal means of control, and compliance with the requirements of 6.1.3.4 is verified.

The resistance of the windings is measured as soon as possible after switching off and then at short intervals so that a curve of the resistance against time from switch-off can be plotted, in order to determine the maximum resistance value.

The temperature rise of the windings is calculated using Equation (7).

$$\Delta_t = \frac{(R_2 - R_1)}{R_1}(C + t_1) - (t_2 - t_1) \tag{7}$$

where

Δ_t is the temperature rise in K;

R_1 is the resistance at the beginning of the test (Ω);

R_2 is the maximum resistance at the end of the test (Ω);

t_1 is the room temperature at the beginning of the test in °C;

t_2 is the room temperature at the end of the test in °C;

C is a constant equal to 234,5 °C for copper.

7.3.3.6 POCED (Type B_{42}, B_{43}, B_{44}, B_{52}, B_{53}, C_{12} , C_{13} , C_{32} and C_{33} appliances)

7.3.3.6.1 Test 1

This test is carried out if, when the appliance is installed in accordance with the manufacturer's instructions, any part of the POCED is capable of being less than 25 mm from combustible parts of the fabric of the building.

Install the appliance in accordance with the requirements of 7.1.6.3 and attach thermocouples junctions to the external surface of those parts of the POCED that are capable of being less than 25 mm from combustible parts of the fabric of the building. Thermocouples shall be used in accordance with the requirements of EN 60584-1 with the limits of accuracy of the thermoelectric voltage used in accordance with Class 2 of EN 60584-2.

The appliance is supplied with one of the reference gases indicated in 7.1.1 according to its category and adjusted in accordance with the requirements of 7.1.3.2.1.

The test is carried out with the appliance operating at its nominal heat input. All measurements are taken when thermal equilibrium has been reached. It is recommended that for this test the appliance should be placed in a room where the ambient temperature is approximately 20 °C.

At the end of the test, check that the maximum temperature rise of the POCED does not exceed the limit specified in 6.1.3.5.

7.3.3.6.2 Test 2

This test is carried out if, in accordance with the manufacturer's installation instructions, the POCED is required to be enclosed within another duct, a sleeve or insulation when it passes through a combustible wall or ceiling.

Install the appliance in accordance with the requirements of 7.1.6.3. The duct, sleeve or insulation enclosing the POCED shall be fitted in accordance with the manufacturer's instructions. This duct, sleeve or insulation shall be so dimensioned and arranged that it encloses a section of the POCED that is 350 mm in length, as close to the appliance as the manufacturer's instructions allow.

Attach thermocouples junctions to the external surface of the duct, sleeve or insulation and then enclose the duct, sleeve or insulation with a 25 mm thick layer of insulation. Thermocouples shall be used in accordance with the requirements of EN 60584-1 with the limits of accuracy of the thermoelectric voltage used in accordance with Class 2 of EN 60584-2.

The appliance is supplied with one of the reference gases indicated in 7.1.1 according to its category and adjusted in accordance with the requirements of 7.1.3.2.1.

The test is carried out with the appliance operating at its nominal heat input. All measurements are taken when thermal equilibrium has been reached. It is recommended that for this test the appliance should be placed in a room where the ambient temperature is approximately 20 °C.

At the end of the test, check that the maximum temperature rise at the external surface of the duct, sleeve or insulation enclosing the POCED does not exceed the limit specified in 6.1.3.5.

7.3.4 Ignition, cross-lighting, flame stability

7.3.4.1 Ignition and cross-lighting

7.3.4.1.1 All appliances (still air conditions)

These tests are carried out with the appliance in the cold condition and at thermal equilibrium unless otherwise stated.

These tests are carried out with the appliance installed in accordance with the requirements of 7.1.6.

7.3.4.1.1.1 Tests

a) Test 1

The appliance is supplied with the appropriate reference and limit gases (see Table 8) at the normal pressure in accordance with the requirements of 7.1.4.

Under these supply conditions it is checked that ignition of the main burner or the ignition burner occurs correctly and that ignition of the main burner by the ignition burner as well as cross-lighting of the various parts of the burner occurs correctly.

This test is repeated at the minimum heat input given by the controls, if ignition is possible under these conditions during normal operation in accordance with the manufacturer's instructions for use.

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b) Test 2

For this test the initial burner and ignition burner adjustments are not altered and the appliance is supplied with reference gas with the pressure at the appliance inlet reduced to 70 % of the normal pressure or the minimum pressure given in 7.1.4, whichever is the lower.

Under these supply conditions it is checked that ignition of the main burner or the ignition burner occurs correctly and that ignition of the main burner by the ignition burner as well as cross-lighting of the various parts of the burner occurs correctly.

This test is repeated at the minimum heat input given by the controls, if ignition is possible under these conditions during normal operation in accordance with the manufacturer's instructions for use.

c) Test 3

Without altering the initial burner or ignition burner adjustment, the appropriate flame lift and light-back limit gases are substituted successively for the reference gas and the pressure is reduced at the appliance inlet to the minimum pressure given in 7.1.4.

Under these supply conditions it is checked that ignition of the main burner or the ignition burner occurs correctly and that ignition of the main burner by the ignition burner as well as cross-lighting of the various parts of the burner occurs correctly.

This test is repeated at the minimum heat input given by the controls, if ignition is possible under these conditions during normal operation in accordance with the manufacturer's instructions for use.

7.3.4.1.1.2 Ignition burner flame reduction

This test is carried out with the appliance installed in accordance with the requirements of 7.1.6.

The appliance is initially adjusted in accordance with the requirements of 7.1.3.2.1 and supplied with the appropriate reference gases (see Table 8) at nominal heat input.

The ignition burner gas rate is then reduced to the minimum required to hold open the gas supply to the main burner.

The necessary reduction in the ignition burner gas rate may be achieved either:

a) by the adjustment of the ignition burner gas rate adjuster, if this exists; or, if this is not possible,

b) by means of an adjuster inserted into the ignition burner gas supply for this purpose.

Correct ignition of the main burner by the ignition burner is then checked.

Where an ignition burner has several ports that are likely to become blocked, the test is carried out with all the ignition burner orifices blocked except for the one that produces the flame that heats the flame sensor.

7.3.4.1.2 Appliances where the start-gas is taken from between the two main burner gas valves

The appliance is initially adjusted in accordance with the requirements of 7.1.3.2.1 and supplied with an appropriate reference gas (see Table 8) at the nominal heat input.

With the downstream automatic gas valve in the main gas line kept open artificially, ignite the appliance.

7.3.4.1.3 Appliances with automatic ignition

The appliance is installed as described in 7.1.6.

The appliance is initially adjusted in accordance with the requirements of 7.1.3.2.1 and supplied with an appropriate reference gas (see Table 8) at the nominal heat input.

Ignition of the ignition burner, or the main burner if this is ignited directly, is checked. The test is repeated, progressively delaying the ignition up to a maximum of 25 % longer than the safety time declared by the manufacturer.

In order to delay the ignition it will generally be necessary to provide independent control of the main gas or start gas automatic shut-off valves and the operation of the ignition device. A suitable arrangement is to provide a voltage supply, independent of the automatic burner control system, to the relevant gas valve(s) and to the ignition device.

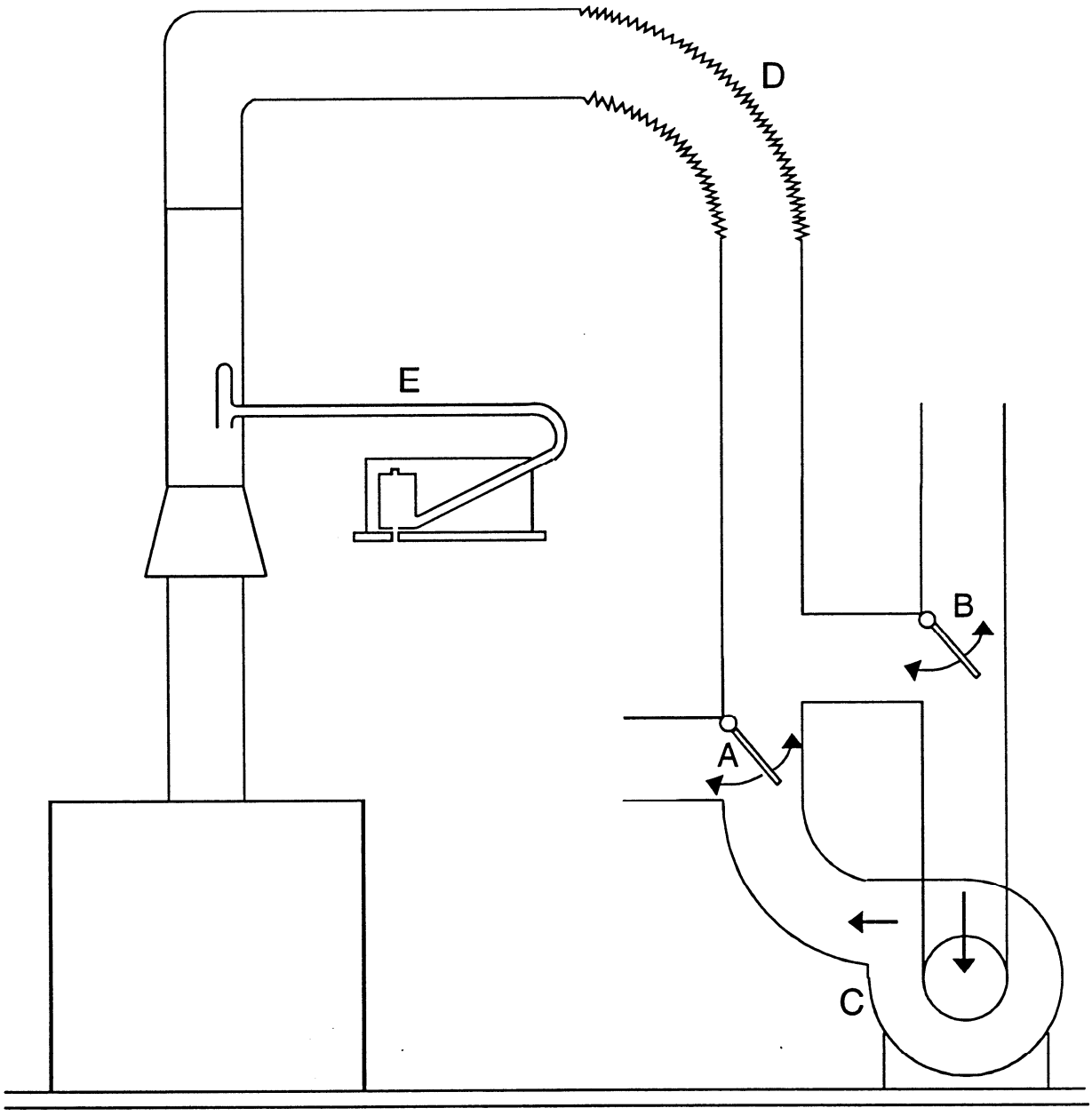
NOTE For safety reasons the ignition delay should be increased in stages.

7.3.4.1.4 Special conditions

7.3.4.1.4.1 Type B_{12}, B_{13}, B_{42} and B_{43} appliances

The appliance is supplied with an appropriate reference gas (see Table 8) at the corresponding normal pressure (see Tables 9 and 10). It is connected to a flue of the same nominal diameter as the flue connection and straight for a length of not less than ten diameters immediately above the draught diverter. Down-draughts of up to 3 m/s are applied through the flue using a suitable down-draught apparatus (see Figure 4).

A second test is carried out with the test flue blocked.



Key

A Diverter valve to obtain either an updraught or downdraught
B Diverter valve to obtain either an updraught or downdraught
C Fan
D Flexible
E Velocity measurement position using a Pitot tube

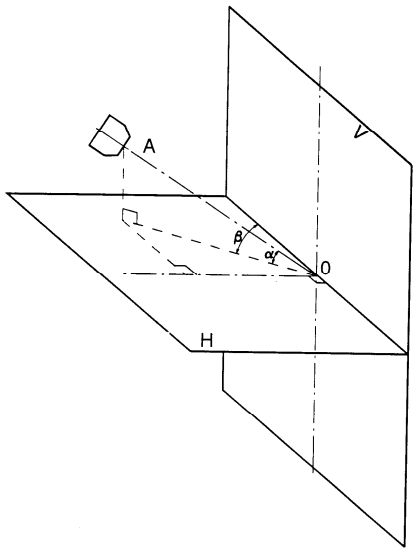
Figure 4 — Test of an appliance under abnormal draught conditions

7.3.4.1.4.2 Type B_{14} and B_{44} appliances

The appliance is tested under the conditions of 7.3.1.2.2. However, for appliances having a manually ignited ignition burner, the restriction of the flue outlet is continued until the flue is completely blocked. In addition, the restriction of the flue outlet is carried out in stages in order that the requirements of 6.1.4.1.4.2 and 6.1.4.2.2.2 can be checked.

7.3.4.1.4.3 Type C_{12} and C_{13} appliances

The appliance is installed on the apparatus described in Figure 5, with lengths of air supply and combustion products ducts of the minimum equivalent resistance specified in the manufacturer's instructions.



Key

A	Wind generator
H	Horizontal plane
V	Vertical plane
α	0° (horizontal winds) + 30° and - 30°
β	0° (glancing winds) 15°, 30°, 45°, 60°, 75°, 90° (perpendicular to the test wall)

When the terminal is not symmetrical, the tests are continued with incident angles of 105°, 120°, 135°, 150°, 165° and 180°.

Angle ß may be varied either by modification of the position of the wind generator (fixed wall) or by rotation of the test wall about a central vertical axis.

The test wall consists of a strong vertical wall at least 1,8 m square with a removable panel at its centre. The terminal of the appliance is mounted so that its geometric centre is at the centre 0 of the test wall, and its projection from the wall is recommended by the manufacturer.

The characteristics of the wind generator and the distance from the test wall at which it is placed are chosen such that at the level of the test wall and after the central panel has been removed:

a) the wind front is either approximately 90 cm square or a circular section with a diameter of 60 cm;

b) wind speeds of 2,5 m/s, 5 m/s and 10 m/s can be obtained, with an accuracy of 10 %, over the whole of the wind front;

c) the wind stream is essentially parallel and has no residual rotational movement.

When the central removable panel is not large enough to allow checking of these criteria, they are checked without the wall at a distance corresponding to the distance existing in practice between the wall and the wind generator discharge nozzle.

Figure 5 —Test apparatus for type C_1 appliances

The appliance is supplied with an appropriate reference gas in accordance with the requirements of Table 8, and adjusted to obtain the nominal heat input.

The tests shown in 7.3.4.1.4.3 a), b) and c) shall then be carried out.

a) Series 1 tests

The appliance terminal is subjected to winds of different speeds in three planes:

— horizontal;

— ascending, at 30° to the horizontal;

— plunging, at 30° to the horizontal.

In each of the three planes, the incident angle of the wind is varied in 15° increments between 0° and 90° inclusive. If the terminal is not symmetrical about the vertical axis, the tests are carried out at 15° increments between 0° and 180° inclusive.

The tests are carried out at wind speeds of 2,5 m/s, 5 m/s and 10 m/s.

Under each of these 63 conditions (117 if not symmetrical) a visual check is made of:

— the ignition and stability of any ignition burner without the main burner alight;

— the ignition of the main burner by any ignition burner;

— the ignition and stability of the main burner at the nominal start-gas rate;

— the cross-lighting of the main burner;

— where applicable, the stability of any ignition burner (and the main burner when operating simultaneously).

These tests are carried out with the appliance at thermal equilibrium.

For each of the three incident planes, the three combinations of wind speed and incident angle that produce the lowest CO_2 concentration in the combustion products are noted.

b) Series 2 tests

For each of the nine combinations noted during the Series 1 tests, it is checked that, with the appliance cold, it is possible to light the ignition burner, if any, and then the main burner by means of either the ignition burner or the device for direct ignition.

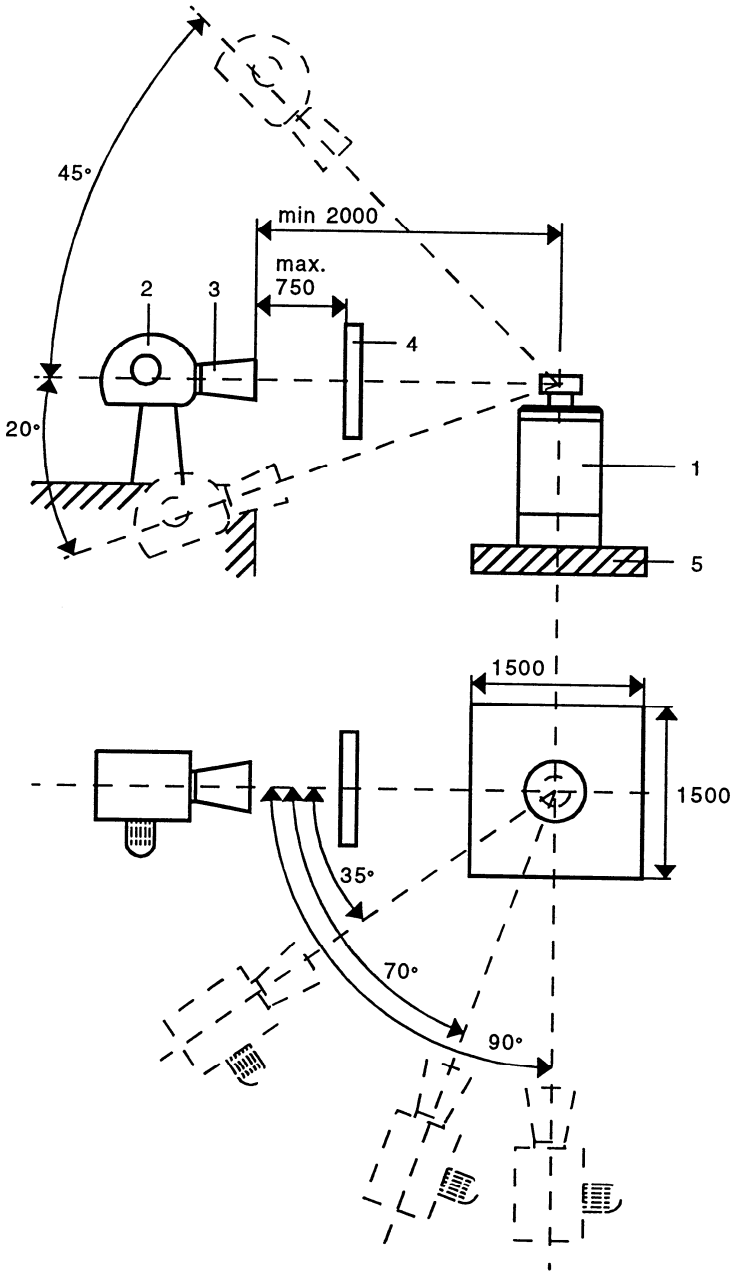
c) Series 3 tests

The Series 1 and Series 2 tests are repeated at the minimum heat input given by the controls if such operation is intended by the manufacturer.

7.3.4.1.4.4 Type C_{32} and C_{33} appliances

The appliance is installed on the apparatus described in Figures 6 and 7, lengths of air supply and combustion products ducts of the minimum equivalent resistance specified in the manufacturer's instructions.

Dimensions in millimetres

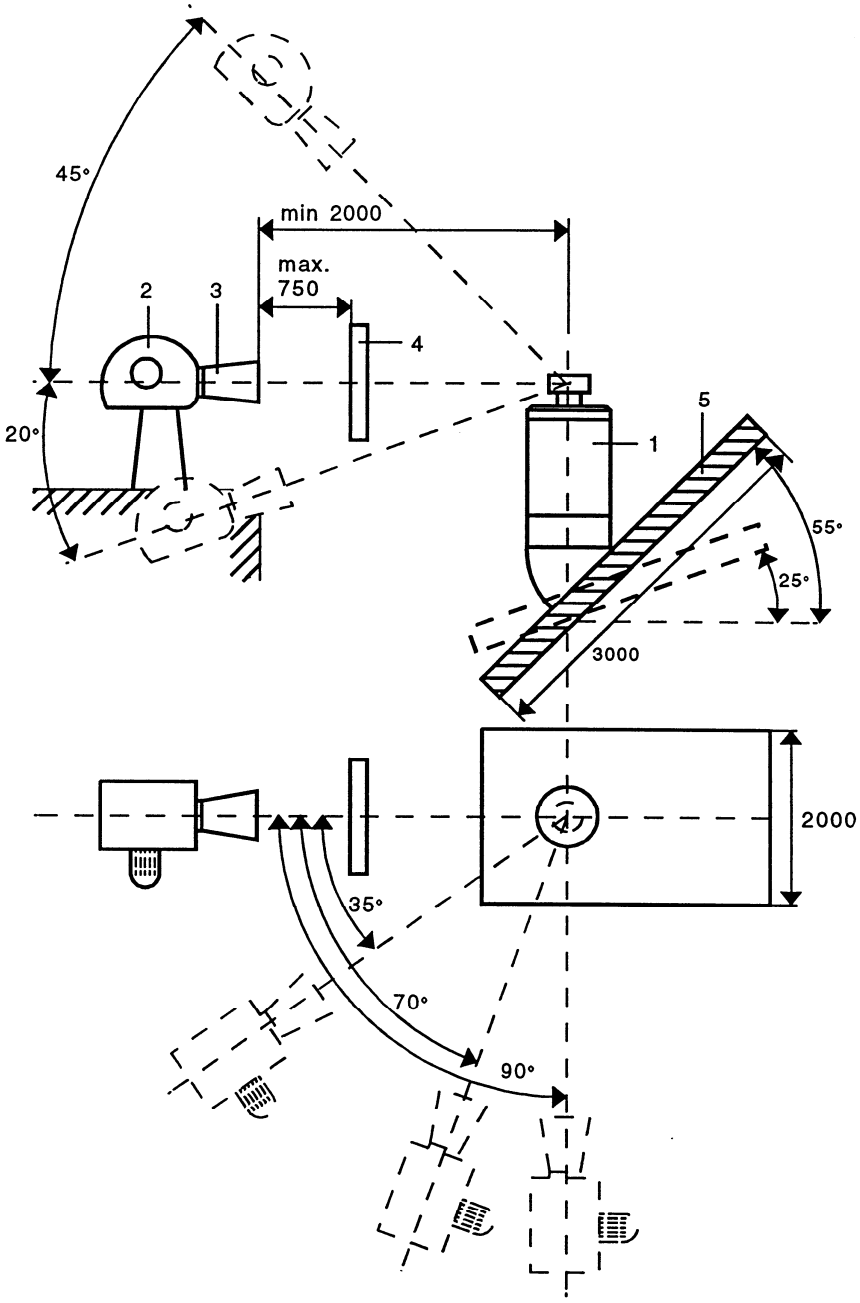


Key

1 Combustion air intake and flue outlet
2 Wind generator able to reproduce wind speeds with an accuracy of ± 10 % across the wind front
3 Diffuser
4 Wind front sufficient to ensure that both the inlet and outlet terminals are covered
5 Test surface

Figure 6 — Test apparatus for Type C_3 appliances — Flat roof

Dimensions in millimetres



Key

1 Combustion air intake and flue outlet
2 Wind generator able to reproduce wind speeds with an accuracy of ± 10 % across the wind front
3 Diffuser
4 Wind front sufficient to ensure that both the inlet and outlet terminals are covered
5 Test surface

Figure 7 — Test apparatus for Type C_3 appliances — Angled roof

The appliance is supplied with an appropriate reference gas in accordance with the requirements of Table 8, and adjusted to obtain the nominal heat input.

The tests shown in 7.3.4.1.4.4 a), b) and c) shall then be carried out.

a) Series 1 tests

The appliance terminal is subjected to winds of different speeds in three planes:

— horizontal;

— ascending, at 20° to the horizontal;

— plunging, at 45° to the horizontal.

In each of these three planes, the incident angle of the wind is varied between 0° and 90° inclusive, with intermediate tests carried out at 35° and 70°. In addition, if the terminal is suitable for use on a sloping roof, the tests are repeated with the test surface angled at 25° and 55° (see Figure 7).

The tests are carried out at wind speeds of 0,5 m/s, 1,5 m/s, 2,5 m/s, 5 m/s and 10 m/s.

Under each of these conditions a visual check is made of:

— the ignition and stability of any ignition burner without the main burner alight;

— the ignition of the main burner by any ignition burner;

— the ignition and stability of the main burner at the nominal start-gas rate;

— the cross-lighting of the main burner;

— where applicable, the stability of any ignition burner (and the main burner when operating simultaneously).

These tests are carried out with the appliance at thermal equilibrium.

For each combination of wind speed and incident angle, the CO and CO_2 concentrations in the combustion products are noted.

b) Series 2 tests

For each of the nine combinations resulting in the lowest CO_2 concentrations during Series 1, it is checked that, with the appliance cold, it is possible to light the ignition burner, if any, and then the main burner by means of either the ignition burner or the device for direct ignition.

c) Series 3 tests

The Series 1 and Series 2 tests are repeated at the minimum heat input given by the controls if such operation is intended by the manufacturer.

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7.3.4.2 Flame stability

7.3.4.2.1 All appliances (still air conditions)

a) Test 1

Without altering the initial main burner or ignition burner adjustment, the appropriate light-back gas is substituted successively for the reference gas and the pressure is reduced at the appliance inlet to the minimum pressure given in 7.1.4.

Under these conditions it is checked that the flames are stable.

This test is then repeated at the minimum input given by the controls at which the appliance can operate normally in accordance with the manufacturer's instructions.

b) Test 2

Without altering the initial main burner or ignition burner adjustment, the appropriate flame lift and light-back limit gases are substituted successively for the reference gas and the pressure is increased at the appliance inlet to the maximum given in 7.1.4.

Under these conditions it is checked that the flames are stable.

This test is then repeated at the minimum input given by the controls at which the appliance can operate normally in accordance with the manufacturer's instructions.

For Type C_6 appliances, the above tests shall be carried out with the restrictor in the test duct system (see Figure 1) set to simulate the least possible resistance in the duct system stated by the appliance manufacturer. The tests are repeated with the restrictor set to simulate the maximum resistance in the duct system stated by the manufacturer.

7.3.4.2.2 Special conditions (Type B_{12}, B_{13}, B_{42} and B_{43} appliances)

The appliance is supplied with the reference gas at normal pressure and is subjected at burner level to a wind stream of 2 m/s which has a minimum diameter (or minimum cross-sectional dimension if the wind stream is not circular) of 0,5 m.

The axis of the wind stream is in a horizontal plane and is moved through one or more (at the discretion of the laboratory) angles of incidence within a full 360° circle around the appliance, the centre of the circle passing through the two vertical planes of symmetry of the appliance.

The test is carried out with the main burner and any ignition burner alight together and, if appropriate, with only the ignition burner alight. Any lighting door remains closed during the test.

The test is repeated at the minimum input given by the controls if such operation is intended by the manufacturer.

During the test, precautions are taken to screen the draught diverter from the effects of the wind.

7.3.4.2.3 Special conditions for appliances designed for outdoor installation

7.3.4.2.3.1 Test 1

The appliance is tested as described in 7.3.4.2.2, at normal pressure only, with a wind stream of 10 m/s directed at the appliance.

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A shield large enough to cover the fan outlet, is placed downstream of the fan and between the fan and the appliance.

Immediately after lighting the appliance, the shield is removed for periods of 3 s so that gusting is produced. This test is repeated at steps of 30° around the appliance in the horizontal plane.

7.3.4.2.3.2 Test 2

The appliance is installed according to the conditions of 7.1.6 using the appropriate reference gas (see Table 8).

Using the apparatus described in 7.3.4.2.2, the appliance is subjected to a horizontal wind speed of 10 m/s centring on the terminal. The appliance is slowly rotated about a vertical axis relative to the fan and the flames are observed. At positions of the appliance where, by inspection, there appears to be maximum flame interference, the rotation of the appliance is stopped.

The appliance is turned off and allowed to cool to room ambient temperature.

A shield large enough to cover the fan outlet, is placed between the fan and the terminal.

Immediately after lighting the appliance, the shield is removed for periods of 3 s so that gusting is produced. The flames are observed once again.

Tests with ascending and plunging winds are carried out as for horizontal winds except that the wind is continuous and directed at an angle of 45° to the horizontal plane upwards and downwards.

All the above tests are repeated with the terminal subjected to horizontal, plunging and ascending winds of speeds 5 m/s and 2,5 m/s.

7.3.5 Combustion

7.3.5.1 Test installation

Unless stated otherwise, the appliances are installed as described in 7.3.5.1.1, 7.3.5.1.2, 7.3.5.1.3, 7.3.5.1.4 and 7.3.5.1.5, as appropriate.

7.3.5.1.1 Type B_{12}, B_{13}, B_{42} and B_{43} appliances

Type B_{12}, B_{13}, B_{42} and B_{43} appliances are installed in accordance with the requirements of 7.1.6.2.1.

7.3.5.1.2 Type B_{14}, B_{22} and B_{23} appliances

Appliances intended to be fitted to a flue having a wall termination shall be connected in turn to a flue of the manufacturer's minimum and maximum equivalent resistance.

Appliances intended to be fitted to a vertical flue having a termination above roof level shall be connected in turn to a flue 1 m high, or the minimum specified by the manufacturer, and a flue of the manufacturer's maximum equivalent resistance.

7.3.5.1.3 Type B_{44}, B_{52} and B_{53} appliances

Appliances shall be connected in turn to a POCED, as supplied or specified by the appliance manufacturer, having the minimum and maximum equivalent resistances specified in the manufacturer's instructions.

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

These appliances are installed in accordance with the requirements of 7.1.6.2, but on a flue of the maximum resistance as specified by the manufacturer.

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

Type C_{62} and C_{63} appliances are installed in accordance with the requirements of 7.1.6.2.6.

7.3.5.1.6 Appliances designed for outdoor installation

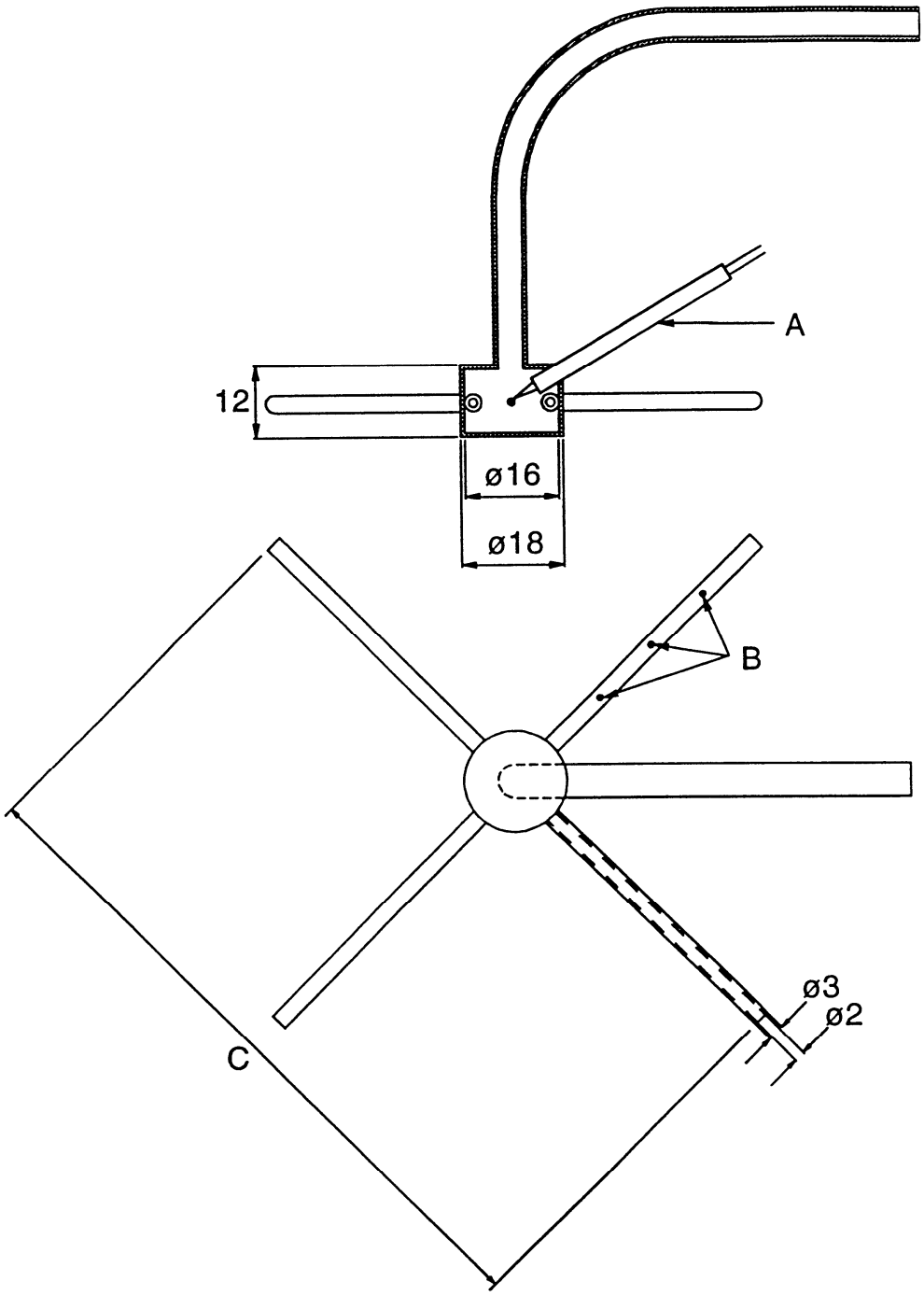
These appliances are installed in accordance with the requirements of 7.1.6.3.

7.3.5.2 Test procedure

The appliance is initially adjusted to the nominal heat input in accordance with the requirements of 7.1.3.2.

The products of combustion shall be collected in such a manner as to ensure a representative sample, using a suitable sampling probe (see Figures 8, 9, 10 and 11, as appropriate).

Dimensions are in millimetres

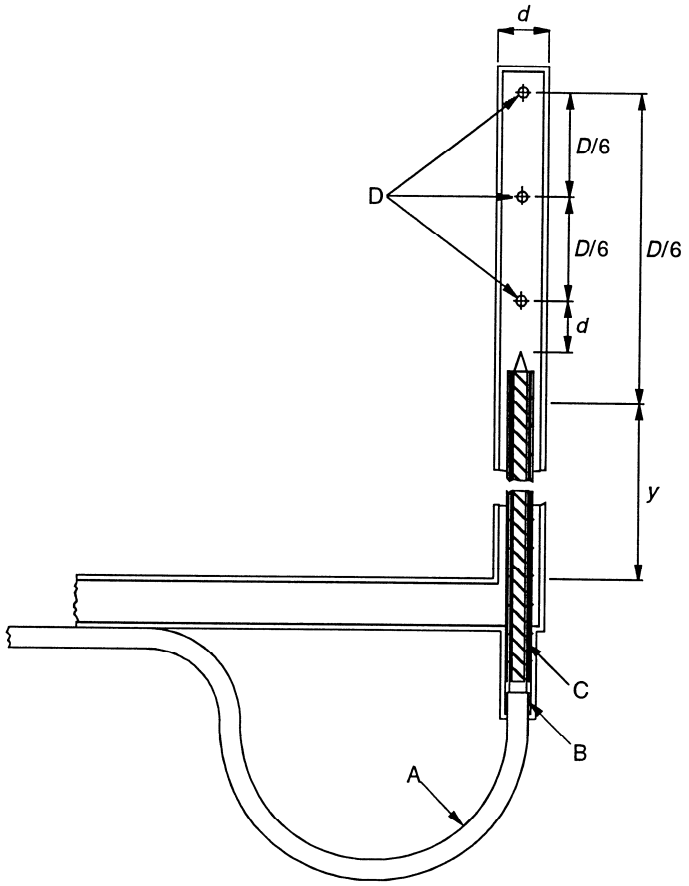


NOTE Sampling probe material is stainless steel with a polished finish.

Key

A Steatite tube with two holes into which the thermocouple wires are sealed
B Three equally spaced Ø 1 mm holes in each of three limbs
C 0,97*D* where *D* is the internal diameter of the flue

Figure 8 — Sampling probe for type B_1 appliances



NOTE 1 Sampling probe material is stainless steel with a polished finish.

NOTE 2 Dimension Y is to be chosen relative to the diameter of the air inlet duct and its insulation.

NOTE 3 Dimensions for a Ø 6 mm probe (suitable for outlet ducts of diameter *D* greater than 75 mm) are:

Probe outside diameter (d): 6 mm;

Probe wall thickness: 0,6 mm;

Sampling hole diameter (D): 1,0 mm;

Twin bore ceramic sleeve: Ø 3 mm x 0,5 mm bore;

Thermocouple wire: Ø 0,2 mm.

For outlet ducts of diameter *D* less than 75 mm, a smaller probe should be used with d and x chosen such that:

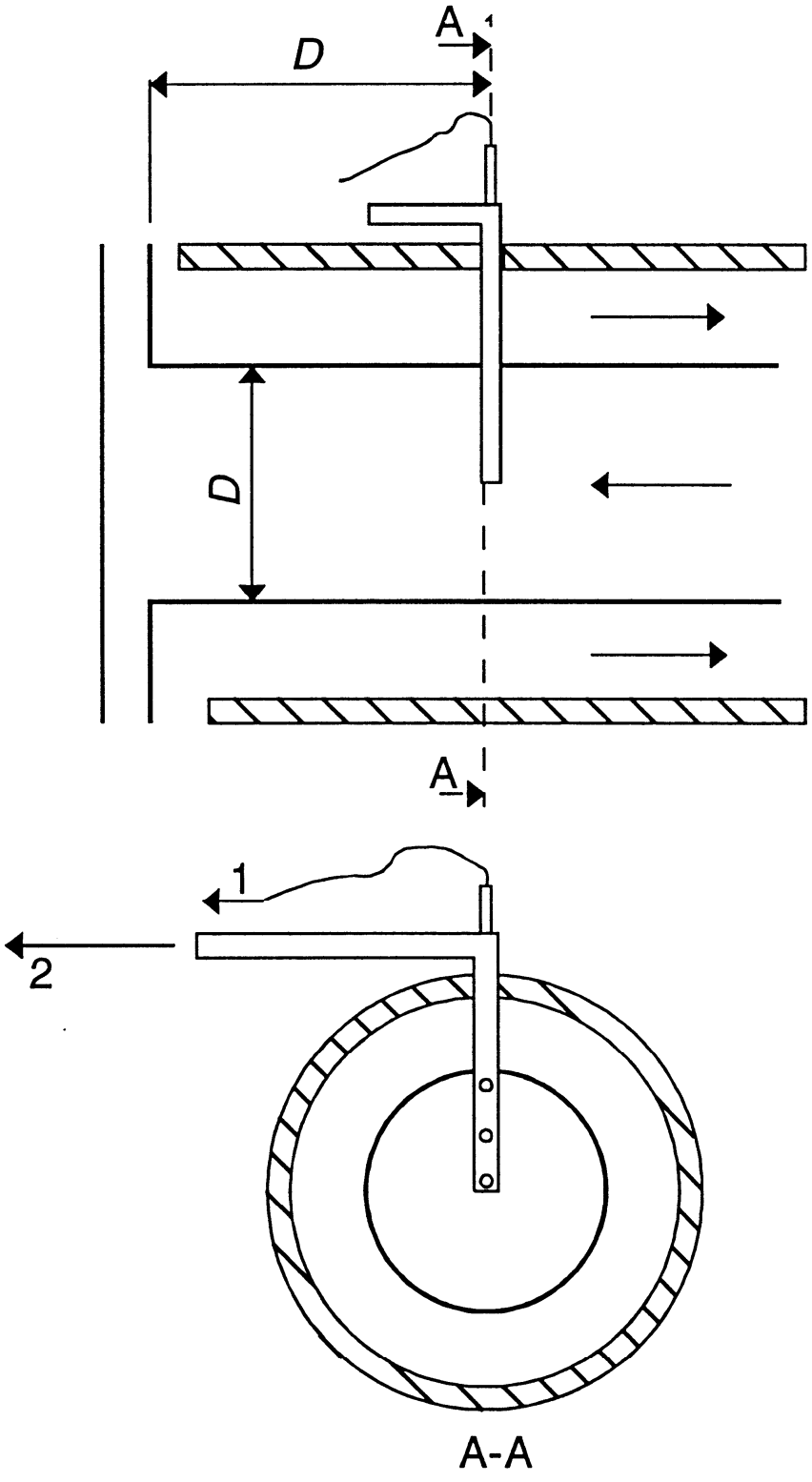
a) the area obstructed by the probe is less than 5 % of the total duct cross section; and

b) the total are of the sampling holes is less than ¾ of the probe cross section.

Key

A Chrome/Alumel thermocouple wire
B Insulating cement
C Twin bore ceramic sleeve
D Three Ø 1 mm sampling holes

Figure 9 — Sampling probe for Type C_1 and C_3 appliances



Key

1 To temperature sensor
2 To sampling pump

Figure 10 — Sampling probe position for Type C1 appliances

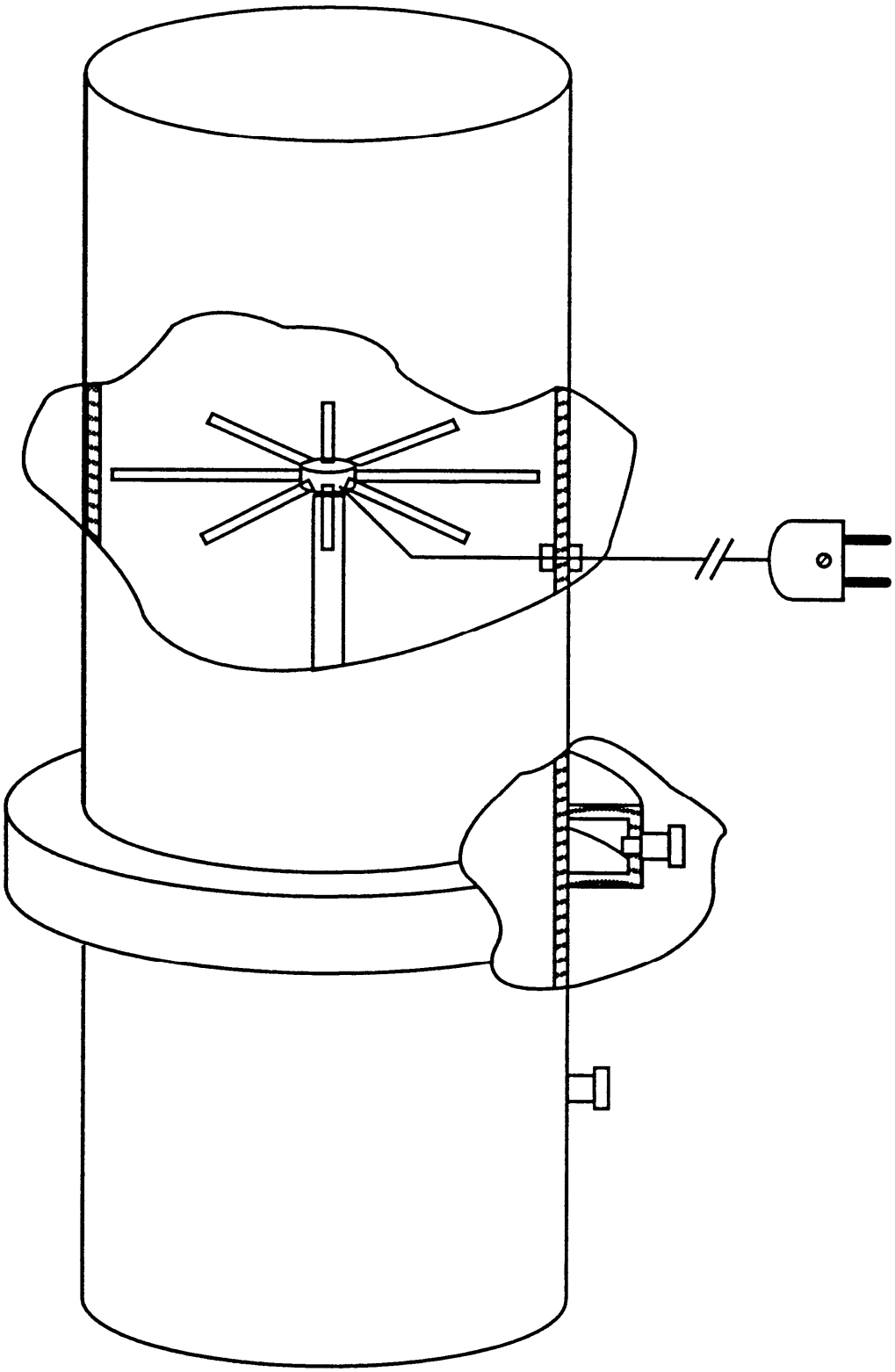


Figure 11 — Sampling probe for Type C_6 appliances

For all tests the sample shall be taken when the appliance has reached thermal equilibrium whilst operating under the specified conditions.

The concentrations of carbon monoxide, CO, carbon dioxide, CO_2, and oxygen, O_2, where appropriate, are measured by a method accurate to within ± 6 % of the reading.

The carbon monoxide concentration of the dry, air-free products of combustion (neutral combustion) is given by Equation (8).

$$V_{CO,N} = V_{CO_2,N} \times \frac{V_{CO,M}}{V_{CO_2,M}} \quad (8)$$

where

$V_{CO,N}$ is the carbon monoxide concentration of the dry air-free products of combustion (%);

$V_{CO_2,N}$ is the calculated carbon dioxide content of the dry air-free products of combustion (%);

$V_{CO,M}$ and $V_{CO_2,M}$ are the carbon monoxide and carbon dioxide concentrations measured in the sample during the combustion test (%).

The values of $V_{CO_2,N}$ (neutral combustion) are given for the test gases in Table 11.

Table 11 — $V_{CO_2,N}$ values

Gas designation	G 110	G 20	G 21	G 25	G 26	G 30	G 31
$V_{CO_2,N}$	7,6	11,7	12,2	11,5	11,8	14,0	13,7

The carbon monoxide concentration of the dry, air-free combustion products ($V_{CO,N}$) may also be calculated using Equation (9).

$$V_{CO,N} = \frac{21}{21 - V_{O_2,M}} \times V_{CO,M} \quad (9)$$

where

$V_{CO,N}$ is the carbon monoxide concentration (%) of the dry, air free combustion products;

$V_{O_2,M}$ is the oxygen concentration (%) measured in the sample;

$V_{CO,M}$ is the carbon monoxide concentration (%) measured in the sample.

The use of this formula is recommended where it gives greater accuracy than the formula based on the CO_2 concentration.

7.3.5.3 All appliances (still air conditions)

The tests described in 7.3.5.3 a), b), c), d) and e) are carried out under still air conditions.

a) Test 1

Without altering the initial burner adjustment the appliance is supplied with the appropriate reference gases (see Table 8) according to its category and the pressure at the appliance inlet increased to the maximum pressure given in 7.1.4.

b) Test 2

Without altering the initial burner adjustment, the appliance is supplied with the appropriate reference gases (see Table 8) according to its category with the pressure at the appliance inlet reduced to 70 % of the normal pressure or the minimum pressure given in 7.1.4, whichever is the lower.

c) Test 3

Without altering the initial burner adjustment, the appropriate incomplete combustion limit gases are substituted successively for the reference gas and the pressure at the appliance inlet increased to the maximum pressure given in 7.1.4. It is checked that the requirements of 6.1.5.1 are assured.

Where necessary, the appropriate sooting limit gases are substituted successively for the incomplete combustion limit gases and the appliance is operated for three cycles of 30 min on and 30 min off. Following the test the appliance is inspected for soot deposition within the heat exchanger.

d) Test 4

Without altering the initial burner adjustment, the appliance is supplied with the appropriate reference gases (see Table 8) according to its category and operated at the nominal heat input.

The test is carried out with the appliance supplied with electricity at a voltage of 85 % of the minimum and then at a voltage of 110 % of the maximum of the voltage range stated by the manufacturer.

e) Test 5

Without altering the initial burner adjustment, the appliance is supplied with the appropriate reference gases (see Table 8) according to its category and operated at the normal test pressure.

For the purposes of this test the combustion air fan only is supplied with electricity by means of a suitable device which permits variation in voltage.

With the appliance operating at thermal equilibrium, gradually reduce the voltage supply to the fan until the gas is shut off by the air flow failure control or the gas/air ratio control. Sample the products of combustion until the moment the gas supply is shut off.

7.3.5.4 Special conditions

7.3.5.4.1 Type B_{12}, B_{13}, B_{42} and B_{43} appliances

Without altering the initial burner adjustment, the appliance is supplied with the appropriate reference gases (see Table 8) according to its category and operated at the nominal heat input.

A first test is carried out with the flue blocked.

A second test is carried out by applying a continuous downdraught of 3 m/s and 1 m/s successively within the test flue using a suitable downdraught apparatus (see Figure 4).

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The combustion products are collected in such a manner as to ensure a representative sample using a suitable device located within the draught diverter.

7.3.5.4.2 Type B_{14} and B_{44} appliances

The appliance is installed as described in 7.1.6 and connected to a flue as described in 7.1.6.2. The test is carried out with each of the reference gases appropriate to the appliance category supplied at the normal pressure.

Once thermal equilibrium has been attained, the flue outlet is progressively restricted until the main burner is shut off by the action of the air proving device. The products of combustion are sampled during the period that the flue outlet is being restricted.

The combustion products are collected in such a manner as to ensure a representative sample, using a suitable device located within the draught diverter.

7.3.5.4.3 Type B_{22}, B_{23}, B_{52} B_{53} , C_{12} , C_{13} , C_{32} , C_{33} , C_{62} ,and C_{63} appliances

Without altering the initial adjustment, the appliance is supplied with the appropriate reference gases (see Table 8) according to its category at the normal pressure.

With the appliance in the cold condition, the flue/ combustion products duct is progressively restricted to the maximum amount that still enables the burner to be ignited. The means of carrying out the restriction shall not give rise to recirculation of the products of combustion. Under this condition, the appliance is operated until thermal equilibrium is reached and the products of combustion are then sampled.

It is checked that the requirements of 6.1.5.2.3 are met.

7.3.5.4.4 Type B_{22}, B_{23}, B_{52} and B_{53} appliances

Without altering the initial adjustment, the appliance is supplied with the appropriate reference gases (see Table 8) according to its category at the normal pressure.

An appliance intended to be used with a flue having a wall termination shall be tested once thermal equilibrium conditions have been attained:

a) with the appliance connected to a flue of the manufacturer's maximum equivalent resistance, the flue outlet is further restricted progressively until the gas is shut off by the air proving device or the gas/air ratio control;

b) with a suction applied to the outlet of the flue so as to reduce the pressure at the outlet of the appliance to 0,5 mbar below that produced by a flue of the manufacturer's minimum equivalent resistance.

An appliance intended to be used with a vertical flue having a termination above the roof level shall be tested once thermal equilibrium conditions have been attained:

c) with the appliance connected to a flue of the manufacturer's maximum equivalent resistance, the flue outlet is further restricted progressively until the gas is shut off by the air proving device or the gas/air ratio control;

d) with a suction applied to the outlet of the flue so as to reduce the pressure at the outlet of the appliance to 0,5 mbar below that produced by a flue of the manufacturer's minimum equivalent resistance.

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7.3.5.4.5 Type C_{12} and C_{13} appliances

The combustion products are sampled under the conditions of test given in 7.3.4.1.4.3 using a combustion air and combustion products duct of the maximum equivalent resistance specified by the manufacturer. The average of the nine highest CO values noted in 7.3.4.1.4.3 is determined and its compliance with the requirement of 6.1.5.2.5 verified.

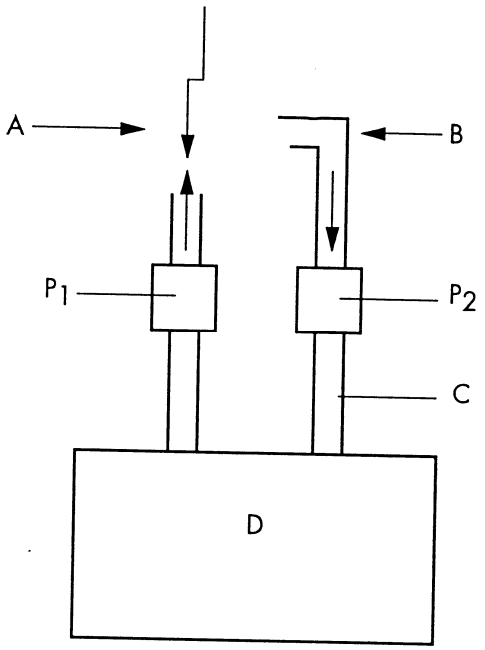
7.3.5.4.6 Type C_{32} and C_{33} appliances

The combustion products are sampled under the conditions of test given in 7.3.4.1.4.4 using a combustion air and combustion products duct of the maximum equivalent resistance specified by the manufacturer. The average of the nine highest CO values noted in 7.3.4.1.4.4 is determined and its compliance with the requirement of 6.1.5.2.6 verified.

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

7.3.5.4.7.1 Operation under recirculation of combustion products

The combustion air inlet duct of the test duct system is fitted with a bend that can be rotated through 360° (see Figure 12). The bend is positioned so that the products of combustion are drawn into the combustion air inlet duct.



Key

A	Restrictor
B	Rotatable bend
C	CO_2 probe
D	Appliance
P_1 and P_2	Pressure test points

Figure 12 — C_6 test duct system for recirculation test

With the combustion products outlet duct unrestricted, the appliance is operated under normal running conditions at nominal distribution air flow. At thermal equilibrium, the combustion products outlet duct is restricted to simulate maximum resistance to flow in the duct system specified by the manufacturer. The bend,

fitted to the combustion air inlet duct, is rotated so that the products of combustion from the outlet duct enter the inlet duct to give a CO_2 concentration in the air inlet duct of 10 % of the concentration initially measured in the combustion products outlet duct.

7.3.5.4.7.2 Operation at minimum combustion air flow

The appliance is operated under normal running conditions at nominal distribution air flow. At thermal equilibrium, the restrictor in the test duct system is set to give the minimum flow through the appliance to actuate the air proving device.

7.3.5.4.7.3 Operation under suction

The appliance is operated under normal running conditions at nominal distribution air flow. At thermal equilibrium, the restrictor in the test duct system is set to simulate the minimum resistance to flow in the duct system.

By means of an external fan, the appliance is subjected to a suction that reduces the pressure measured in the above condition by 0,5 mbar at the discharge orifice.

7.3.5.4.8 Appliances designed for outdoor installation

Without altering the initial burner adjustment, the appliance is supplied with the appropriate reference gases (see Table 8) according to its category and operated at the nominal heat input.

Using the apparatus described in 7.3.4.2.3, the appliance is subjected to a horizontal wind speed of 2,5 m/s centring on the terminal. The appliance is slowly rotated about a vertical axis relative to the fan.

The test is repeated at wind speeds of 5 m/s and 10 m/s.

The above tests are repeated with ascending and plunging winds at an angle of 45° to the horizontal.

7.3.5.5 Other pollutants

7.3.5.5.1 General

The appliance is installed as specified in 7.3.5.1.

For appliances intended to use second and third family gases, the tests are carried out with reference gas G 20.

For appliances intended to use only G 25 as the reference gas, the tests are carried out with G 25.

For appliances intended to use only third family gases, the tests are carried out with reference gas G 30.

For appliances intended to use propane only, the tests are carried out with reference gas G 31.

The appliance is adjusted to its nominal heat input and, where appropriate, to other heat inputs provided by the controls.

Then NO_x measurements are carried out when the appliance is at thermal equilibrium, conforming with details as given in CR 1404.

The reference conditions for the combustion air are:

a) temperature 20 °C;

b) humidity 10 g H_2O/kg air.

If the test conditions are different from these reference conditions, it will be necessary to correct the NO_x values using Equation (10).

$$NO_{x,0} = NO_{x,m} + \frac{0,02NO_{x,m} - 0,34}{1 - 0,02(h_m - 10)}(h_m - 10) + 0,85(20 - T_m) \quad (10)$$

where

$NO_{x,0}$ is the value of NO_x corrected to the reference conditions expressed in mg/kWh;

$NO_{x,m}$ is the measured at h_m and T_m in mg/kWh in the range 50 mg/kWh to 300 mg/kWh;

h_m is the humidity during the measurement of $NO_{x,m}$ in g/kg in the range 5 g/kg to 15 g/kg;

T_m is the ambient temperature during the measurement of $NO_{x,m}$ in ˚C in the range 15 ˚C to 25 ˚C.

The measured NO_x values are weighted in accordance with the requirements of 7.3.5.5.2. It is checked that the weighted NO_x value does not exceed the limit stated in 6.1.5.3.

For the calculation of conversions of NO_x (see Annex K).

7.3.5.5.2 Weighting

The measured NO_x values are weighted depending upon the appliance, to take into account its efficiency, its heat capacity and its usage characteristics.

a) For on/off appliances: $$E_{Q_n} = \frac{9\eta_{ref}}{10\eta_{Q_n}}$$

b) For high/low appliances:

with $Q_{min} \geq 60$ % $$0,2E_{Q_n} \times \frac{9\eta_{ref}}{10\eta_{Q_n}} + 0,8E_{Q_{min}} \times \frac{9\eta_{ref}}{10\eta_{Q_{min}}}$$

with $60\% > Q_{min} \geq 50$ % $$0,25E_{Q_n} \times \frac{9\eta_{ref}}{10\eta_{Q_n}} + 0,75E_{Q_{min}} \times \frac{9\eta_{ref}}{10\eta_{Q_{min}}}$$

with $50\% > Q_{min} \geq 40$ % $$0,33E_{Q_n} \times \frac{9\eta_{ref}}{10\eta_{Q_n}} + 0,67E_{Q_{min}} \times \frac{9\eta_{ref}}{10\eta_{Q_{min}}}$$

with $40\% > Q_{min} \geq 30$ % $$0,5E_{Q_n} \times \frac{9\eta_{ref}}{10\eta_{Q_n}} + 0,5E_{Q_{min}} \times \frac{9\eta_{ref}}{10\eta_{Q_{min}}}$$

with $Q_{min} < 30$ % $$E_{Q_n} = \frac{9\eta_{ref}}{10\eta_{Q_n}}$$

c) Modulating appliances:

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with $Q_{min} \geq 60$ %

$$0{,}2E_{Q_n} \times \frac{9\eta_{ref}}{10\eta_{Q_n}} + 0{,}8E_{Q_{min}} \times \frac{9\eta_{ref}}{10\eta_{Q_{min}}}$$

with $Q_{min} < 60$ %

$$0{,}2E_{Q_n} \times \frac{9\eta_{ref}}{10\eta_{Q_n}} + 0{,}4E_{Q_{60}} \times \frac{9\eta_{ref}}{10\eta_{Q_{60}}} + 0{,}4E_{Q_{min}} \times \frac{9\eta_{ref}}{10\eta_{Q_{min}}}$$

where

E_{Qn} is the emission figure at the nominal heat input;

E_{Qmin} is the emission figure at the minimum heat input;

E_{Q60} is the emission figure at 60 % of the nominal heat input;

η_{ref} is the reference efficiency, i.e. the applicable efficiency requirement stated in 6.2;

η_{Qn} is the efficiency at nominal heat input;

η_{min} is the efficiency at minimum heat input;

η_{60} is the efficiency at 60 % of the nominal heat input.

NOTE Also see 6.2, where Q_{min} is understood to be any heat input lower than the nominal heat input, and for which both the efficiency and the NO_x emission figure are measured.

7.3.6 Overheat cut-off device

7.3.6.1 Test 1

The appliance shall be installed as described in 7.1.6 and supplied with a typically distributed gas (see 7.1.3.1) or an appropriate reference gas corresponding to its category and operated within ± 2 % of the manufacturer's maximum nominal heat input. Any air temperature control or air flow control devices are rendered inoperative.

Dependent on the appliance design and test suitability, then carry out the test as described in 7.3.6.1.1, 7.3.6.1.2 or 7.3.6.1.3.

7.3.6.1.1 Appliances designed to be connected to distribution ductwork or appliances where the air flow static pressure is designed to be ≥ 100 Pa

Any air outlet louvres are set to give the least possible deflection of the delivered air. A duct of 1,0 m in length having the same cross section and dimensions as the appliance outlet shall be connected to each outlet (for the purposes of this test the manufacturer shall supply the necessary duct).

The open end of the duct is fitted with a device that will symmetrically reduce the cross sectional area of the duct outlet.

At the centre of the open end of the duct a single thermocouple or similar device is placed to measure the temperature of the air leaving the appliance.

The appliance is operated and the air flow is gradually reduced, using the restrictor device, until the overheat cut-off device operates to turn off the burner and the air temperature is noted.

The overheat cut-off device is then reset as soon as it is possible to do so and the test is repeated.

If the temperature recorded is higher than the first recorded temperature then the test is repeated until the worst condition is reached.

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7.3.6.1.2 Appliances designed to be free blowing into the heated space and fitted with a single outlet

Any air outlet louvres are set to give the least possible deflection of the delivered air. A duct of 1,0 m in length having the same cross section and dimensions as the appliance outlet shall be connected to the outlet (for the purposes of this test the manufacturer shall supply the necessary duct).

Sufficient thermocouples, or similar devices are placed at 0,5 m from the appliance outlet and parallel to the plane of that outlet within the duct and positioned to give the average temperature of the delivered air. Five thermocouples in the shape of a cross will normally be suitable.

The appliance is operated and the air flow is gradually reduced, by reducing the voltage supply to the fan or other suitable means, until the overheat cut-off device operates to turn off the burner and the average air temperature is noted.

The overheat cut-off device is then reset as soon as it is possible to do so and the test is repeated.

If the temperature recorded is higher than the first recorded temperature then the test is repeated until the worst condition is reached.

7.3.6.1.3 Appliances designed to be free blowing into the heated space and fitted with multiple outlets

Any air outlet louvres are set to give the least possible deflection of the delivered air.

Sufficient thermocouples, or similar devices, are placed to measure the average air temperature at each outlet and in the plane of that outlet. Five thermocouples in the shape of a cross will normally be suitable.

The appliance is operated and the air flow is gradually reduced by progressively closing off the air inlet to the fan in a symmetrical manner, or other suitable means, until the overheat cut-off device operates to turn off the burner and the average air temperature is noted.

The overheat cut-off device is then reset as soon as it is possible to do so and the test is repeated.

If the temperature recorded is higher than the first recorded temperature then the test is repeated until the worst condition is reached.

7.3.6.2 Test 2

The appliance is installed in accordance with the requirements of 7.1.6.

The air temperature control and the air distribution fan are rendered inoperative.

The appliance is operated from the cold condition a typically distributed gas (see 7.1.3.1) or an appropriate reference gas corresponding to its category and operated within ± 2 % of the manufacturer's maximum nominal heat input.

The appliance is operated until the overheat control operates to cut off the gas to the main burner, after which the control is reset as soon as possible in order to re-ignite the burner(s). The appliance is cycled on the overheat control for sufficient time to ensure that the worst condition has been reached.

7.3.7 Heat exchanger thermal cycling

Prior to the test being carried out, the heat exchanger is carefully examined and any manufacturing abnormalities noted (e.g. tool damage, welding faults and careless assembly). Any such abnormalities are not considered in the final examination of the heat exchanger.

The appliance is installed under the conditions of 7.1.6 and operated at the normal pressure using an appropriate reference gas.

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A thermocouple wired to an independent control is attached to the body of the overheat cut-off device. The air temperature control device is disconnected and the appliance is operated until the overheat cut-off device operates to cut off the gas to the main burner. The temperature sensed by the thermocouple at the moment of shut-off is recorded by the independent control.

The overheat cut-off device is then disconnected and replaced by the independent control set to shut the appliance down at a temperature of 10 K above the temperature of the thermocouple previously recorded.

NOTE 1 If an appliance is fitted with a re-settable temperature limiter (overheat control device) in addition to the overheat cut-off device, the former may be used as the basis for conducting the test (i.e. fixed at a temperature of 10 K above its set point).

The appliance is then operated with the gas on and the air distribution fan off until the independent control shuts the appliance down. The air distribution fan is then switched on and runs for 3,5 min.

The cycle is repeated 5 000 times.

If components other than the heat exchanger are adversely affected during the thermal cycling test, action shall be taken to safeguard such components and avoid deleterious effects on the heat exchanger.

NOTE 2 If it can be shown that either the physical form of the heat exchanger, or the type of control adopted, make such a test inappropriate, an equivalent test may be devised and agreed by negotiation between the manufacturer and the notified body.

7.3.8 Effectiveness of the pre-purge

The appliance is installed and adjusted in accordance with the manufacturer's instructions as specified in 7.1.6.

Without altering the initial burner adjustment the appliance is supplied with the appropriate reference gas(es) (see Table 8) at the nominal heat input.

The products of combustion are collected as described in 7.3.5, when the appliance has reached thermal equilibrium.

The volume of air available for combustion, V_c (in m^3), is calculated using Equation (11).

$$V_c = Q_g\left(A_s + A_e\right)\left(\frac{T_p}{3600}\right) \tag{11}$$

where

A_s is the stoichiometric air requirement for the fuel (V/V);

A_e is the excess air (V/V);

Q_g is the gas rate in cubic metres per hour (m^3/h);

T_p is the pre-purge time in seconds (s).

The stoichiometric air requirement for the fuel, A_s, is calculated using Equation (12).

$$A_s = \left(\frac{100}{21}\right)\left(V_{CO_2,P} + \frac{V_{H_2O,P}}{2}\right) \tag{12}$$

The excess air, A_e, is calculated using Equation (13).

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$$A_e = \frac{\left(100 V_{CO_2,P}\right)}{V_{CO_2,M}} - \left(K\left(A_s + 1\right) - V_{H_2O,P}\right) \quad (13)$$

where

$V_{CO2,P}$ is the volume of carbon dioxide produced by the complete combustion of 1 m^3 of reference gas (*V*/*V*);

$V_{CO2,M}$ is the carbon dioxide concentration measured in the sample of the products of combustion;

$V_{H2O,P}$ is the volume of water produced by the complete combustion of 1 m^3 of reference gas (*V*/*V*);

K is the ratio of the total volume of wet products of combustion and the total volume of gas and air supplied to the appliance.

The values of A_s, $V_{CO2,P}$, $V_{H2O,P}$ and *K* for the reference gases are given in Table 12.

Table 12 — Reference values for excess air determination

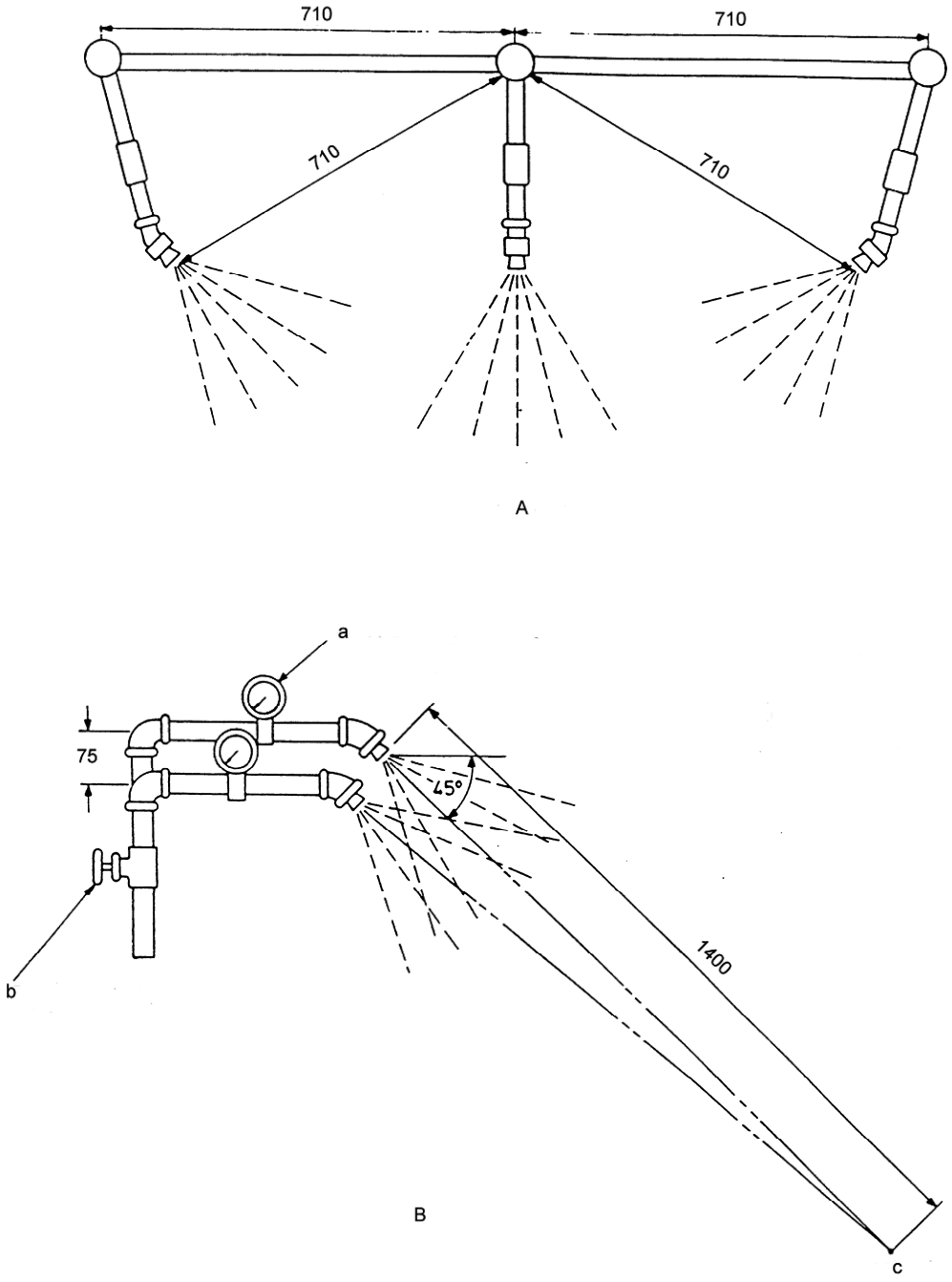
Reference gas	G 110	G 120	G 20	G 25	G 30	G 31
A_s	3,67	4,17	9,52	8,19	30,95	23,8
$V_{CO2,P}$	0,26	0,32	1	0,86	4	3
$V_{H2O,P}$	1,02	1,11	2	1,72	5	4
K	0,946	0,955	1	1	1,047	1,04

Compare the value of V_c with the measured volume of the combustion circuit.

7.3.9 Weather resistance

Two independent sets of adjustable spray units, each as shown in Figures 13 and 14, are used. Each spray unit is adjustable in height from 2 m to 3 m above the floor and in any lateral direction.

Dimensions in millimetres

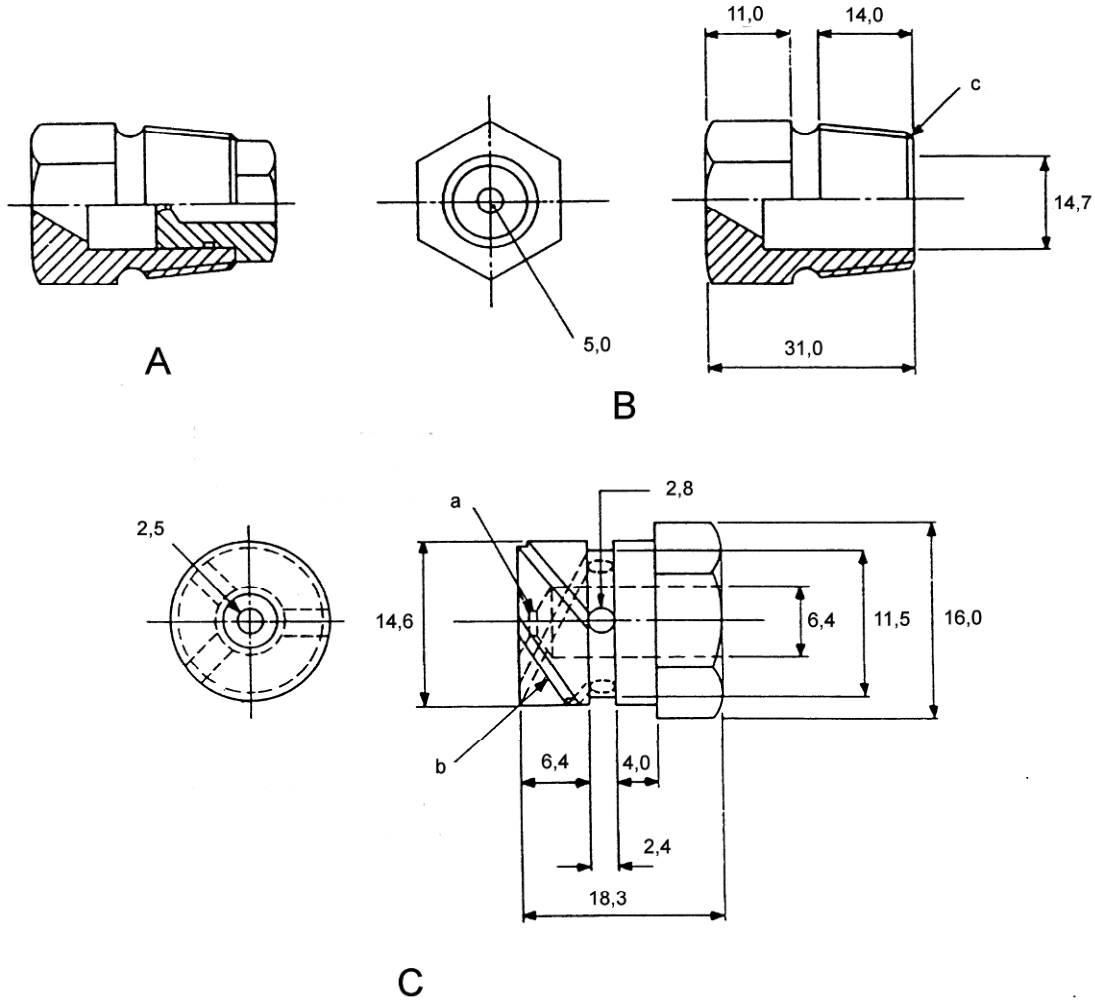


Key

A Plan view
B Side elevation
a Water pressure gauge for each spray head
b Control valve for each spray head
c Focal point

Figure 13 — Arrangement of spray heads and associated piping for the weather resistance test

Dimensions in millimetres



Key

A Assembly
B Body
C Insert
a Straight throat, not more than 0,8 mm long. Drill relief 115°, 0,8 mm deep
b 3 square section slots: 1,5 mm wide, 1,5 mm deep; equally spaced (120°); 60° helix; leading edges tangential to radial edges
c ½ in B.S.P. taper

Figure 14 — Detail of spray head construction and assembly

The two spray units are placed in opposition with the spray heads equidistant from the appliance under test.

The appliance is installed as described in 7.1.6 on a test platform of such size as to accommodate the appliance easily and supplied with the reference gas corresponding to the appliance category at the normal pressure.

The spray heads are set to operate at 350 mbar and the units adjusted to varying elevations and horizontal distances from the appliance to determine the most critical location. Exposure at the location deemed to be most critical is maintained throughout the test.

After adjustment of the spray units, any ignition burner is ignited and the test applied for a period of 15 min. The main burners are then ignited and the test continued for a further 15 min.

The test is repeated with the appliance located in any other position relative to the spray units as may be required.

7.4 Efficiency

7.4.1 General test conditions

7.4.1.1 Principle

The thermal efficiency is determined by the flue loss method from measurements of CO_2 concentration and the temperature of the products of combustion.

7.4.1.2 Test room

The room shall be adequately ventilated but free from draughts likely to affect the performance of the appliance. The room temperature shall be maintained at 20 °C ± 5 °C and, during the course of a test, it shall not vary by more than 2 K.

7.4.1.3 Preparation of appliance

The appliance is installed in accordance with the requirements of 7.1.6 and operated, in accordance with the manufacturer's instructions, with reference gas (see Table 8) except that Type C_{32} and C_{33} appliances are installed with combustion air and combustion products ducts of the minimum resistance declared by the manufacturer.

7.4.2 Test conditions

The appliance is supplied with typical distributed gas(es) or the reference test gas(es) corresponding to its category and operated within ± 2 % of the specified heat input(s) using the minimum delivered air flow declared by the manufacturer.

The CO_2 concentration and the temperature of the combustion products are measured by means of a suitable probe, incorporating a temperature-measuring device, located in the flue system after the draught diverter or combustion products duct, as appropriate. The sampling rate of combustion products for the measurement of temperature is approximately 100 l/h.

For all Type B appliances, the test probe to be used is as shown in Figure 8 and is positioned 800 mm above the flue outlet connection on the appliance.

For Type C_1 appliances, the test probe to be used is as shown in Figure 9. Where possible, it is positioned as shown in Figure 10.

NOTE For Type C_1 appliances where the aforementioned location is not appropriate, the sampling position will be by agreement between the manufacturer and the test authority, sufficient measurements being taken to ensure consistency of results.

For Type C_3 appliances, the test probe to be used is as shown in Figure 9. It is positioned 800 mm above the flue outlet connection on the appliance.

For Type C_6 appliances, the test probe to be used is as shown in Figure 11.

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For appliances designed for outdoor installation, the test probe is located at the combustion products outlet.

NOTE A probe similar in design to that shown in Figure 9 is appropriate

7.4.3 Test procedure

With the appliance installed and adjusted as described in 7.4.1.3, the appliance is operated for a sufficient time to reach thermal equilibrium. Measurements are then made of the temperature and the CO_2 concentration of the combustion products and of the combustion air.

The gas rate is measured by timing an integral number of revolutions of the gas meter over a period of at least 100 s.

7.4.4 Accuracy of measurement

Measurements are made to the accuracy shown in Table 13.

Table 13 — Accuracy of measurement

Quantity measured	Measurement accuracy
Combustion air temperature	± 0,5 °C
Combustion products temperature	± 2 °C
CO_2 concentration of the combustion air and the combustion products	± 6 % of the sample concentration
Calorific value	± 0,5 %

7.4.5 Calculation of efficiency

V_f is calculated from the volume of CO_2 (V_{CO2}) produced by the combustion of 1 m³ of gas (see Table 14), and from the CO_2 concentration of the products of combustion ($V_{CO2,M}$) as given by Equation (14).

$$V_f = 100\frac{V_{CO_2}}{V_{CO_2,M}} \tag{14}$$

Table 14 — V_{CO2} values

Gas designation	V_{CO2}
G 110	0,26
G 120	0,32
G 20	1
G 25	0,86
G 30	4
G 31	3

The net efficiency, η_{net}, (in %) is given by Equation (15).

$$\eta_{net} = 100 - (q_1 + q_2) \tag{15}$$

where

$$q_1 = C_1 V_f \left(\frac{t_2 - t_1}{H_i}\right) 100$$

and

$$q_1 = 0{,}077(t_2 - t_1)\left(\frac{H_s - H_i}{H_i}\right)$$

and

q_1 is the heat of the dry products of combustion (percentage of heat released per unit volume of gas);

q_2 is the heat of the water vapour contained in the products of combustion (percentage of heat released per unit volume of gas);

C_1 is the mean specific heat of the dry products of combustion in MJ/m^3 · K (see Figure 15);

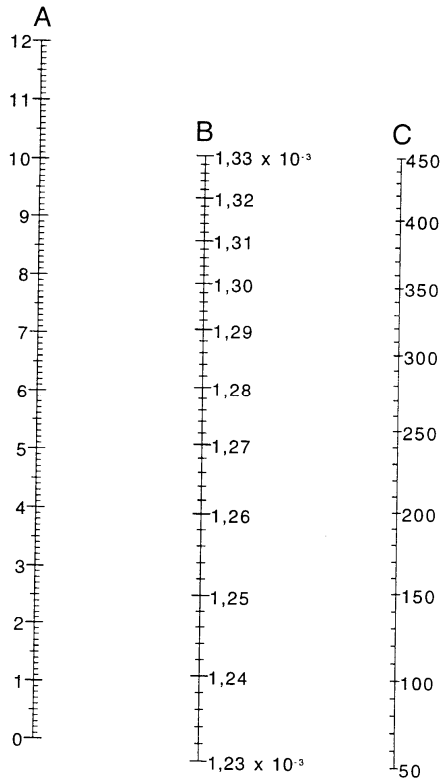
t_1 is the average combustion air temperature in °C;

t_2 is the average temperature of the products of combustion in °C;

H_i is the net calorific value of the gas at 1 013,25 mbar and 15 °C, dry in MJ/m^3;

H_s is the gross calorific value of the gas at 1 013,25 mbar and 15 °C, dry in MJ/m^3;

V_f is the volume of dry products of combustion per unit volume of gas in m^3.



Key
A % CO_2 in combustion products minus % CO_2 in air
B Mean specific heat of dry products of combustion in MJ/m^3 ·K
C Temperature of combustion products in °C

Figure 15 — Mean specific heat of dry combustion products

7.4.6 Supplementary test for appliances with a modulating or high/low control

The test is carried out and the efficiency measured as specified in 7.4.1 to 7.4.5, with the appliance adjusted to give the minimum rate.

It is checked that the requirements of 6.2 are met.

8 Marking and instructions

8.1 Marking of the appliance

8.1.1 Description

Appliances are described by their:

a) category;

b) nominal input, or range of adjustable inputs.

8.1.2 Data plate

The appliance shall carry one or more data plates and/or labels that are firmly and durably attached to the appliance such that the information given is visible to, and can be read by, the installer. The data plate(s) and/or label(s) shall, in indelible[5)] characters, give at least:

a) the manufacturer's[6)] name and address;

b) the nominal heat input and, where necessary, the range of input for an appliance with an adjustable input, expressed in kilowatts, stating whether it is based on net or gross calorific value;

c) the trade name of the appliance;

d) the serial number;

e) the Product Identification Number (PIN number of the notified body);

f) the commercial identification of the appliance;

g) the type of gas in relation to the pressure and/or the pressure couple, for which the appliance has been adjusted; any pressure indication shall be identified in relation to the corresponding category index; if an intervention is necessary on the appliance in order to change from one pressure to the other within a pressure couple of the third family, only the pressure corresponding to the current adjustment of the appliance shall be indicated;

h) the direct country or countries of destination of the appliance;

i) the appliance category or categories: if more than one appliance category is specified, each of these categories shall be identified in relation with the appropriate direct country or countries of destination;

j) the setting pressure for regulated appliances;

---

5) The indelibility of the marking is checked by a test carried out in accordance with the requirements of 7.14 of EN 60335-1:2002.

6) "Manufacturer" means the person, organization or company who assumes responsibility for designing and manufacturing a product with a view to placing it on the market on their own behalf within the EU.

k) the nature and voltage of the current used and the maximum electrical input power used (volts, amperes, frequency and kilowatts) for all intended electrical supply conditions.

No other information shall be included on the appliance if this could lead to confusion with regard to the current state of adjustment of the appliance, the corresponding appliance category (or categories) and the direct country (or countries) of destination.

For an appliance with an adjustable nominal input, there shall be room for the installer to durably mark the nominal heat input value for which it has been adjusted on commissioning.

8.1.3 Other marking

The appliance shall be marked with:

"This appliance must be installed in accordance with the rules in force, and used only in a sufficiently ventilated space. Consult instructions before installation and use of this appliance."

8.2 Marking of the packaging

The packaging shall show at least the:

a) type of gas in relation to the pressure and/or the pressure couple, for which the appliance has been adjusted; any pressure indication shall be identified in relation to the corresponding category index; if an intervention is necessary on the appliance in order to change from one pressure to the other within a pressure couple of the third family, only the pressure corresponding to the current adjustment of the appliance shall be indicated;

b) direct country or countries of destination of the appliance;

c) appliance category or categories: if more than one appliance category is specified, each of these categories shall be identified in relation with the appropriate country or countries of destination.

In addition, the packaging shall be marked with:

"This appliance must be installed in accordance with the rules in force, and used only in a sufficiently ventilated space. Consult instructions before installation and use of this appliance."

No other information shall be included on the packaging if this could lead to confusion with regard to the current state of adjustment of the appliance, the corresponding appliance category (or categories) and the direct country (or countries) of destination.

8.3 Utilization of symbols on the appliance and packaging

8.3.1 Electrical supply

The marking concerning electrical values shall be in conformity with EN 60335-1.

8.3.2 Type of gas

In order to represent all of the category indices corresponding to the adjustment of an appliance, the symbol of the reference gas shall be used which is common to all of these indices, in accordance with the requirements of Table 15.

In order to satisfy the needs expressed by CEN members it is permitted that their countries declared means of identification may be included, in addition to the symbol. These additional means are given in Annex F.

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Table 15 — Gas type symbol

Gas type symbol		Corresponding category index
First family[a)]	G 110	1a
	G 120	1b
	G 130	1c
Second family	G 20	2H, 2E, 2E+, 2Esi[b)], 2Er[b)], 2ELL[b)]
	G 25	2L, 2Esi[c)], 2Er[c)], 2ELL[c)]
Third family	G 30	3B/P, 3+[d) f)], 3B
	G 31	3+[e) f)], 3P

[a)] If, in its current state of adjustment, the appliance can use gases from different groups, all the reference gases corresponding to these groups shall be indicated.

[b)] When the appliance is adjusted for G 20.

[c)] When the appliance is adjusted for G 25.

[d)] Only applies to appliances which do not need any adjustment between G 30 and G 31, or to appliances which need an adjustment and which are adjusted for G 30.

[e)] Only applies to appliances which need an adjustment between G 30 and G 31, and which are adjusted for G 31.

[f)] For the appliances which need an adjustment between G 30 and G 31, the label concerning the adjustment to the other gas and the other pressure of the pressure couple shall be supplied with the technical instructions.

8.3.3 Gas supply pressure

The gas supply pressure can be expressed uniquely by the numerical value using the unit (mbar). Nevertheless, if it is necessary to explain this value, the symbol "p" shall be used.

8.3.4 Country of destination

In accordance with EN ISO 3166-1, the names of countries shall be represented by:

AT	Austria	IE	Ireland
BE	Belgium	IS	Iceland
BG	Bulgaria	IT	Italy
CH	Switzerland	LT	Lithuania
CY	Cyprus	LU	Luxembourg
CZ	Czech Republic	LV	Latvia
DE	Germany	NL	Netherlands
DK	Denmark	MT	Malta
EE	Estonia	NO	Norway
ES	Spain	PL	Poland
FI	Finland	PT	Portugal
FR	France	RO	Romania
GB	United Kingdom	SE	Sweden
GR	Greece	SI	Slovenia
HU	Hungary	SK	Slovakia

8.3.5 Category

The category can be expressed uniquely by its designation in accordance with the requirements of EN 437. Nevertheless, if it is necessary to explain it, the term "category" shall be symbolized by "cat".

8.3.6 Other information

The symbols given below are not obligatory, but are recommended under the title "preferential", and to the exclusion of any other symbol, to avoid the use of many and different markings:

— Nominal heat input of a burner: *Q*n.

— Nominal heat input of all appliance burners: Σ*Q*n.

8.3.7 Emissions

The manufacturer may chose to declare the weighted NO_x emission value or to express it by class as:

a) Class 1, for values not exceeding 250 mg/kWh;

b) Class 2, for values not exceeding 200 mg/kWh;

c) Class 3, for values not exceeding 150 mg/kWh;

d) Class 4, for values not exceeding 100 mg/kWh;

e) Class 5, for values not exceeding 50 mg/kWh.

The value or class may be marked on the appliance or contained in the technical data.

8.4 Instructions

8.4.1 General

The instructions shall be written in the official language(s) of the country or countries of destination and shall be valid for that or those countries.

If the instructions are written in an official language that is used by more than one country, the country or countries for which they are valid shall be identified by the codes given in 8.3.4.

Instructions for countries other than those stated on the appliance may be supplied with the appliance, on condition that each set of instructions includes as an initial statement:

> "These instructions are only valid if the following country code is on the appliance: If this code is not present on the appliance, it is necessary to refer to the technical instructions which will provide the necessary information concerning the modification of the appliance to the conditions of use for the country."

8.4.2 Technical instructions for installation and adjustment

In addition to the information given in 8.2, the technical instructions may include information indicating, where appropriate, that the appliance has been certified for use in countries other than those stated on the appliance[7)]. If such information is given, the instructions shall include a warning that modification of the appliance and its method of installation are essential in order to use the appliance safely and correctly in any of these additional countries. This warning shall be repeated in the official language(s) of each of these countries. Furthermore, the instructions shall indicate how to obtain the information, instructions and parts that are necessary for safe and correct use in the countries concerned.

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7) Indirect country of destination.

Before installation, check:

— that the local distribution conditions, nature of gas and pressure, and the current state adjustment of the appliance are compatible, and

— that the local electrical supply conditions are compatible with the electrical data given on the data plate.

The technical instructions for installation and adjustment shall:

a) describe the installation conditions for the appliance (e.g. on a floor or a wall) and its accessories (e.g. room thermostat);

b) state the minimum distance necessary between the appliance surfaces (including surfaces of the POCED in the case of Type B_4, B_5, C_1 and C_3 appliances) and any nearby walls;

c) describe any precautions to be taken to avoid overheating the floor, walls or ceiling if these are made from combustible materials. These precautions shall include details of any insulation or sleeve required when a POCED passes through a wall or ceiling made from combustible materials;

d) state the minimum and maximum ambient temperature in which the appliance is designed to operate;

e) provide information on the combustion and ventilation air requirements, the gas and electricity supply and connections and procedure to be followed for commissioning the appliance;

f) include a complete wiring diagram and a technical data table;

g) the heat output;

h) the NO_x class if declared by the manufacturer.

The technical data table shall include the appliance heat input, heat output, rating of any ignition burner, burner pressure, injector sizes, number of injectors, gas connection size, flue size, physical dimensions, mass, electric motor details, fan ratings, air delivery volumes, and such other technical data as may be required by the installer and commissioning engineer.

For Type B_{12}, B_{13} and B_{14} appliances, the installation instructions shall specify the minimum flue height for the appliance and, where necessary, they shall also describe the method of fixing the draught diverter and the connecting piece for the flue pipe. They shall specify the method of checking for spillage of products of combustion from the draught diverter.

For Type B_{14} appliances, the installation instructions shall specify the method of adjusting any damper or other combustion air controlling device.

For Type B_{22}, B_{23} appliances, they shall state the minimum and maximum equivalent resistance, or such other information for the assembly of the flue system, and give details for calculating the equivalent resistance (e.g. the allowance to be made for bends).

For all Type B_4, B_5, C_1 and C_3 appliances, they shall specify the minimum and maximum equivalent resistance[8)].

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8) In the case of Type B_4, B_5, C_1 and C_3 appliances the minimum and maximum equivalent resistance corresponds to the POCED supplied or specified by the manufacture with the minimum and maximum resistance to flow. Due account shall be taken of the resistance to flow of any terminal supplied or specified by the manufacturer and in the case of Type C appliances the resistance to flow of the air supply duct.

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For all Type B_4, B_5, C_1 and C_3 appliances, the specification shall include a description of the POCED including any bends, its materials of construction and any critical tolerances (e.g. length, diameter, thickness, insertion depth); the method of installing the POCED, including any necessary supporting elements, the method of attachment to the building and a statement confirming that the POCED is capable of withstanding its own weight.

For Type C_6 appliances, they shall state the maximum resistance permitted in the combustion air inlet duct and combustion products outlet duct, and the corresponding temperature and CO_2 concentration or mass flow of the combustion products to enable calculation of possible duct systems. Furthermore, they shall specify the method for calculating the resistance in the duct system using the aforementioned parameters.

NOTE The Notified Body shall verify the above parameters specified by the manufacturer. The temperature and the CO_2 concentration of the combustion products shall be within 10 K and 0,5 % respectively. If the manufacturer specifies a mass flow, this shall be within 5 % of the stated value.

They shall also give all relevant information for adjusting the gas and delivered air rates. They shall also include a table for the appliance category, giving the various calorific values and the gas rate settings, in m³/h in relation to the average conditions of use (15 °C, 1 013,25 mbar) or in kg/h, together with the instructions about how to adjust the air rate.

If the manufacturer claims that the appliance is suitable for use in garages, then the instruction for installation shall take into account the relevant national installation rules.

If the appliance is intended for outdoor use, this shall be made clear in the instructions.

8.4.3 Instructions for use and maintenance

All the instructions shall be provided by the manufacturer. The instructions for use and maintenance shall provide all the necessary information for the safe and sensible use of the appliance.

In particular, they shall deal with the operations of ignition and extinction (also see 8.4.5), the use of the various controls with which the appliance may be fitted, simple cleaning and maintenance of the appliance, also mentioning, where necessary, the nature of the products recommended. They shall also stress that a qualified installer is required to install, adjust and, where necessary, convert the appliance for use with other gases.

They shall also state the recommended frequency of periodic servicing.

8.4.4 Instructions for servicing

The servicing instructions shall indicate the frequency of servicing and the scope of the service programme recommended by the manufacturer. They shall also specify such special tools as are necessary for any servicing procedure.

The procedure for removing or gaining access to parts or components to be serviced, together with the recommended service work and associated procedures shall be clearly defined.

The instructions shall also include complete electrical, functional and wiring diagrams and a short list of appliance parts and part numbers of those items that the manufacturer considers may be required for replacement purposes during the life of the appliance.

Reference shall also be made to the necessity for consulting the appliance manufacturer before replacing parts other than those specified or recommended in the servicing instructions.

A fault-finding chart shall be incorporated as an aid to servicing. The service instructions shall also include a line or block diagram showing the arrangement of the gas controls.

The servicing instructions shall contain any specific recommendations for emergency servicing under wet conditions, including the provision of weatherproof covers, for appliances designed for outdoor installation.

The servicing instructions shall draw attention to the necessity for re-commissioning the appliance after servicing.

They shall deal with the assembly of parts which are likely to be replaced, and with the greasing of taps, the electric motor and the fan, and with cleaning.

8.4.5 Lighting instructions

Lighting and shut-down instructions shall be provided. When affixed to the appliance they shall be in an accessible and readily visible position.

The instructions shall include any delay recommended by the manufacturer following failure to ignite or the extinction of the main burner.

8.4.6 Instructions for conversion

The conversion instructions shall provide technical information on the procedures to be followed when converting the appliance from use on one gas in a family to use on a gas in another family, or from one gas group to another within a family.

In particular, they shall explain the operations and adjustments to be carried out and the marking on the parts and injectors supplied for each of the gases which may be used.

9 Evaluation of conformity of POCED's and their associated terminals

9.1 General

The compliance of a POCED and its associated terminal shall be demonstrated by:

a) initial type testing;

b) factory production control by the manufacturer, including product assessment.

NOTE The requirements are given in the relevant Tables ZB.1 or ZB.2.

9.2 Type testing

9.2.1 Initial type testing

Initial type testing shall be performed to show conformity the requirements of this standard.

NOTE The requirements are given in the relevant Tables ZB.1 or ZB.2.

Tests previously performed in accordance with the provisions of this standard (e.g. same product, same characteristic(s), test method, sampling procedure, system of attestation of conformity) may be taken into account. In addition, initial type testing shall be performed at the beginning of the production of a new POCED and/or its associated terminal, or at the beginning of a new method of production (where this may affect the stated properties).

Where characteristics are determined on the basis of conformity with other product standards (e.g. metals including coatings, seals and sealants), these characteristics do not need to be reassessed provided that the designer ensures the validity of the results. Products CE marked in accordance with appropriate harmonised European specifications may be presumed to have the performances stated of them, although this does not

replace the responsibility of the manufacturer to ensure that the POCED and any associated terminal as a whole is correctly designed and its component products have the necessary performance values.

9.2.2 Further type testing

Whenever a change occurs in the POCED, any associated terminal, the raw material or supplier of the components, or the production process, which would change the tolerances or one or more of the characteristics that are assessed by the requirements, the type tests shall be repeated for the appropriate characteristic(s).

9.2.3 Sampling for type testing

Unless otherwise stated in the particular test method given in Clause 7 of this standard, type testing is carried out utilising a POCED, and any associated terminal, having the minimum and maximum equivalent resistance.

The results of all type tests shall be recorded and held by the manufacturer, until superseded.

9.3 Factory production control (FPC)

9.3.1 General

NOTE 1 A FPC system conforming with the following requirements of the relevant part(s) of EN ISO 9001:2008, and made specific to the requirements of this standard, is considered to satisfy the above requirements.

The manufacturer shall establish, document and maintain a FPC system to ensure that the manufactured products conform to the stated performance characteristics. The FPC system shall consist of procedures, regular inspections and tests and/or assessments and the use of the results to control the raw and other incoming materials or components, equipment, the production process and the product.

The manufacturer is responsible for organising the effective implementation of the factory production control system. Tasks and responsibilities in the production control organisation should be documented and this documentation should be kept up to-date. In each factory the manufacturer may delegate the action to a person having the necessary authority to:

a) identify procedures to demonstrate conformity of the product at appropriate stages;

b) identify and record any instance of non-conformity;

c) identify procedures to correct instances of non conformity.

The manufacturer should draw up and keep up-to-date documents defining the factory production control which he applies. The manufacturer's documentation and procedures should be appropriate to the product and manufacturing process. All FPC systems should achieve an appropriate level of confidence in the conformity of the product. This involves:

d) the preparation of documented procedures and instructions relating to factory production control operations, in accordance with the requirements of the reference technical specification;

e) the effective implementation of these procedures and instructions;

f) the recording of these operations and their results;

g) the use of these results to correct any deviations, repair the effects of such deviations, treat any resulting instances of non-conformity and, if necessary, revise the FPC to rectify the cause of non-conformity.

The production control operations shall include some or all of:

h) the specification and verification of raw materials and constituents;

i) the controls and tests to be carried out during manufacture according to a frequency laid down;

j) the verifications and tests to be carried out on finished products according to a frequency which may be laid down in the technical specifications and adapted to the product and its conditions of manufacture.

NOTE 2 Depending on the specific case, it may be necessary to carry out:

a) the operations referred to under i) and j),

b) only the operations under i) or,

c) only those under j).

The operations under i) centre as much on the intermediate states of the product as on manufacturing machines and their adjustment and equipment. These controls and tests and their frequency are chosen based on product type and composition, the manufacturing process and its complexity, the sensitivity of product features to variations in manufacturing parameters, etc.

The manufacturer shall have or have available the installations, equipment and personnel which enable him to carry out the necessary verifications and tests. He may, as may his agent, meet this requirement by concluding a sub-contracting agreement with one or more organisations or persons having the necessary skills and equipment.

The manufacturer has responsibility to calibrate or verify and maintain the control, measuring or test equipment in good operating condition, whether or not it belongs to him, with a view to demonstrating conformity of the product with its technical specification. The equipment shall be used in conformity with the specification or the test reference system to which the specification refers.

If necessary, monitoring is carried out of the conformity of intermediate states of the product and at the main stages of its production.

This monitoring of conformity focuses where necessary on the product throughout the process of manufacture, so that only products having passed the scheduled intermediate controls and tests are dispatched.

The results of inspections, tests or assessments requiring action shall be recorded, as any action taken. The action to be taken when control values or criteria are not met shall be recorded.

9.3.2 Equipment

All weighing, measuring and testing equipment shall be calibrated and regularly inspected according to documented procedures, frequencies and criteria.

9.3.3 Raw materials and components

The specifications of all incoming raw materials and components shall be documented, as the inspection scheme for ensuring their conformity.

9.3.4 Product testing and evaluation

The manufacturer shall establish procedures to ensure that the stated values of the characteristics are maintained. An example of a sampling plan for FPC is given in Annex L.

9.3.5 Non-conforming products

The manufacturer shall establish procedures for dealing with non-conforming products.

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Annex A
(informative)

National situations[9)]

A.1 General

In each country in which this standard applies, appliances may be marketed only if they comply with the particular national supply conditions of that country.

In order to permit, both at the time of testing the appliance and at the time of its sale, the correct choice to be made from all the situations covered, the various national situations are summarized in A.2, A.3, A.4, A.5, A.6, and A.7.

A.2 Categories listed in the body of the standard and marketed in different countries

Tables A.1 and A.2 give the national situations concerning the marketing in the various countries of the appliance categories listed in the body of the standard.

The information given in the table indicates only that these categories may be sold throughout the whole of the country concerned and A.3 should be consulted for confirmation.

In all cases of doubt the local gas supplier should be consulted in order to identify the precise category applicable.

9) This annex does not apply to the POCEDs (chimneys).

Table A.1 — Category I (single categories) marketed

Country	I_{2H}	I_{2L}	I_{2E}	I_{2E+}	I_{2N} [a)]	I_{2R} [a)]	$I_{3B/P}$	I_{3+}	I_{3P}	I_{3B}	I_{3R} [a)]
AT	X						X				
BE				X				X	X		
BG											
CH	X						X	X	X		
CY[b]											
CZ	X						X		X		
DE			X				X		X		
DK	X						X				
EE[b]											
ES	X							X	X		
FI	X						X				
FR	X [c]	X [c]		X			X [d]	X	X		
GB	X							X	X		
GR	X							X	X		
HU[b]	X						X		X	X	
IE	X							X	X		
IS											
IT	X							X			
LT[b]											
LU			X								
LV [b]											
MT[b]											
NL	X [c]	X					X		X		
NO							X				
PL[b]											
PT	X							X	X		
SE	X						X				
SI	X				X	X	X	X	X		X
SK[b]											

[a] Category to be deleted if it is not selected by any country.
[b] Information on categories to be supplied by new CEN Member.
[c] Categories applicable only to certain types of appliance, submitted to on site EC verification procedure, Annex II, article 6 of the Gas Appliance Directive (90/396/EEC). (France and Netherlands to clarify if applicable here.)
[d] Categories applicable only to certain types of appliance specified in the individual standards. (France to specify if applicable here.)

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Table A.2 — Double categories marketed

Country	II_{1a2H}	$II_{2H3B/P}$	II_{2H3+}	II_{2H3P}	II_{2H3B}	$II_{2L3B/P}$	II_{2L3P}	$II_{2E3B/P}$	$II_{2E3+B/P}$	II_{2E+3+}	II_{2E+3P}	II_{2R3R} [a]
AT		X										
BE												
BG												
CH	X	X	X	X								
CY [b]												
CZ		X		X								
DE								X				
DK	X	X										
EE [b]												
ES			X [c]	X								
FI		X										
FR				X [d]			X [d]		X [e]	X	X	
GB			X	X								
GR		X	X	X								
HU [b]		X		X	X							
IE			X	X								
IS												
IT	X		X									
LT [b]												
LU												
LV [b]												
MT [b]												
NL						X	X					
NO												
PL [b]												
PT			X	X								
SE	X	X										
SI		X	X	X								X
SK [b]												

[a] Category to be deleted if it is not selected by any country.
[b] Information on categories to be supplied by new CEN Member.
[c] Appliances of this category set for Group H gases of the second family may use air and commercial propane gas mixtures where the gross Wobbe index (at 15 °C and 1 013,25 mbar) is between 46 MJ/m^3 and 51,5 MJ/m^3 at the same supply pressure, without additional tests.
[d] Categories applicable only to certain types of appliance, submitted to on site EC verification procedure, Annex II, article 6 of the Gas Appliance Directive (90/396/EEC). (France to clarify if applicable here.)
[e] Categories applicable only to certain types of appliance specified in the individual standards. (France to specify if applicable here.)

A.3 Appliance supply pressures corresponding to the categories given in A.2

Table A.3 gives the conditions in the various countries concerning the supply pressures to appliances in the categories given in A.2.

Other, higher supply pressures may be necessary and such pressures may be provided after consultation with the appropriate gas supplier(s) in the country(ies) concerned.

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Table A.3 — Normal supply pressures

Gas	G 110	G 20	G 25		G 20 + G 25	G 30		G 31			G 30 + G 31	
Pressure (mbar)	8	20	20	25	Couple 20/25	30 28-30	50	30	37	50	Couple 28-30/37	Couple 50/67
Country												
AT		X					X			X		
BE					X					x[a]	X	X
BG												
CH		X					X			X	X	
CY [b)]												
CZ		X[c)]					X[d)]	X	X	X[e)]		
DE		X	X			X	X			X		
DK	X	X						X				
EE [b)]												
ES		X				X			X	X[a)]	X	
FI		X				X		X				
FR					X	X	X[a)]		x	X[a)]	X	
GB		X[f)]				X			X	X	X	
GR		X				X		X	X	X	x	
HU [b)]		X[g)]				X	X	X		x		
IE		X				X			X		X	
IS												
IT	X	X									X	
LT [b)]												
LU		X										
LV [b)]												
MT [b)]												
NL				X				X		X		
NO						X		X				
PL [b)]												
PT		X				X			X		X	
SE	X	X				X		X				
SI		X				X			X		X	
SK [b)]												

a) Only for certain types of non-domestic appliances. (Countries to clarify.)
b) Information on supply pressures to be supplied by new CEN Member.
c) Currently 18 mbar.
d) For certain types of industrial appliances. (CZ to clarify.)
e) For certain types of appliances. (CZ to clarify.)
f) Normal supply pressure for this appliance: 17,5 mbar.
g) Pressures of 25 mbar and 85 mbar.

A.4 Special categories marketed nationally or locally

A.4.1 General

The national or local conditions of gas distribution (gas composition and supply pressures) lead to the definition of special categories which are marketed nationally or locally in certain countries, as shown in Table A.4.

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Table A.4 — Test gases corresponding to categories marketed nationally or locally

Category	Reference gas	Incomplete combustion limit gas	Light back limit gas	Lift limit gas	Sooting limit gas	Country
I_{2Esi}, I_{2Er}	G 20, G 25	G 21	G 222	G 231	G 21	FR
$I_{2E(S)B}$	G 20, G 25	G 21	G 222	G 231	G 21	BE
$I_{2E(R)B}$	G 20, G 25	G 21	G 222	G 231	G 21	BE
I_{2ELL}	G 20, G 25	G 21	G 222	G 231, G 271	G 21	DE
I_{2S}	G 25.1	G 26.1	G 222	G 27.1	G 26.1	HU[a]
I_{2HS}	G 20, G 25.1	G 21, G 26.1	G 222	G 27.1	G 21, G 26.1	HU[a]
II_{2Esi3+} II_{2Er3+}	G 20, G 25 G 30	G 21	G 222 G 32	G 231 G 31	G 30	FR
II_{2Esi3P} II_{2Er3P}	G 20, G 25 G 31	G 21	G 222 G 32	G 231 G 271	G 31 G 32	FR
$II_{2ELL3B/P}$	G 20, G 25, G 30	G 21, G 30	G 222, G 32	G 231 G 271	G 30	DE
$II_{2S3B/P}$	G 25.1, G 30	G 26.1, G 30	G 32	G 27.1 G 31	G 26.1, G 30	HU[a]
II_{2S3P}	G25.1, G 31	G 26.1, G 30	G 32	G 27.1, G 31	G 26.1, G 31, G 32	HU[a]
II_{2S3B}	G 25.1, G 30	G 26.1, G 30	G 32	G 27.1, G 31	G 26.1, G 30	HU[a]
$II_{2HS3B/P}$	G 20, G 25.1 G 30	G 21, G 26.1, G 30	G 222 G 32	G 23, G 27.1, G 31	G 21, G 26.1, G 30	HU[a]
II_{2HS3P}	G 20, G 25.1 G 31	G 21, G 26.1, G 30	G 222 G 32	G 23, G 271, G 31	G 21, G 26.1, G 31, G 32	HU[a]
II_{2HS3B}	G 20, G 25.1 G 30	G 21,G 26.1, G 30	G 222 G 32	G 23, G 271, G 31	G 21, G 26.1, G 30	HU[a]
$III_{1a2H3B/P}$	G 110, G 20 G 30	G 21	G 112 G 222, G 32	G 23 G 31	G 30	DK, IT
$III_{1c2E+3+}$	G 130, G 20 G 30	G 21	G 132 G 222, G 32	G 231 G 31	G 30	FR
$III_{1c2E+3P}$	G 130, G 20 G 31	G 21	G 132 G 222, G 32	G 231 G 31	G 32	FR
$III_{1c2Esi3+}$ $III_{1c2Er3+}$	G 130, G 20 G 25, G 30	G 21	G 132 G 222, G 32	G 231 G 31	G 30	FR
$III_{1c2Esi3P}$ $III_{1c2Er3P}$	G 130, G 20 G 25, G 31	G 21	G 132 G 222, G 32	G 231 G 31	G 32	FR
$III_{1ab2H3B/P}$	G 110, G 120 G 20, G 30	G 21	G 112 G 222, G 32	G 23 G 31	G 30	SE

[a] Hungary to confirm selection.

A.4.2 Definition of special categories

The definitions of the special categories given in Table A.4 are derived in the same way as those categories listed in 4.2. The characteristics of the gases distributed regionally are given in A.5.

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A.4.2.1 Category I

A.4.2.1.1 Appliances designed for the use of gases linked to the first family

Category I_{1b}: appliances using only gases of Group B linked to the first family, at a fixed supply pressure (this category is not used).

Category I_{1c}: appliances using only gases of Group C linked to the first family, at a fixed supply pressure (this category is not used).

Adjustment of the gas rate is optional for the replacement of a gas of one group to a gas of another group within the first family and of the gases which are linked to it.

A.4.2.1.2 Appliances designed for the use of gases of the second family and the gases linked to it

Category I_{2Esi}: appliances capable of using only gases of Group E of the second family, and operating under the appropriate pressure of a pressure couple. The replacement of a gas in the range Es of Group E (Wobbe index between 44,8 MJ/m^3 and 54,7 MJ/m^3) by a gas in the range Ei of Group E (Wobbe index in the range 40,9 MJ/m^3 and 44,8 MJ/m^3) or vice versa necessitates a modification to the burner setting and possibly a change of injectors, of calibrated orifices and of the atmosphere control device.

Category I_{2Er}: appliances capable of using only gases of Group E of the second family and being able to operate with a pressure couple without adjustment on the appliance. However, specific adjustment of the burner gas rate is optional for the replacement of a gas of the range Es of Group E (Wobbe index between 44,8 MJ/m^3 and 54,7 MJ/m^3) by a gas of the range Ei of Group E (Wobbe index between 40,9 MJ/m^3 and 44,8 MJ/m^3). If this adjustment has been carried out, a re-adjustment to the previous setting is then necessary in order to return to the use of a gas in the range Es of Group E.

Category I_{2LL}: appliances using only gases of Group LL linked to the second family, at a fixed supply pressure. On condition that the Wobbe index of the second family gas distributed does not exceed the upper limit of 43,7 MJ/m^3, the appliance may be adjusted according to a lower nominal value (this category is not used).

Category I_{2ELL}: appliances capable of using gases of Group E of the second family, and gases of Group LL linked to the second family. The gases of Group E of the second family are used under the same conditions as for category I_{2E}. The gases of Group LL of the second family are used under the same conditions as for category I_{2LL}.

Category I_{2S}: appliances using only gases of Group S linked to the second family, at the defined supply pressure.

Category I_{2HS}: appliances using only gases of Group H of the second family and gases of Group S linked to the second family. The Group H second family gases are used under the same conditions as for category I_{2H}. The Group S second family gases are used under the same conditions as for category I_{2S}.

A.4.2.2 Category II

A.4.2.2.1 Appliances designed to use gases of the first family or that are linked to it and gases of the second family or that are linked to it

A.4.2.2.2 Appliances designed to use of gases of the second family or that are linked to it and gases of the third family

Category II_{2Esi3+}: appliances capable of using gases of Group E of the second family and gases of the third family. The second family gases are used under the same conditions as for category I_{2Esi}. The third family gases are used under the same conditions as for category I_{3+}.

Category II_{2Esi3P}: appliances capable of using gases of Group E of the second family and gases of Group P of the third family. The second family gases are used under the same conditions as for category I_{2Esi}. The gases of the third family are used under the same conditions as for category I_{3P}.

Category II_{2Er3+}: appliances capable of using gases of Group E of the second family and gases of the third family. The second family gases are used under the same conditions as for category I_{2Er}. The gases of the third family are used under the same conditions as for category I_{3+}.

Category II_{2Er3P}: appliances capable of using gases of Group E of the second family and gases of Group P of the third family. The second family gases are used under the same conditions as for category I_{2Er}. The gases of the third family are used under the same conditions as for category I_{3P}.

Category $II_{2ELL3B/P}$: appliances capable of using gases of Group E of the second family, gases of Group LL linked to the second family and gases of the third family. The second family gases or the gases that are linked to it are used under the same conditions as for category I_{2ELL}. Gases of the third family are used under the same conditions as for category $I_{3B/P}$.

Category $II_{2S3B/P}$: appliances capable of using gases of Group S linked to the second family and gases of the third family. The gases linked to the second family are used under the same conditions as for category I_{2S}. The third family gases are used under the same conditions as for category $I_{3B/P}$.

Category II_{2S3P}: appliances capable of using gases of Group S linked to the second family and gases of Group P of the third family. The gases linked to the second family are used under the same conditions as for category I_{2S}. The third family gases are used under the same conditions as for category I_{3P}.

Category II_{2S3B}: appliances capable of using gases of Group S linked to the second family and gases of Group B of the third family. The gases linked to the second family are used under the same conditions as for category I_{2S}. The third family gases are used under the same conditions as for category I_{3B}.

Category $II_{2HS3B/P}$: appliances capable of using gases of Group H of the second family, gases of Group S linked to the second family and gases of the third family. Gases of the second family or gases linked to it are used under the same conditions as for category I_{2HS}. The third family gases are used under the same conditions as for category $I_{3B/P}$.

Category II_{2HS3P}: appliances capable of using gases of Group H of the second family, gases of Group S linked to the second family and gases of Group P of the third family. Gases of the second family or gases linked to it are used under the same conditions as for category I_{2HS}. The third family gases are used under the same conditions as for category I_{3P}.

Category II_{2HS3B}: appliances capable of using gases of Group H of the second family, gases of Group S linked to the second family and gases of Group B of the third family. Gases of the second family or gases linked to it are used under the same conditions as for category I_{2HS}. The third family gases are used under the same conditions as for category I_{3B}.

A.4.2.3 Category III

Category $III_{1a2H3B/P}$: appliances capable of using gases of Group A of the first family, gases of Group H of the second family and gases of the third family. The first family gases are used under the same conditions as for category I_{1a}. The second family gases are used under the same conditions as for category I_{2H}. The third family gases are used under the same conditions as for category $I_{3B/P}$.

Category $III_{1c2E+3+}$: appliances capable of using gases of Group C linked to the first family, gases of Group E of the second family and gases of the third family. The gases linked to the first family are used under the same conditions as for category I_{1c}. The second family gases are used under the same conditions as for category I_{2E+}. The third family gases are used under the same conditions as for category I_{3+}.

Category $III_{1c2E+3P}$: appliances capable of using gases of Group C linked to the first family, gases of Group E of the second family and gases of Group P of the third family. The gases linked to the first family are

used under the same conditions as for category I_{1c}. The second family gases are used under the same conditions as for category I_{2E+}. The third family gases are used under the same conditions as for category I_{3P}.

Category $III_{1c2Esi3+}$: appliances capable of using gases of Group C linked to the first family, gases of Group E of the second family and gases of the third family. The gases linked to the first family are used under the same conditions as for category I_{1c}. The second family gases are used under the same conditions as for category I_{2Esi}. The third family gases are used under the same conditions as for category I_{3+}.

Category $III_{1c2Esi3P}$: appliances capable of using gases of Group C linked to the first family, gases of Group E of the second family and gases of the third family. The gases linked to the first family are used under the same conditions as for category I_{1c}. The second family gases are used under the same conditions as for category I_{2Esi}. The third family gases are used under the same conditions as for category I_{3P}.

Category $III_{1c2Er3+}$: appliances capable of using gases of Group C linked to the first family, gases of Group E of the second family and gases of the third family. The gases linked to the first family are used under the same conditions as for category I_{1c}. The second family gases are used under the same conditions as for category I_{2Er}. The third family gases are used under the same conditions as for category I_{3+}.

Category $III_{1c2Er3P}$: appliances capable of using gases of Group C linked to the first family, gases of Group E of the second family and gases of Group P of the third family. The gases linked to the first family are used under the same conditions as for category I_{1c}. The second family gases are used under the same conditions as for category I_{2Er}. The third family gases are used under the same conditions as for category I_{3P}.

Category $III_{1ab2H3B/P}$: appliances capable of using gases of Group A of the first family, gases of Group B linked to the first family, gases of Group H of the second family and gases of the third family. The first family gases or the gases linked to it are used under the same conditions as for categories I_{1a} and I_{1b}. The second family gases are used under the same conditions as for category I_{2H}. The third family gases are used under the same conditions as for category $I_{3B/P}$.

A.4.3 Gas rate adjusters, aeration adjusters and regulators

This clause has been included to enable CEN Members to provide information equivalent to that given in 5.2.2, 5.2.3, 5.2.4 and 5.2.6 in relation to the special categories they have requested, detailed in A.4.1.

A.4.4 Conversion to different gases

This clause has been included to enable certain member states to provide information equivalent to that given in 5.1.1.1 in relation to the special appliance categories listed in A.4.1.

A.5 Test gases corresponding to the special categories given in A.4

The characteristics of the test gases corresponding to the gases distributed nationally or locally and the corresponding test pressures are given in Table A.5 (reference conditions only).

Mixtures of gases of Group A with gases of Groups C or E, where the Wobbe index is between 21,1 MJ/m^3 and 24,8 MJ/m^3 are also linked to Group A of the first family.

These mixtures may only be used without supplementary tests in appliances in multiple categories including Group A of the first family.

Table A.5 — Test gases corresponding to local situations

Gas family and group		Nature of gas	Desig-nation	Composition Volume %	*W*I MJ/m³	*H*I MJ/m³	*W*s MJ/m³	*H*s MJ/m³	*d*	Test Pressure mbar	Country
Gases linked to the first family	Group B	Reference Incomplete combustion Sooting	G 120	H_2 = 47 CH_4 = 32 N_2 = 21	24,40	15,68	27,64	17,77	0,4 13	p_n = 8 p_{min} = 6 p_{max} = 15	SE
		Light back	G 112	H_2 = 59 CH_4 = 17 N_2 = 24	19,48	11,81	22,36	13,56	0,3 67		
	Group C	Reference (Propane–air)	G 130	C_3H_8 = 26,9 Air = 73,1 [a)]	22,14	23,66	24,07	25,72	1,1 42	p_n = 8 p_{min} = 6 p_{max} = 15	FR
		Light back	G 132	C_3H_8 = 13,8 C_3H_6 = 13,8 Air[1)] = 72,4	22,10	23,56	23,84	25,41	1,1 36		
Gases linked to the second family	Group LL	Reference	G 25[2)]	CH_4 = 86 N_2 = 14	37,38	29,25	41,52	32,49	0,6 12	p_n = 20 p_{min} = 18 p_{max} = 25	DE
		Incomplete combustion Sooting	G 26	CH_4 = 80 C_3H_8 = 7 N_2 = 13	40,52	33,36	44,83	36,91	0,6 78		
		Flame lift	G 271	CH_4 = 74 N_2 = 26	30,94	25,17	34,36	27,96	0,6 62		
	Group S	Reference	G 25.1	CH_4 = 86 CO_2 = 14	35,25	29,30	39,11	32,51	0,6 91	p_n = 25 p_{min} = 20 p_{max} = 33 02 p_n = 85 p_{min} = 73 p_{max}= 100	HU
		Incomplete combustion Sooting	G 26.1	CH_4 = 80 C_3H_8 = 6 CO_2 = 14	37,61	32,60	41,58	36,04	0,7 51		
		Lift limit	G 27.1	CH_4 = 82 CO_2 = 18	32,70	27,94	36,29	31,00	0,7 30		
Gases of the second family	Range Es of Group E	Reference	G 20[2)]	CH_4 = 100	45,67	34,02	50,72	37,78	0,5 55	p_n = 20 p_{min} = 17 p_{max} = 25	FR
		Incomplete combustion Sooting	G 21	CH_4 = 87 C_3H_8 = 13	49,60	41,01	54,76	45,28	0,6 84		
		Light back	G 222	CH_4 = 77 H_2 = 23	42,87	28,53	47,87	31,86	0,4 43		
		Lift limit	G 26	CH_4 = 80 C_3H_8 = 7 N_2 = 13	40,52	33,36	44,83	36,91	0,6 78		
	Range Ei of Group E	Reference Light back	G 25[2)]	CH_4 = 86 N_2 = 14	37,38	29,25	41,52	32,49	0,6 12	p_n = 25 p_{min} = 20 p_{max} = 30	
		Incomplete combustion Sooting	G 26	CH_4 = 80 C_3H_8 = 7 N_2 = 13	40,52	33,36	44,83	36,91	0,6 78		
		Lift limit	G 231	CH_4 = 85 N_2 = 15	36,82	28,91	40,90	32,11	0,6 17		

[1)] Composition of the air (%): 0_2 = 20,95; N_2 = 79,05.
[2)] For the characteristics of the reference gases G 20 and G 25, see Table 4.

A.6 Gas connections in the various countries

Table A.6 shows the national situations concerning the various types of gas connection specified in 5.1.6.

Table A.6 — Permitted inlet connections

Country	Category I_{3+}, I_{3P}, I_{3B}, $I_{3B/P}$			Other categories		
	Threaded connections		Other connections	Threaded connections		Other connections
	EN 10226-1 EN 10226-2	EN ISO 228-1		EN 10226-1 EN 10226-2	EN ISO 228-1	
AT	Yes	—	Yes	Yes	—	—
BE	Yes	Yes	Yes	—	Yes	—
BG	—	—	—	—	—	—
CH	Yes	Yes	Yes	Yes	Yes	—
CY	—	—	—	—	—	—
CZ	—	—	—	—	—	—
DE	Yes	—	Yes	Yes	—	—
DK	Yes	Yes	Yes	—	Yes	—
EE	—	—	—	—	—	—
ES	—	—	—	—	—	—
FI	Yes	Yes	Yes	Yes	Yes	—
FR	—	Yes	Yes	—	Yes	—
GB	Yes	—	Yes	Yes	—	Yes
GR	Yes	—	Yes	Yes	—	—
HU	—	—	—	—	—	—
IE	Yes	—	Yes	Yes	—	Yes
IS	—	—	—	—	—	—
IT	Yes	—	Yes	Yes	—	—
LT	—	—	—	—	—	—
LU	—	—	—	—	—	—
LV	—	—	—	—	—	—
MT	—	—	—	—	—	—
NL	Yes	—	—	Yes	—	—
NO	Yes	Yes	Yes	—	—	—
PT	Yes	Yes	Yes	Yes	Yes	Yes
RO	—	—	—	—	—	—
SE	—	—	—	—	—	—
SI	Yes	Yes	Yes	Yes	Yes	Yes
SK	—	—	—	—	—	—

A.7 Flue connections in the various countries

Table A.7 shows the national situations concerning the diameters of standard flue pipes.

Table A.7 — Standard flue pipe diameters

Country	Standard flue pipe diameters (external) in mm																
AT	60	70	80	90	100	110	120	130	140	150	160	180	200				
BE	All diameters acceptable																
BG																	
CH	60	70	80	90	100	110	120	130	150	160	170	180	200				
CY																	
CZ																	
DE	60	70	80	90	100	110	120	130	150	200							
DK	Diameters not standardized																
EE																	
ES																	
FI	90	100	110	130	150	180	200										
FR	66	83	97	111	125	139	153	167	180								
GB	76	102	127	153	metal pipes (all 0, -1 tolerance)												
GR	60	70	80	90	100	110	120	130	150	180	200						
IE	76	102	127	153	metal pipes (all 0, -1 tolerance)												
	84	109	137	162	fibrous cement pipes (all ± 3 tolerance)												
IS																	
IT	60	80	100	110	120	150											
LT																	
LU																	
LV																	
MT																	
NL	60	70	80	90	100	110	130	150	180	200							
NO																	
PL																	
PT	60	85	90	95	105	110	115	120	125	130	135	145	155	205	255	305	355
RO																	
SE																	
SI	60	70	80	90	100	110	120	130	140	150	160	180	200				
SK																	

Annex B
(informative)

Equivalence rules[10)]

B.1 Conversion to categories within a restricted Wobbe index range

Any appliance belonging to one category may be categorized as an appliance belonging to another category covering a more restricted range of Wobbe index provided that the requirements 5.1.1, 5.2.2.2, 5.2.2.3 and 5.2.5 are satisfied, that its state of conversion corresponds to that of the country (or countries) of destination and that the information provided on the appliance corresponds to its adjustment.

In principle, this equivalence is recognized without the appliance having to be submitted to new tests.

However, supplementary tests may be necessary using the pressures and the test gases currently in force in the intended country (or countries) of destination:

a) when the supply pressures are different in the country (or countries) for which the appliance has been tested from those in the intended country of destination; or

b) when an appliance fitted with adjusters[11)], even though sealed, has been tested under the conditions of the original category with test gases different from those of the country where it is to be sold; or

c) when the requirements for regulators (see 5.2.5) with respect to the existing category differ from those of the new category.

In all cases these supplementary tests are at most those stated in 7.1.5.1.

EXAMPLE 1 An appliance in category I_{2E} for G 20 at 20 mbar may be categorized as an appliance in category I_{2H} for G 20 at 20 mbar without additional tests. If, however, the pressures are different, the tests specified in 6.1.5.1 shall be carried out, after changing the injectors, if necessary.

EXAMPLE 2 An appliance in category I_{2E}+ for G 20 at 20 mbar may be categorized as an appliance in category I_{2H} for G 20 at 20 mbar provided that it satisfies the corresponding tests specified in 7.1.5.1 after changing the injectors, if necessary, and after adjusting the regulator in accordance with the requirements of 5.2.5.

B.2 Conversion to categories within an identical Wobbe index range

Any appliance belonging to one category may be categorized as an appliance belonging to another category covering an identical range of Wobbe index provided that the requirements in 5.1.1, 5.2.2.2, 5.2.2.3 and 5.2.5 are satisfied, that its state of conversion corresponds to that of the country (or countries) of destination and that the information provided on the appliance corresponds to its adjustment.

In principle, this equivalence is recognized without the appliance having to be submitted to new tests.

However, supplementary tests may be necessary using the pressures and the test gases currently in force in the intended country (or countries) of destination:

---

10) This annex does not apply to the POCEDs (chimneys).

11) Throughout Annex B the word "adjuster" refers to gas rate adjusters and to fixed primary aeration adjusters as appropriate.

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a) when the supply pressures are different in the country (or countries) for which the appliance has been tested from those in the intended country of destination; or

b) when an appliance fitted with adjusters, even though sealed, has been tested under the conditions of the original category with test gases different from those of the country where it is to be sold; or

c) when the requirements for regulators (see 5.2.5) with respect to the existing category differ from those of the new category.

In all cases these supplementary tests are at most those stated in 7.1.5.1.

EXAMPLE 1 An appliance in category I_{2E+} may be categorized as an appliance in category I_{2Esi} or I_{2Er} provided that it satisfies the tests specified in 7.1.5.1 for the test pressures and the test gases relating to category I_{2Esi} or I_{2Er} and with the corresponding injectors and adjustments. These adjustments shall take into account the requirements of 5.2.5.

EXAMPLE 2 An appliance in category I_{2Esi} or I_{2Er} may be categorized as an appliance in category I_{2E+} provided that it satisfies the tests specified in 7.1.5.1 for the test pressures corresponding to category I_{2E+}. In addition, any adjusters shall be locked and sealed in the appropriate positions, taking account the requirements of 5.2.5.

NOTE Where the intended country of destination is Belgium, account should be taken of the Special Conditions given in Annex I.

B.3 Conversion to categories within a wider Wobbe index range

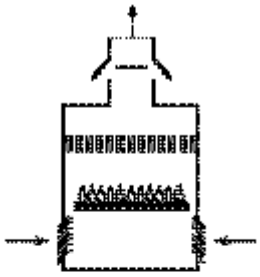
An appliance belonging to one category may be categorized as an appliance in another category covering a wider range of Wobbe index if it complies with all the constructional requirements of the proposed new category.

In addition, the appliance shall be submitted to the tests specified in 7.1.5.1 using the test gases and test pressures for the proposed new category. Where appropriate, account shall be taken of the Special Conditions given in Annex I.

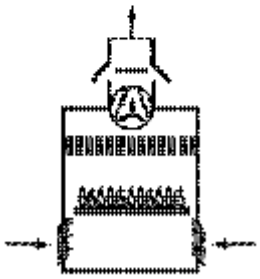
Annex C
(normative)

Classification according to the evacuation of the combustion

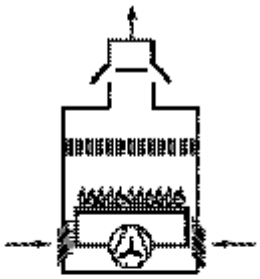
C.1 Type B_1



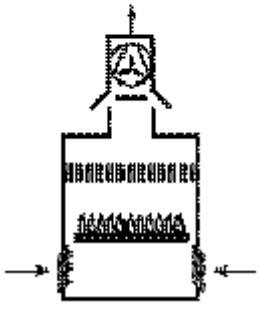
Type B_{11}



Type B_{12}

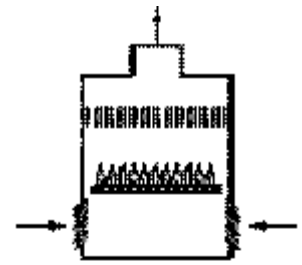


Type B_{13}

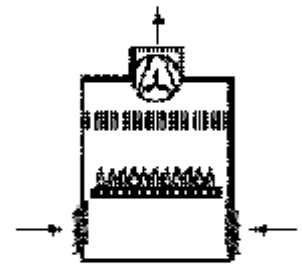


Type B_{14}

C.2 Type B_2



Type B_{21}



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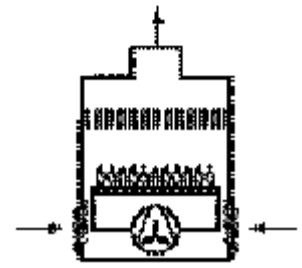

Type B_{23}

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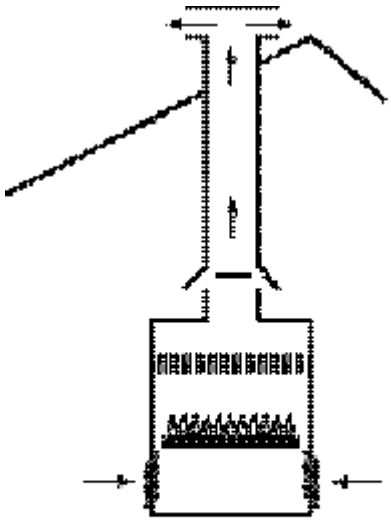
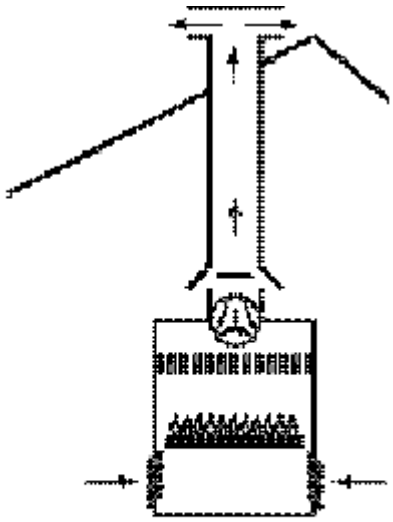
C.3 Type B_4



Type B_{41}



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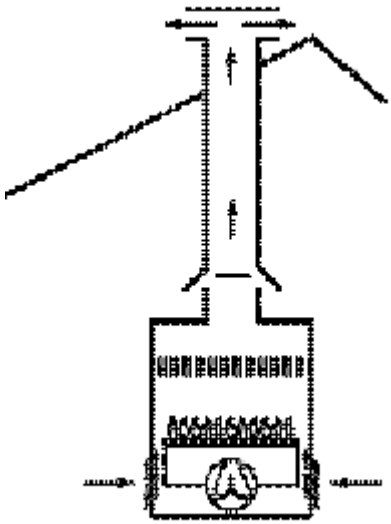
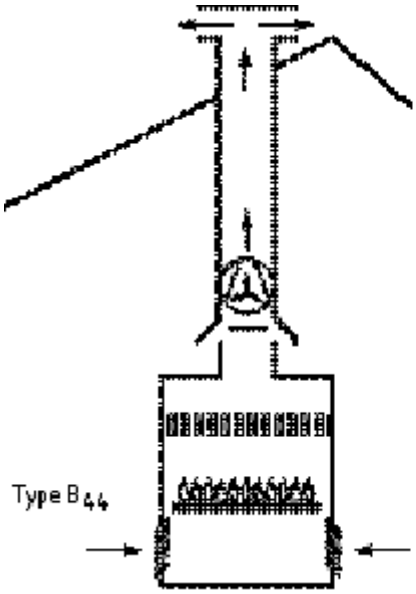
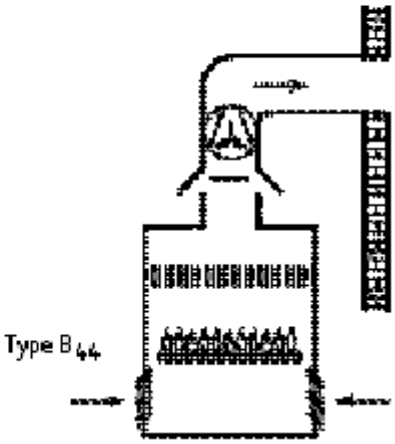
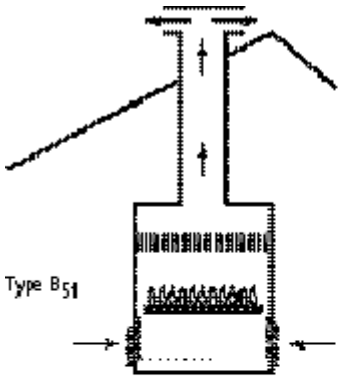


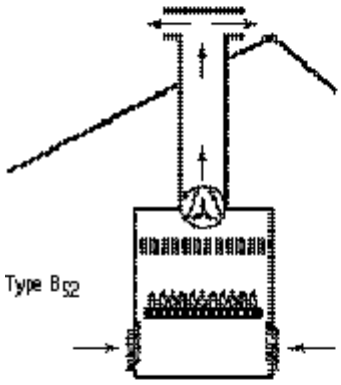
Type B_{43}

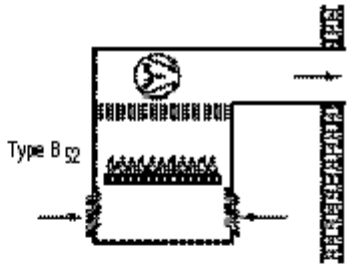


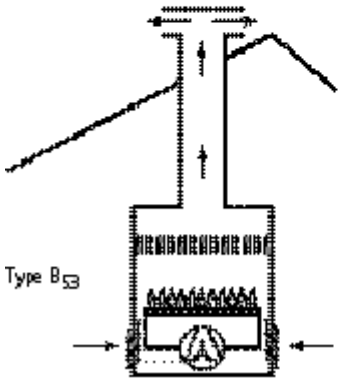


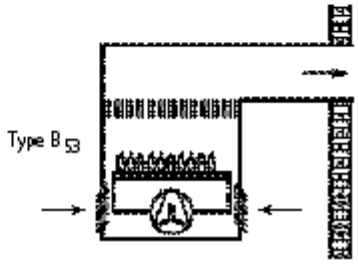
C.4 Type B_5



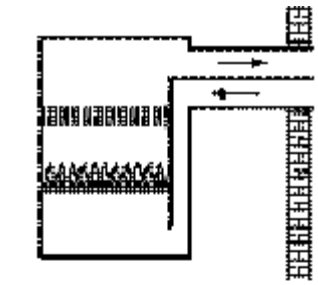




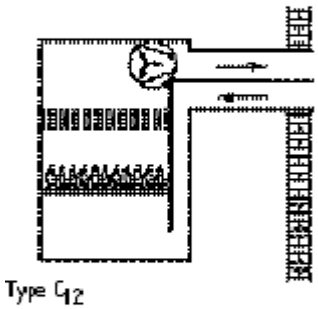




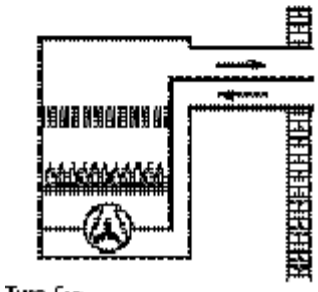
C.5 Type C_1



Type C_{11}

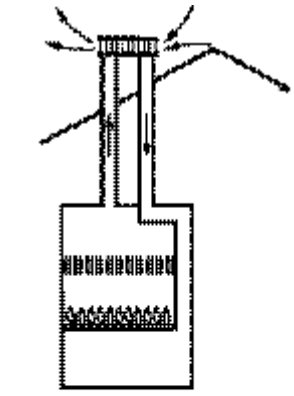


Type C_{12}

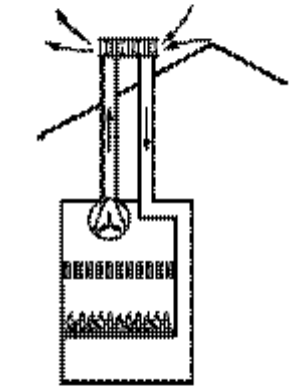


Type C_{13}

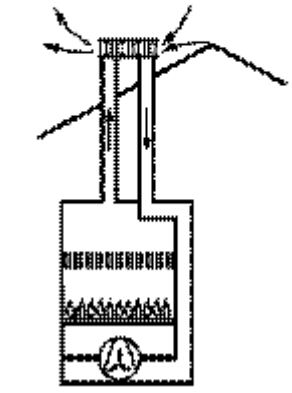
C.6 Type C_3



Type C_{31}



Type C_{32}



Type C_{33}

Annex D
(normative)

Requirements and test methods for separate air supply and combustion products evacuation ducts

D.1 Requirements

D.1.1 Pressure losses

The pressure loss in the combustion products evacuation duct system (including the terminal) of a combined air supply and combustion products evacuation system corresponding to an air speed of 2 m/s shall be less than 20 Pa.

D.1.2 Pressure loss under the influence of wind

Under the test conditions corresponding to a wind speed of 2 m/s in the combustion products evacuation duct, the pressure loss of a combined air supply and combustion products evacuation system shall not exceed 40 Pa.

D.1.3 Suction under the influence of wind

Under the wind test conditions corresponding to a wind speed of 2 m/s in the combustion products evacuation duct, the pressure difference between the inlet of the air supply duct and the outlet of the combustion products evacuation duct of a combined air supply and combustion products evacuation system shall be less than 50 Pa.

D.1.4 Recirculation of the combustion products

Under the wind test conditions corresponding to a wind speed of 2 m/s in the combustion products evacuation duct, the recirculation of the combustion products between the outlet and the inlet shall be less than the value given in Figure D.1.

D.2 Test methods

D.2.1 Pressure loss in still air

The combined air supply and combustion products evacuation system is connected to the recycling device as shown in Figure D.2.

D.2.2 Pressure loss under the influence of wind

With the combined system installed and adjusted as stated in D.2.1, it is subjected to a wind speed as stated in D.2.5.

D.2.3 Suction under the influence of wind

Under the test conditions of D.2.2, it is checked that the suction between the inlet and outlet of the combined system is less than 0,5 mbar.

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D.2.4 Recirculation of the combustion products

With the combined system installed and adjusted as stated in D.2.1, it is subjected to a wind speed as stated in D.2.5.

The recirculation of air from the evacuation duct to the air supply duct is determined by means of a gas tracer (e.g. CO_2).

At the various wind angles, the recirculation shall be less than the value given in Figure D.2.

D.2.5 Wind test conditions

D.2.5.1 Incident angles

The appliance terminal is subjected to various wind speeds at incident angles varying in 15° steps from - 45° to + 90° in relation to a horizontal plane (see Figure D.3).

D.2.5.2 Wind speeds

The tests described in D.2.2 and D.2.3, concerning the pressure loss and suction under the influence of wind, are carried out at a wind speed of 12 m/s.

During the recirculation tests of D.2.4, the wind speed is maintained constant at 2,5 m/s.

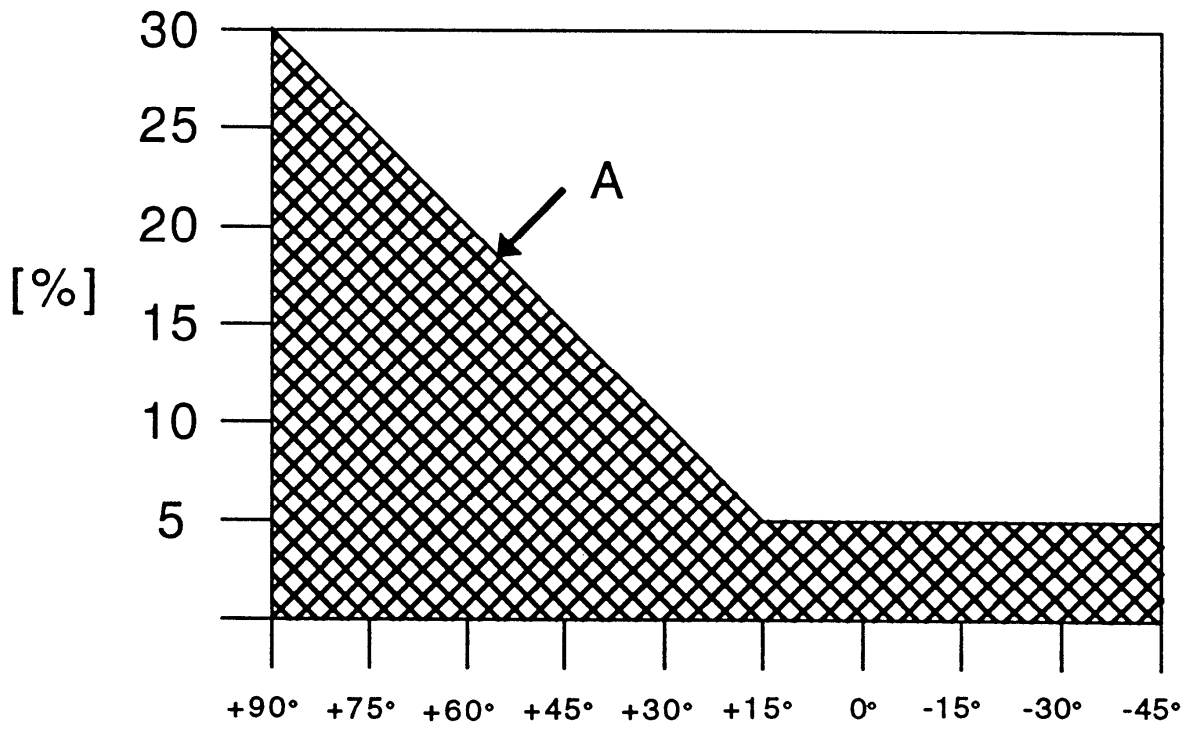
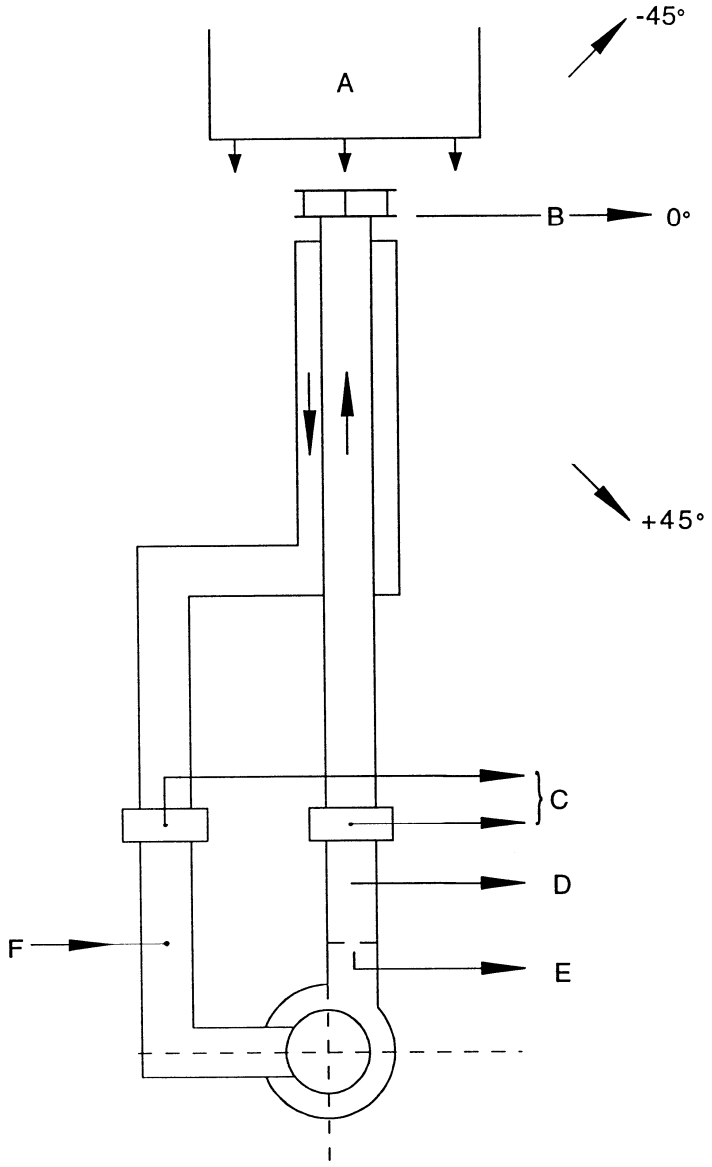


Figure D.1 — Maximum permitted recirculation of the combustion products

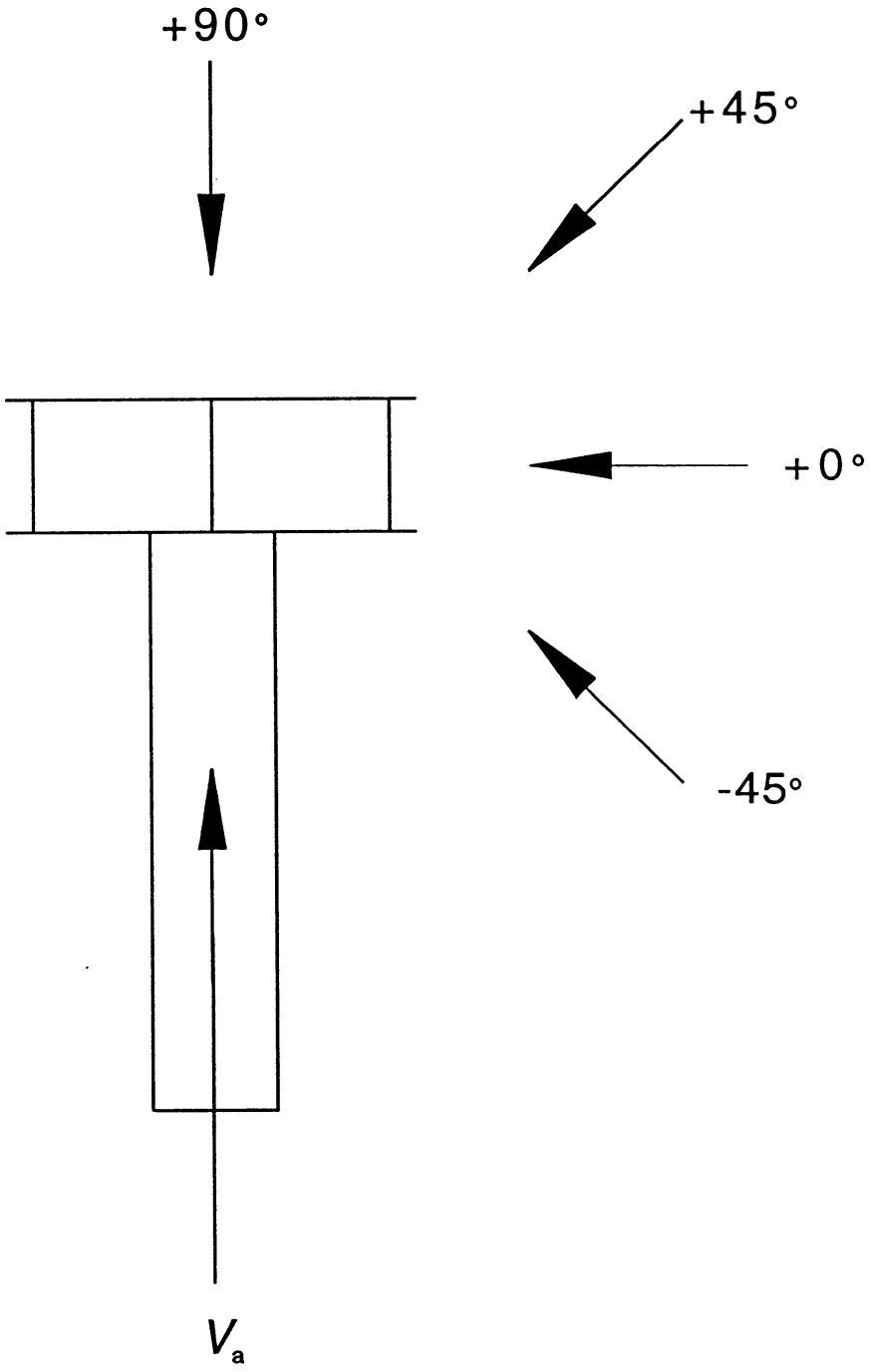


$$\%\ recirculation = \frac{(measured\ \ recirculation - source\ \ recirculation)}{measured\ \ recirculation} \text{X } 100$$

Key

A Air tunnel wind speed: 0 to 12 m/s
B Rotation point
C Measurement of air pressure
D Measurement of CO_2
E Orifice plate for a wind speed of 2,0 m/s
F Injection of CO_2

Figure D.2 — Recycling device for pressure loss test (see D.2.1)



Key

V_a Products of combustion

Figure D.3 — Relationship of terminal and wind direction for wind test

Annex E
(informative)

Facilities for commissioning and testing (see 5.13)[12)]

E.1 Appliances with automatic ignition of a start-gas flame

a) a manual valve downstream of the main gas automatic shut-off valve; or

b) a removable air-break electrical link other than a disconnection of the electrical wiring (e.g. a fuse holder/cartridge or purpose made link) in the electrical supply to the main gas automatic shut-off valves or the main gas control function within an automatic shut-off valve; or

c) an air-break switch requiring the use of a tool for its operation to isolate the electrical supply to the main gas automatic shut-off valves or the main gas control function within an automatic shut-off valve; or

d) an air-break switch not requiring the use of a tool for its operation to isolate the electrical supply to the main gas automatic shut-off valves or the main gas control function within an automatic shut-off valve.

In this particular case, where the main gas valve(s) is (are) fitted with a closed position indicator switch, or a proof of closure switch, then the switch shall be checked for correct position throughout the start-gas ignition period and subsequent period of main gas isolation. Failure to prove correct positioning shall cause safety shut-down.

NOTE 1 Additional circuitry over and above that provided by the control box may be necessary to satisfy requirement d).

NOTE 2 Designers should be aware that the intention of this requirement is to prevent inadvertent release of the main gas supply at all times that the commissioning engineer is setting or checking the start-gas flame.

All air heaters should be provided with such manual valves as are essential for the normal operation and commissioning of the appliance.

Means shall be provided for checking the gas soundness of automatic shut-off valves.

Means shall be provided for checking the regulator inlet and outlet pressures and the burner manifold pressure.

Connections or test points shall be provided for measurement of the flame detector signal on all appliances except those fitted with thermoelectric flame supervision devices.

E.2 Appliances with direct automatic ignition of the main burner

To facilitate commissioning, means shall be provided for:

a) checking the soundness of the gas circuit;

b) initial checking of the operation of the burner control system while the gas supply is isolated.

A means of achieving this is to fit a manual valve downstream of the automatic shut-off valves.

---

12) This annex does not apply to the POCEDs (chimneys).

Annex F
(informative)

Identification of gas types in use in various countries[13)]

Table F.1 — Means of identification of gas types in use in various countries

Type of gas / Country code [b)]	G 110	G 120	G 130	G 150	G 20	G 25	G 30	G 31
AT					Erdgas		Flüssiggas	
BE					Aardgas, Gaz naturel	Aardgas, Gaz naturel	Butaan, Butane	Propaan, Propane
BG								
CH					Erdgas H		Butan	Propan
CY								
CZ								
DE					Erdgas E W_o(12,0 – 15,7) kWh/m^3 0° C	Erdgas LL W_o (10,0 – 13,1) kWh/m^3 0° C	Flüssiggas B/P Butan	Propan
DK	Bygas				Naturgas		F-Gas	F-Gas
EE								
ES	Gas manufacturado		Aire propanado	Aire metanado	Gas natural		Butano	Propano
FI					Maakaasu, Naturgas		Butaani, Butan	Propaani, Propan
Fr[a)]			Air propané/ Air butané		Gaz naturel Lacq	Gaz naturel Groningue	Butane	Propane
GB					Natural Gas		Butane	Propane
GR					Qυσικὸ Aèριο		Υγρ èρ ο Μείγμα	Προπ νιο
HU								
IE					Natural Gas		Butane	Propane
IS								
IT	Gas di Città				Gas naturale/ Gas metano		GPL	
LT								
LU								
LV								
MT								
NL						Aardgas	Butaan	Propaan
NO							Butan	Propan
PL								
PT					Gás Natural		Butano	Propano
SE								
SI					Zemeljski plin		Utekočinjeni naftni plin (UNP) Butan	Utekočinjeni naftni plin (UNP) Propan
SK								

a) The meaning of the symbol corresponding to the type of gas should be explained in detail in the technical instructions. Concerning the system and its packaging, if an additional marking is intended by the manufacturer to explain the symbol, this text should be in conformity with the description given in this table. In the case of pressure couples, the two descriptions of the family should be mentioned.

b) See 8.3.4 for codes.

13) This annex does not apply to the POCEDs (chimneys).

Annex G
(informative)

Requirements in EN 1020 which relate to the design and construction of forced draught burners covered in EN 676:1996[14)]

Clause	Paragraph
5.1.2	1, 3, 4, 5
5.1.3	1, 4
5.1.5	4, 6
5.1.6.1	All
5.1.7.2.2	1
5.1.12	2, 3, 4, 5
5.2.1	1
5.2.3	All
5.2.4.2	All
5.2.5	1, 8
5.2.8.2.2	1
5.2.9.2.1	1
5.2.10	1, 2
5.3.2	All
5.5.2	1, 2, 5
5.6.2	1, 2 (excluding 2nd indent), 3 , 4 (excluding item b)), 6, 7, 10, 11, 12, 13
5.7.2.1	1, 3 (in part), 4 (in part)
5.7.2.2	1, 2, 3 (excluding item b)), 4
5.11	1

14) This annex does not apply to the POCEDs (chimneys).

Annex H
(informative)

A-deviations[15)]

H.1 General

A-deviation: National deviation due to regulations, the alteration of which is for the time being outside the competence of the CEN/CENELEC Member.

This European Standard falls under Directive 90/396/EEC on the approximation of the laws of Member States concerning gas appliances.

A-deviations in an EFTA country are valid instead of the relevant provisions of the European Standard in that country until they have been removed.

H.2 Switzerland

The Swiss law (Ordinance on Air Pollution Control (OAPC) of 1985-12-16 (state on 2009-01-01)) is applicable instead of the requirements of 6.1.5 and 6.2 regarding energy efficiency (chimney losses, standby losses) and emissions of CO and NO_x.

15) This annex does not apply to the POCEDs (chimneys).

Annex I
(normative)

Special national conditions[16)]

I.1 Special national conditions

Special national conditions are national characteristics or practice that cannot be changed even over a long period (e.g. climatic conditions, electrical earthing conditions). If it affects harmonization, it forms part of the European Standard or Harmonization Document.

For the countries in which the relevant special national conditions apply these provisions are normative, for other countries they are informative.

I.2 Belgium

Appliances of categories I_{2E+}, $I_{2E(R)B}$ and $I_{2E(S)B}$ marketed in Belgium have to undergo a test for ignition, crosslighting and flame stability with the limit gas G 231 at the minimum pressure of 15 mbar.

I.3 Italy

Appliances of categories $I_{3B/P}$, $II_{2H3B/P}$ and $III_{1a2H3B/P}$ without pressure regulators marketed in Italy shall have successfully undergone a test for flame stability with the limit gas G 31 at the pressure of 45 mbar.

16) This annex does not apply to the POCEDs (chimneys).

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Annex J
(informative)

National solutions for countries whose national bodies are Affiliate Members of CEN[17)]

J.1 Categories listed in the body of the standard and marketed in different countries

J.2 Appliance supply pressures corresponding to the categories given in J.1

J.3 Special categories marketed nationally or locally

J.4 Gases and test pressures corresponding to the special categories given in J.3

17) This annex does not apply to the POCEDs (chimneys).

Annex K
(informative)

Calculation of conversions of NO_x[18)]

Table K.1 — Conversion of the emission value of NO_x for first family gases

$1x10^{-6}$ = 2,054 mg/m^3 ($1x10^{-6}$ = 1 cm^3/m^3)		G 110	
		mg/kWh	mg/MJ
O_2 = 0 %	$1x10^{-6}$ =	1,714	0,476
	1 mg/m^3=	0,834	0,232
O_2 = 3 %	$1x10^{-6}$ =	2,000	0,556
	1 mg/m^3=	0,974	0,270

Table K.2 — Conversion of the emission value of NO_x for second family gases

$1x10^{-6}$ = 2,054 mg/m^3 ($1x10^{-6}$ = 1 cm^3/m^3)		G 20		G 25	
		mg/kWh	mg/MJ	mg/kWh	mg/MJ
O_2 = 0 %	$1x10^{-6}$ =	1,764	0,490	1,797	0,499
	1 mg/m^3=	0,859	0,239	0,875	0,243
O_2 = 3 %	$1x10^{-6}$ =	2,059	0,572	2,098	0,583
	1 mg/m^3=	1,002	0,278	1,021	0,284

Table K.3 — Conversion of the emission value of NO_x for third family gases

$1x10^{-6}$ = 2,054 mg/m^3 ($1x10^{-6}$ = 1 cm^3/m^3)		G 30		G 31	
		mg/kWh	mg/MJ	mg/kWh	mg/MJ
O_2 = 0 %	$1x10^{-6}$ =	1,792	0,498	1,778	0,494
	1 mg/m^3=	0,872	0,242	0,866	0,240
O_2 = 3 %	$1x10^{-6}$ =	2,091	0,581	2,075	0,576
	1 mg/m^3=	1,018	0,283	1,010	0,281

18) This annex does not apply to the POCEDs (chimneys).

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Annex L
(informative)

Sampling plan example

L.1 Sampling plans

L.1.1 General

In this example sampling plans are selected from the tables published in ISO 2859-1.

L.1.2 Acceptable Quality Level (AQL)

In this example the AQL is decided in relation to the nature of the inspection feature being controlled. For defects classed as Major, the sampling plan is based on an AQL of 4.0.

NOTE Classification of defects should be the responsibility of the person responsible for the manufacturing process.

L.1.3 The inspection level

The inspection level defines the relationship between the batch size and the sample size. In this example all incoming goods are subjected to inspection level II.

L.1.4 Normal, tightened or reduced inspection

In this example the normal inspection is used initially on all incoming materials, after which:

a) when ten successive batches have been accepted on original there can be a switch to reduced inspection. This should remain in operation until one batch is rejected, at which point normal inspection is resumed;

b) when two out of any five successive batches have been rejected on original inspection, there can be a switch to tightened inspection. This should remain in operation until five successive batches have been accepted, at which point normal inspection is resumed.

L.1.5 Single, double, multiple or sequential sampling

Unless otherwise specified, all incoming material should be subjected to single sampling plans.

L.1.6 Batch quality

Once the first four variables have been decided, the sampling plan tables should indicate the amount of samples to be inspected for any given batch quantity.

All information regarding levels of inspection should be indicated where appropriate on the inspection records.

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L.2 Inspection levels and procedures

L.2.1 Incoming material

In this example sample inspected to ISO 2859-1 using an AQL = 2,5, general inspection level II, single sampling plan for normal inspection incorporating the switching rules to tighten or reduce inspection if necessary. All mill certification should be checked against the relevant technical specification.

L.2.2 In-process aspects

For all dimensional aspects an inspection feature should be introduced each time the material changes form during the process.

A first inspection should be implemented and verified by the setter or supervisor at each machine operation and from then on the operators should carry out each required dimensional check at a rate of four per batch – unrecorded, using go-no go gauges.

For the purposes of this example this is supplemented by a beginning and end of shift full dimensional check by the line supervisor using measuring equipment. This is a record check, a register of all results being maintained.

L.2.3 Finished goods checks

At the end of the manufacturing process, each unit should be visually inspected for damage.

At the warehouse, once a week, the goods inwards inspector should randomly select four samples from a particular product range and subject each item to full dimensional checks. This should also be carried out to a formalised programme.

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Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directives

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 90/396/EEC on the approximation of the laws of the Member States concerning gas appliances.

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

The clauses of this standard (see Table ZA.1) are likely to support requirements of EU Directive 90/396/EEC.

Table ZA.1 — Identification form on the compliance of EN 621 with the essential requirements of EU Directive 90/396/EEC on the approximation of the laws of Member States concerning gas appliances

Essential Requirement	Subject	Relevant clauses in EN 1020
1	General conditions	↓
1.1	Safe design and construction	Whole standard
1.2	Instructions - installer - user Warning notices - appliance - packaging Official language	 8.4.2 8.4.3 8.1, 8.3 8.2, 8.3 8.4.1
1.2.1	Installer's instructions contain: - Type of gas used - Gas supply pressure - Fresh air for combustion - Products dispersal - Forced draught burners	 8.1.2, 8.2, 8.4.2 8.1.2, 8.2, 8.4.2 8.1.2, 8.2, 8.4.2 8.4.2 Not applicable
1.2.2	User instructions contain: - all instructions - restrictions on use	 8.4.1, 8.4.3 8.4.2
1.2.3	Warning notices state: - type of gas - gas supply pressure - restrictions on use	 8.1, 8.2, 8.4 8.1, 8.2, 8.4 8.1.3

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Table ZA.1 *(continued)*

Essential Requirement	Subject	Relevant clauses in EN 1020
1.3	Fittings - manual valves - regulators - multifunctional control - flame supervision device - automatic valves - automatic burner control systems - thermostats Instructions	 5.2.4 5.2.5 5.2.6 5.2.7 5.2.8 5.2.9 5.10 Not applicable
2.1	Fitness for purpose	5.1.2, 6.1.7
2.2	Properties of materials	Foreword, 1
3.1.1	Durability	5.1.2, 6.1.7
3.1.2	Condensation	5.1.2
3.1.3	Explosion risk	5
3.1.4	Air/water penetration	Not applicable
3.1.5	Normal auxiliary energy fluctuation - appliance - controls	 5.1.12 , 6.1.5.1, 7.3.5.3.4 5.2.6, 5.2.7, 5.2.8, 5.2.9.1
3.1.6	Abnormal auxiliary energy fluctuation - appliance - controls	 5.1.12 , 6.1.5.1, 7.3.5.3.4 5.2.6, 5.2.7, 5.2.8, 5.2.9.1
3.1.7	Electrical hazards	5.1.11
3.1.8	Deformation	Not applicable
3.1.9	Safety/control device failure: - regulator - multifunctional control - flame supervision device - automatic shut-off valves - automatic burner control system - thermostats/cut-off device	 5.2.5 5.2.6 5.2.7 5.5 5.2.8, 5.6.1.2, 5.6.2, 5.2.9.2, 5.5 5.10
3.1.10	Overruling of safety devices	5.2.1
3.1.11	Pre-set adjuster protection	5.2.2.1, 5.2.3
3.1.12	Levers and setting devices	5.2.4.2, 5.2.9.2.2

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Table ZA.1 *(concluded)*

Essential Requirement	Subject	Relevant clauses in EN 1020
3.2.1	Gas leakage	5.1.6.1, 6.1.1
3.2.2	Gas release during: - ignition - re-ignition - extinction	 5.5.1, 5.5.2, 5.6.1, 5.6.2 5.5.2, 7.3.4 5.5.1, 5.5.2
3.2.3	Unburned gas accumulation	5.5
3.3	Ignition: ignition, re-ignition and cross-lighting	6.1.4
3.4.1	Flame stability Harmful substances	6.1.4 6.1.5
3.4.2	Combustion products release	6.1.1.2
3.4.3	Combustion products release	Not applicable
3.4.4	Flueless domestic appliances	Not applicable
3.5	Rational use of energy	6.2
3.6.1	Floor etc. temperatures	6.1.3.2, 6.1.3.5
3.6.2	Temperature of knobs/levers	6.1.3.1
3.6.3	External parts	6.1.3.2
3.7	Foodstuffs and water	Not applicable
Annex II	Certification	Foreword, 1

Compliance with this standard provides one means of conforming with the specific essential requirements of the Directive concerned and associated EFTA regulations.

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Annex ZB
(informative)

Clauses of this European Standard addressing the provisions of the EU Construction Products Directive

ZB.1 Scope and relevant characteristics

This European Standard has been prepared under Mandate M105 “Chimneys, flues and specific products” given to CEN by the European Commission and the European Free Trade Association.

The clauses of this European Standard shown in this annex meet the requirements of the mandate given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the chimneys covered by this annex for the intended uses indicated herein; reference shall be made to the information accompanying the CE marking.

WARNING — Other requirements and other EU Directives, not affecting the fitness for intended uses, can be applicable to the chimneys falling within the scope of this European Standard.

NOTE 1 In addition to any specific clauses relating to dangerous substances contained in this standard, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

NOTE 2 An informative database of European and national provisions on dangerous substances is available at the Construction web site on EUROPA (accessed through *http://ec.europa.eu/enterprise/construction/internal/dangsub/dangmain_en.htm*).

This annex establishes the conditions for the CE marking of the chimneys intended for the uses indicated in Table ZB.1 and shows the relevant clauses applicable.

This annex has the same scope as Clause 1 of this standard and is defined by Tables ZB.1 and ZB.2.

Table ZB.1 — Scope and relevant requirement clauses

Product: Metal system POCEDs as covered in Clause 1 of this standard, except terminals and supports. Intended use: Single- and multi-wall POCEDs			
Essential Characteristics	Requirement clauses in this European Standard(s)	Levels and/or classes	Notes
Compressive strength	8.4.2	None	Manufacturer's declaration
Fire reaction	None	None	Not applicable [a]
Resistance to fire Soot fire resistance, integrity E and insulation I Classification O and declaration of distance to combustible material	None 8.4.2 6.1.3.5	None Oxx None	Not applicable [b) c)] Manufacturer's declaration of minimum distance to combustible material Pass/fail criteria
Gas tightness /leakage	6.1.	None	Pass/fail criteria
Flow resistance	8.4.2	None	Manufacturer's declaration of minimum and maximum equivalent resistance
Thermal resistance/ Dimensioning	None 8.4.2	None None	Not applicable [d] Manufacturer's declaration
Thermal shock resistance	None	None	Not applicable [b]
Flexural tensile strength	5.1.5 8.4.2	None	Pass/fail criteria. Manufacturer's declared value
Durability against chemicals	5.1.2 6.1.7	None	Pass/fail criteria
Durability against corrosion	5.1.2 6.1.7	None	Pass/fail criteria
Resistance to freeze - thaw	None	None	Not applicable [e]

[a] Fire reaction - No requirements for metal POCEDs.

[b] Soot fire resistance G - is not applicable to gas-fired appliances.

[c] Insulation I - is not required for metal POCEDs.
Integrity E - is not required for metal POCEDs.

[d] This characteristic is only relevant when it is required to match the chimney with the appliance. The performance of the POCED is verified as part of the performance testing of the appliance.

[e] This characteristic is only relevant to construction materials that absorb water. This standard only applies to appliances with metal POCEDs.

Table ZB.2 — Scope and relevant requirement clauses

Product: Terminals as covered in Clause 1 of this standard Intended use: Single and multi-wall POCEDs			
Essential Characteristics	Requirement clauses in this European Standard(s)	Levels and/or classes	Notes
Flow resistance	8.4.2	None	Manufacturer's declaration.

The requirement on a certain characteristic is not applicable in those Member States (MSs) where there are no regulatory requirements on that characteristic for the intended use of the product. In this case, manufacturers placing their products on the market of these MSs are not obliged to determine nor declare the performance of their products with regard to this characteristic and the option “No performance determined” (NPD) in the information accompanying the CE marking (see ZB.3) may be used. The NPD option may not be used, however, where the characteristic is subject to a threshold level.

ZB.2 Procedure(s) for attestation of conformity of [construction products]

ZB.2.1 System(s) of attestation of conformity

The system(s) of attestation of conformity of the POCEDs indicated in Tables ZB.1 and ZB.2 in accordance with the Decision of the Commission 95/467/EC of 27-09-95 amended by the decisions 01/596/EC of 8 January 2001 and 2002/592/EC of 15 July 2002 and as given in Annex III of the mandate for “Chimneys, flues and specific products", is shown in Table ZB.3 for the indicated intended use(s) and relevant level(s) or class(es).

Table ZB.3 — System(s) of attestation of conformity

Product(s)	Intended use(s)	Level(s) or class(es)	Attestation of conformity system(s)
Metal system chimney products	Chimneys	Any	2+
Terminals			4
System 2+: See Directive 89/106/EEC (CPD) Annex III.2.(ii), First possibility, including certification of the factory production control by an approved body on the basis of initial inspection of factory and of factory production control as well as of continuous surveillance, assessment and approval of factory production control. System 4: See Directive 89/106/EEC (CPD) Annex III.2.(ii),Third possibility.			

The attestation of conformity of the POCEDs in Tables ZB.1.and ZB.1.2 shall be based on the evaluation of conformity procedures indicated in Tables ZB.4 and ZB.5 respectively resulting from application of the clauses of this or other European Standard indicated therein.

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Table ZB.4 — Assignment of evaluation of conformity tasks for chimneys under system 2+ in Table ZB.1

Tasks			Content of the task	Evaluation of conformity Clauses to apply
Tasks under the responsibility of the manufacturer	Factory production control (FPC)		Parameters related to all relevant characteristics of Table ZB.1	9.3
	Initial type testing by the manufacturer		All relevant characteristics of Table ZB.1	9.2
	Possibly testing of samples taken at the factory		All relevant characteristics of Table ZB.1	9.3
Tasks of the Approved body	Certication of the FPC by the FPC certification body on the basis of: -	Initial inspection of factory and of FPC	Parameters related to all relevant characteristics of Table ZB.1	9.3
		Continuous surveillance, assessment and approval of FPC	Parameters related to all relevant characteristics of Table ZB.1	9.3

Table ZB.5 — Assignment of evaluation of conformity tasks for terminals under system 4 in Table ZB.2

Tasks		Content of the task	Evaluation of conformity Clauses to apply
Tasks for the manufacturer	Factory Production Control (FPC)	Parameters related to all relevant characteristics of Table ZB.2	9.3
	Initial type testing	All relevant characteristics of Table ZB.2	9.2

ZB.2.2 EC Certificate and Declaration of conformity

When, in the case of products under system of conformity 2+, compliance with the conditions of this annex is achieved, and once the notified body has drawn up the certificate mentioned below, the manufacturer or his agent established in the EEA shall prepare and retain a declaration of conformity, which entitles the manufacturer to affix the CE marking. This declaration shall include:

a) name and address of the manufacturer, or his authorised representative established in the EEA, and the place of production;

NOTE 1 The manufacturer may also be the person responsible for placing the product onto the EEA market, if he takes responsibility for CE marking.

b) description of the product (type, identification, use, ...), and a copy of the information accompanying the CE marking;

NOTE 2 Where some information required for the declaration is already given in the CE marking information, it does not need to be repeated.

c) provisions to which the product conforms (i.e. Annex ZB of this EN);

d) particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions);

e) the number of the accompanying factory production control certificate;

f) name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or his authorised representative.

The declaration shall be accompanied by a factory production control certificate, drawn up by the notified body, which shall contain, in addition to the information above:

g) name and address of the notified body;

h) the number of the factory production control certificate;

i) conditions and period of validity of the certificate, where applicable;

j) name of, and position held by, the person empowered to sign the certificate.

The above mentioned declaration and certificate shall be presented in the official language or languages of the Member State in which the product is to be used.

When, in the case of products under system of conformity 4, compliance with the conditions of this annex is achieved, the manufacturer or his agent established in the EEA shall prepare and retain a declaration of conformity (EC Declaration of conformity), which entitles the manufacturer to affix the CE marking. This declaration shall include:

k) name and address of the manufacturer, or his authorised representative established in the EEA, and the place of production;

NOTE 3 The manufacturer may also be the person responsible for placing the product onto the EEA market, if he takes responsibility for CE marking.

l) description of the product (type, identification, use, ...), and a copy of the information accompanying the CE marking;

NOTE 4 Where some information required for the declaration is already given in the CE marking information, it does not need to be repeated.

m) provisions to which the product conforms (i.e. Annex ZB of this EN), and a reference to the ITT report(s) and factory production control records (if appropriate);

n) particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions);

o) name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or his authorised representative.

ZB.3 CE marking and labelling

The manufacturer or his authorised representative established within the EEA is responsible for the affixing of the CE marking.

The CE marking symbol to affix shall be in accordance with Directive 93/68/EC and shall be shown on the appliance Data Badge. The following information shall accompany the CE marking symbol and may be on the Data Badge, the packaging, in the appliance Installation instructions or as a separate insert with the appliance instruction pack. Where is it is not possible for this information to appear with the CE marking symbol on the appliance Data Badge, the CE marking symbol will be repeated at the head of the information, see Figure ZB.1:

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a) identification number of the certification body (only for products under systems 2+);

NOTE The certification body is the "Notified Body" (notified under the CPD) responsible for the Factory Production Control Certificate (FPC certificate).

b) name or identifying mark and registered address of the appliance manufacturer;

c) the last two digits of the year in which the marking is affixed;

d) number of the factory production control certificate (if relevant);

e) reference to this European Standard.

Figure ZB.1 gives an example of the information to be given on the product, label, packaging and/or commercial documents.

CE 01234	*CE conformity marking, consisting of the "CE"-symbol given in directive 93/68/EEC.* *Identification number of the notified body*
AnyCo Ltd, PO Box 21, B-1050 05 01234-CPD-00234	*Name or identifying mark and registered address of the manufacturer* *Last two digits of the year in which the marking was affixed* *Certificate number*
EN 1020 Metal POCED Distance to combustible materials: O25	*Number of European Standard* *Definition of the product* *Information on mandated characteristics not included in the designation or threshold values to be given (see Table ZB.1)*

Figure ZB.1 — Example of CE marking information of a POCED

In addition to any specific information relating to dangerous substances shown above, the product should also be accompanied, when and where required and in the appropriate form, by documentation listing any other legislation on dangerous substances for which compliance is claimed, together with any information required by that legislation.

NOTE 1 European legislation without national derogations need not be mentioned.

NOTE 2 Affixing the CE marking symbol to a product means that it complies with all applicable directives.

Bibliography

[1] EN 676, *Automatic forced draught burners for gaseous fuels*

[2] ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

[3] EN 60730-2-1:1997, *Automatic electrical controls for household and similar use — Part 2: Particular requirements for electrical controls for electrical household appliances (IEC 60730-2-1:1989, modified)*

[4] EN 61558-2-6:1998, *Safety of power transformers, power supply units and similar — Part 2-6: Particular requirements for safety isolating transformers for general use (IEC 61558-2-6:1997)*

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