BRITISH STANDARD

BS EN 416-1:2009

Single burner gas-fired overhead radiant tube heaters for non-domestic use

Part 1: Safety

ICS 97.100.20

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 416-1:2009. It supersedes BS EN 416-1:1999 and which is withdrawn.

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

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

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

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 April 2009

ISBN 978 0 580 55854 2

Amendments/corrigenda issued since publication

Date	Comments

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 416-1

March 2009

ICS 91.140.40

Supersedes EN 416-1:1999

English Version

Single burner gas-fired overhead radiant tube heaters for non-domestic use - Part 1: Safety

Tubes radiants suspendus à monobrûleur à usage non-domestique utilisant les combustibles gazeux - Partie 1: Sécurité

Gasgeräte-Heizstrahler - Dunkelstrahler mit einem Brenner mit Gebläse für gewerbliche und industrielle Anwendung - Teil 1: Sicherheit

This European Standard was approved by CEN on 10 January 2009.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 416-1:2009: E

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Foreword

This document (EN 416-1:2009) 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of an identical text or by endorsement, at the latest by September 2009, and conflicting national standards shall be withdrawn at the latest by September 2009.

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 416-1:1999.

This revision modifies EN 416-1:1999. It has been prepared to incorporate requirements for combustion products evacuation ducts, POCEDs, supplied as an integral part of the appliance to support EU Directive 89/106/EEC on construction products under Mandate M/105. To this end, it extends the scope of the standard to cover Type B_4 and B_5 appliances.

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

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 EC Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document.

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

1 Scope

This European Standard specifies the requirements and test methods for the construction, safety, classification and marking of non-domestic gas fired overhead radiant tube heaters incorporating a single burner system under the control of an automatic burner control system, referred to in the body of the text as 'appliances'.

This standard is applicable to Type A_2, A_3, B_{12}, B_{13}, B_{22}, B_{23}, B_{42}, B_{43}, B_{52}, B_{53}, C_{12}, C_{13}, C_{32} and C_{33} appliances intended for use in other than domestic dwellings, in which the supply of combustion air and/or the evacuation of the products of combustion is achieved by mechanical means located upstream of the draught diverter, if provided.

This standard is not applicable to:

a) appliances designed for use in domestic dwelling;

b) outdoor appliances;

c) appliances of heat input in excess of 120 kW (based on the net calorific value of the appropriate reference test gas);

d) appliances having fully pre-mixed gas and air burners in which:

1) either the gas and all the combustion air are brought together just before the level of the combustion zone; or

2) the pre-mixing of the gas and all combustion air is carried out in a part of the burner upstream of the combustion zone;

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

f) appliances having combustion products evacuation ducts 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 intended to be type tested would need to be subject to further consideration.

Requirements concerning the rational use of energy have not been included in this European Standard.

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 88-1:2007, *Pressure regulators and associated safety devices for gas appliances - Part 1: Pressure regulators for inlet pressures up to and including 500 mbar*

EN 126:2004, *Multifunctional controls for gas burning appliances*

EN 161:2007, *Automatic shut-off valves for gas burners and gas appliances*

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

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

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

EN 10226-1:2004, *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 10226-2:2005, *Pipe threads where pressure tight joints are made on the threads – Part 2: Taper external threads and taper internal threads - Dimensions, tolerances and designation*

EN 13410, *Gas-fired overhead radiant heaters - Ventilation requirements for non-domestic premises*

EN 60335-1:2002, *Household and similar electrical appliances - Safety - Part 1: General requirements*

EN 60335-2-102:2006, *Household and similar electrical appliances - Safety - Part 2-102: Particular requirements for gas, oil and solid-fuel burning appliances having electrical connections*

EN 60529:1992, *Degrees of protection provided by enclosures (IP Code)*

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

EN 60584-2:1993, *Thermocouples — Part 2: Tolerances*

EN ISO 228-1:2003, *Pipe threads where pressure-tight joints are not made on the threads - Part 1: Dimensions, tolerances and designation (ISO 228-1:2000)*

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

EN ISO 6976:2005, *Natural gas - Calculation of 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 274:1975, *Copper tubes of circular section — Dimensions*

ISO 7005-1:1992, *Metallic flanges - Part 1: Steel flanges*

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

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

CR 1404:1994, *Determination of emissions from appliances burning gaseous fuels during type-testing*

3 Definitions

For the purposes of this standard the following definitions apply:

3.1 Appliance and its constituent parts

3.1.1
overhead radiant tube heater
gas fired appliance intended for installation above head level which is designed to heat the space beneath by radiation by means of a tube or tubes, heated by the internal passage of combustion products

3.1.2
single burner systems
those radiant tube heaters which employ a single combustion system incorporating independent flame monitoring and combustion air fan

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

3.1.4
mechanical joint
means of ensuring the soundness of an assembly of several parts (e.g. metal to metal joints, conical joints, toroidal sealing rings ('O' rings), flat joints without the use of liquids (e.g. pastes and tapes)

3.1.5
gas circuit
part of the appliance that conveys or contains the gas between the appliance gas inlet connection and the burner(s)

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 by such means as e.g. a screw, after the gas rate has been adjusted by the manufacturer or installer

3.1.9
sealing an adjuster
term applied to any arrangement in respect of the adjuster such that any attempt to change the adjustment breaks the sealing device or sealing material and makes this interference apparent

NOTE 1 A factory sealed adjuster is considered to be non-existent.

NOTE 2 A regulator is considered to be non-existent if it has been factory sealed in a position such that it is not operational in the range of supply pressure corresponding to the appliance category.

3.1.10
putting an adjuster or a control out of service
putting an adjuster or a control (of temperature, pressure, etc.) out of action and sealing it in this position. The appliance then functions as if the adjuster or control had been removed.

3.1.11
injector
component that admits the gas into a burner

3.1.12
main burner
burner that is intended to ensure the thermal function of the appliance and is generally called the burner

3.1.13
premixed burner
burner in which the gas and a quantity of air, at least equal to that theoretically necessary for complete combustion, are mixed before the flame port(s)

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

3.1.15
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

3.1.16
primary aeration adjuster
device enabling the primary air to be set at the necessary value according to the supply conditions

3.2 Combustion circuit

3.2.1
combustion products circuit
circuit including the combustion chamber, the radiant tube, the combustion products evacuation duct and either the fitting piece or the connection to the terminal, if any

3.2.2
air supply and combustion products evacuation ducts
means for transporting combustion air to the burner and combustion products to the terminal or fitting piece

NOTE A fitting piece is not utilised by appliances of Type C_1 or of Type C_3. It is necessary to distinguish between:

a) completely surrounded ducts where the combustion products evacuation duct is surrounded by combustion air throughout its length; and

b) separate ducts where the combustion products evacuation duct and the combustion air supply duct are neither concentric nor completely surrounded ducts

3.2.3
combustion chamber
enclosure inside which combustion of the air-gas mixture takes place

3.2.4
flue outlet
part of a Type B appliance that connects with a flue to evacuate the products of combustion

3.2.5
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

3.2.6
terminal
device(s) fitted to the outside of the building, which are connected to the air supply and combustion products evacuation ducts for Type C_1 and Type C_3 appliances (one or two devices)

3.2.7
terminal guard
device that protects the terminal from mechanical damage from outside influences

3.2.8
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 manufacturer's instructions

3.3 Adjusting, control and safety devices

3.3.1
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.

3.3.2
air proving device
device intended to cause safety shutdown in the event of abnormal conditions of air admission or of combustion products evacuation

3.3.3
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; the programming unit follows a predetermined sequence of actions and always operates in conjunction with a flame detector device

3.3.4
programme
sequence of control operations determined by the programming unit involving switching on, starting up, supervising and switching off the burner

3.3.5
flame detector
device by which the presence of a flame is detected and signalled

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

3.3.6
flame signal
signal given by the flame detector, normally when the flame sensor senses a flame

3.3.7
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

3.3.8
flame simulation
condition which occurs when the flame signal indicates the presence of a flame when in reality no flame is present

3.3.9
pressure regulator [1)]
device which maintains the outlet pressure constant, independent of the variations in inlet pressure within defined limits

3.3.10
adjustable pressure regulator
regulator provided with means for changing the outlet pressure setting

3.3.11
volume regulator [1)]
device which maintains the gas rate constant within a given tolerance, independent of the upstream pressure

3.3.12
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

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

3.3.13
automatic shut-off valve
valve designed to open when energized and to close automatically when de-energized

3.4 Operation of the appliance

3.4.1
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]

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[1] The term ‘regulator’ is used in both cases.

3.4.2
nominal heat input
Q_n
value of the heat input (kW) declared by the manufacturer

3.4.3
volume flow rate
V
volume of gas consumed by the appliance in unit time during continuous operation

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

3.4.4
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].

3.4.5
start gas
gas that is supplied at the start gas rate either at the main burner or at a separate ignition burner

3.4.6
start gas rate
restricted gas flow rate admitted either to a separate ignition burner or to the main burner during start up

3.4.7
start gas flame
flame established at the start gas rate either at the main burner or at a separate ignition burner

3.4.8
flame stability
characteristic of flames which remain on the burner ports or in the flame reception zone intended by the construction

3.4.9
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

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

3.4.10
light-back
entry of a flame into the body of the burner

3.4.11
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

3.4.12
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

3.4.13
yellow tipping
yellowing of the tip of the blue cone of an aerated flame

3.4.14
purge
forced introduction of air through the combustion chamber and flue passages in order to displace any remaining fuel/air mixture and/or products of combustion

3.4.14.1
pre-purge
purge which takes place between the start signal and energising of the ignition device

3.4.14.2
post-purge
purge which takes place immediately following shut-down

3.4.15
first safety time [2)]
interval between the ignition burner valve, start gas valve or main gas valve, as applicable, being energised and the ignition burner valve, start gas valve or main gas valve, as applicable, being de-energized if the flame detector signals the absence of a flame at the end of this interval

3.4.16
second safety time
where there is a first safety time applicable to either an ignition burner or to a start gas flame only, the second safety time is the interval between the main gas valve being energized and the main gas valve being de-energized if the flame detector signals the absence of a flame at the end of this interval

3.4.17
extinction safety time
time which elapses between the moment when the supervised flame is extinguished and the moment when the automatic burner control system initiates shut-down of the burner by removing power to the automatic gas shut-off valves

3.4.18
running condition of the system
condition in which the burner is in normal operation under the supervision of the programming unit and its flame detector

3.4.19
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)

3.4.20
safety shut-down
process which is effected immediately following the response of a safety control or sensor or the detection of a fault in the burner control system and which puts the burner out of operation by immediately removing the power to the gas shut-off valve(s) and the ignition device

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

3.4.21
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

3.4.22
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 mains electrical supply and its subsequent restoration

3.4.23
spark restoration
process by which, following the loss of the flame signal, the ignition device will be switched on again without the total interruption of the gas supply

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 volatile or non-volatile lock out.

3.4.24
automatic re-cycling
process by which, after a safety shut-down, a full start-up sequence is automatically repeated

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 disappeared, with volatile or non-volatile lock out.

3.5 Gases

3.5.1
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

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 The calorific value is expressed either in MJ/m^{3}of dry gas at the reference conditions or in MJ/kg of dry gas [EN 437:2003].

3.5.2
relative density
d
ratio of the masses of equal volumes of dry gas and dry air at the same conditions of temperature and pressure

3.5.3
Wobbe index
gross Wobbe index: W_s and 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. 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 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].

3.5.4
test pressure
gas pressures used to verify the operational characteristics of appliances using combustible gases; they consist of normal and limit pressures

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

3.5.5
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]

3.5.6
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]

3.5.7
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

3.6 Conditions of operation and measurement

3.6.1
reference conditions
for the purposes of this standard, the following reference conditions apply:

a) for calorific values, temperature: 15 °C

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

3.6.2
cold condition
condition of the appliance required for some tests and obtained by allowing the unlit appliance to attain thermal equilibrium at room temperature

3.6.3
hot condition
condition of the appliance required for some tests and obtained by heating to thermal equilibrium at the nominal heat input

3.6.4
equivalent resistance
resistance to flow (in mbar) measured at the outlet of the appliance, which is equivalent to that of the actual flue

3.6.5
thermal equilibrium
operating state of the appliance, corresponding to a particular setting of the input in which the flue gas temperature (°C) does not change by more than ± 2 % over a period of 10 min

3.7 Country of destination

3.7.1
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; at the time of putting the appliance on the market and/or installation, the appliance shall be capable of operating, without adjustment or modification, with one of the gases distributed in the country concerned, at the appropriate supply pressure

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

3.7.2
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. Subsequent modification or adjustment is essential in order that it can be utilized safely and correctly in this country

4 Appliance classification

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

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

Table 1 — Gas classification

Gas family	Gas Group	Gross Wobbe index (MJ/m^3) at 15 °C and 1 013,25 mbar	
		Minimum	Maximum
First	a	22,4	24,8
Second		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 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 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 pressures;

Category I_{2E}: appliances using only gases of Group E of the second family at the prescribed 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 pressure;

Category I_{3+}: appliances capable of using gases of the third family (propane and butane) and operating with a pressure couple without adjustment of the appliance. However, for certain types of appliance specified in the particular standards adjustment of the primary combustion air may be permitted when changing from propane to butane and vice versa. No gas pressure regulating device is permitted on the appliance;

Category I_{3P}: appliances using only gases in Group P of the third family only (propane) at the prescribed 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 gases:

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 those 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 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 gases of the three families.

This category is not in general use.

Category III appliances which are in use in certain countries are given in A.3.

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

4.3.1 General

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

4.3.2 Type A

An appliance not intended for connection to a flue or to a device for evacuating the products of combustion to the outside of the room in which the appliance is installed.

This standard applies to:

a) Type A_2: an appliance with a fan downstream of the combustion chamber;

b) Type A_3: an appliance with a fan upstream of the combustion chamber.

4.3.3 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.

The variations of Type B relevant to this standard are:

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

b) Type B_2: a Type B appliance without a draught diverter;

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

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

This standard applies to:

e) Type B_{12}: a 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;

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

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

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

i) Type B_{42}: a 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;

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

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

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

See Annex B.1 for the types of appliance identified above, in which the combustion air is supplied and/or in which the products of combustion are evacuated by mechanical means.

4.3.4 Type C

An appliance in which the combustion circuit is sealed with respect to the inhabitable area of the building in which the appliance is installed.

The variations of Type C relevant to this standard are:

a) Type C_1: a 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;

b) Type C_3: a 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.

This standard applies to:

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

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

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

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

See B.2 for the types of appliance identified above, in which the combustion air is supplied and/or in which the products of combustion are evacuated either by natural draught or mechanical means.

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) Categories $I_{3B/P}$: 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);

d) Category I_{3P}: no modification to appliance relative to a change of gas. For changing 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 first and second families

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

Adjustment of the gas rate of the ignition burner, either by using an adjuster or by a change of injector or restrictor and, if necessary, a change of complete ignition burner or of some of its parts.

Putting the regulator out of service under the conditions of 5.2.6.

Putting the gas rate adjusters out of service under the conditions of 5.2.2 and 5.2.3 if applicable.

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, restrictor or regulator.

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

Putting the regulator out of service under the conditions of 5.2.6.

Putting the gas rate adjusters out of service under the conditions of 5.2.2.

The 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).

5.1.1.3 Category III

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

5.1.2 Materials and method of construction

The quality and thickness of materials used in the construction of an appliance, including its POCED in the case of Type B_4, B_5, C_1 and C_3 appliances, shall be:

a) such that the construction and performance characteristics are not altered so as to affect the safe operation of the appliance in normal conditions of use and of maintenance by the user;

b) such as to ensure a reasonable operating life.

In particular, when the appliance is installed according to the manufacturer's instructions, all the components shall withstand the mechanical, chemical and thermal conditions to which they may be subjected when used in a manner which can be reasonably foreseen.

Copper shall not be used for gas carrying parts where the 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.

5.1.3 Accessibility for maintenance and use

Components and controls shall be arranged such that they are readily accessible for adjustment, maintenance or exchange. Where necessary, access doors or removable panels shall be provided.

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

Parts of the appliance which are not intended to be removed by the user and for which removal would affect safety shall be capable of removal only with the aid of tools.

5.1.4 Means of sealing

5.1.4.1 Soundness of the gas circuit

Holes for screws, studs, etc., intended for the assembly of components shall not open into the gas ways. The wall thickness between holes (including threads) and gas ways 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 such as tape, mastic or 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 appliance use.

5.1.4.2 Soundness of the combustion circuit (Type B appliances)

The soundness of the combustion circuit of the appliance shall be affected by mechanical means only, with the exception of those parts which do not require to be disconnected for routine maintenance, and which may be joined with mastic or paste in such a way that permanent soundness is assured under normal condition of use.

5.1.4.3 Soundness of the combustion circuit (Type C appliances)

Parts which have to be removed during routine service and affect the soundness of the appliance and/or its ducts, shall be sealed by mechanical means, excluding pastes, liquids and tapes. The need for replacement of the seal(s), following a cleaning or servicing operation as stated by the manufacturer, is permitted.

However, parts of the assembly that are not intended to be dismantled for maintenance may be joined in such a way that permanent soundness is assured during continuous service under normal conditions of use.

The ducts, bends, if any, and the terminal or fitting piece shall fit together correctly and shall form a stable assembly. Parts intended to be dismantled for periodic servicing shall be designed and arranged so that soundness is guaranteed after re-assembly.

Any fitting piece shall allow a sound connection to be made to the system intended for the evacuation of combustion products and supply of air.

5.1.5 Supply of combustion air and evacuation of combustion products

5.1.5.1 General

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

Unless otherwise stated, fan assisted appliances may be fitted with a means of adjustment in the combustion circuit intended to adapt the appliances to the pressure losses in the installed ducts, either by restrictors or by setting the means of adjustment to predetermined positions in accordance with detailed instructions from the manufacturer.

According to the appliance type, the manufacturer shall supply any terminal and/or fitting piece, with the appliance for test.

If the appliance has a POCED 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 appliances), shall not undergo any permanent distortion when subjected to the wind load test specified in 4.3.2 of EN 1859:2000.

5.1.5.2 Air supply and combustion products evacuation ducts

The assembly of the various parts during installation shall be such that no work is necessary other than adjusting the length of the air supply and combustion products evacuation ducts (possibly by cutting them). Such adaptation shall not impair the correct operation of the appliance.

It shall be possible to connect the appliance, the air supply and combustion products evacuation ducts and the terminal or fitting piece using ordinary tools if necessary. All necessary accessories and the fitting instructions shall be supplied by the manufacturer.

The terminal outlets from separate ducts for the supply of combustion air and the evacuation of combustion products shall fit inside a square of 50 cm for Type C_1 and C_3 appliances.

NOTE In accordance with the national regulations sampling points in the combustion circuit may be required.

5.1.5.3 Air inlets

All openings for the supply of air into the appliance shall be adequately protected against inadvertent obstruction. In addition, such openings shall not permit the entry of a ball of 16 mm diameter applied with a force of 5 N. The cross section of the air passageway(s) shall not be adjustable.

5.1.5.4 Appliance outlet

The cross-section of the combustion circuit shall not be adjustable.

The outlet for products of combustion of a Type A appliance shall be so designed and arranged that it is protected against inadvertent obstruction (e.g. from matter falling from above).

5.1.5.5 Type B_{12} and Type B_{13} appliances

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

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 in the country where the appliance is to be installed (see A.6).

It shall be possible to insert a flue pipe of 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.

NOTE Where *D* is the nominal internal diameter of the appliance outlet.

5.1.5.6 Type B_{22} and Type 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 standards in force in the country where the appliance is to be installed (see A.6).

It shall be possible to insert a flue pipe of 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.

NOTE Where *D* is the nominal internal diameter of the appliance outlet.

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) and the mass flow rate of flue gases in kg/s (see Annex D). In addition, the manufacturer shall state the flue pressure (Pa) and flue gas temperature (°C).

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.

5.1.5.7 Type B_{42} and B_{43} appliances

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

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, insertion depth, etc.

5.1.5.8 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, insertion depth, etc.

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

Where the appliance is intended to be fitted to a flue having a wall termination, the manufacturer shall either supply a flue terminal or state the type of termination which shall be used. The design of this shall be such that it will not allow entry of a ball of 16 mm diameter applied with a force of 5 N.

5.1.6 Inlet connections

The appliance inlet connection shall be one of the following types:

a) a thread conforming to EN ISO 228-1:2003. In this case the end of the gas inlet connection shall have a flat annular surface at least 3 mm wide for thread sizes 1 [3)], ½ and ⅜ and at least 2,5 mm wide for thread size ¼, to allow the interposition of a sealing washer. Moreover, when the end of the gas inlet connection has a thread of nominal size ½, it shall be possible to insert a gauge of 12,3 mm diameter to a depth of at least 4 mm;

b) a thread conforming to EN 10226-1:2004 or EN 10226-2:2005;

c) a compression fitting suitable for copper tube conforming to Table 2 of ISO 274:1975;

d) a straight tube at least 30 mm long, the end of which is cylindrical, smooth and clean, to allow connection by means of a compression fitting as specified in c);

e) a flange to ISO 7005-1:1992, ISO 7005-2:1988 or ISO 7005-3:1988.

NOTE The conditions of inlet connections prevailing in the various countries are given in A.5.

The gas inlet connection shall be so secured that connections to the gas supply can be made without disturbing any controls or gas-carrying components of the appliance.

5.1.7 Confirmation of operation

Means shall be provided to allow observation of any ignition burner flame during commissioning and servicing. If the means of observation is a viewing port, it shall, when located in an area of high temperature, be covered with heat resistant glass or equivalent material and sealed with a suitable heat resistant sealant.

It shall at all times be possible for the user to ascertain visually whether the appliance is in operation or has gone to volatile or non-volatile lock-out where:

a) mirrors or windows are used, their optical properties shall not have deteriorated at the completion of all the tests specified in this standard;

b) indicator lights are used; their purpose shall be clearly and permanently identified on the appliance, or on the plate or label required by 8.1.1. The indicator lighting circuitry shall be so designed and arranged that:

   1) it indicates when a supervised flame is present and, in the case of a supervised ignition burner, it also indicates when the main burner is in operation;

   2) any failure arising in the indicator lighting circuitry shall either not affect the operation of any safety device or prevent the operation of the appliance.

[3)] This inlet connection may be necessary for appliances burning first family gases.

5.1.8 Electrical equipment

The electrical equipment of the appliance shall be so designed and constructed as to obviate hazards of electrical origin and shall comply with the requirements of EN 60335-2-102:2006 which cover such hazards.

If the appliance is fitted with electronic components or electronic systems providing a safety function, these shall comply with the relevant requirements of EN 298:2003 with regard to electromagnetic compatibility immunity levels.

If the manufacturer specifies the nature of the electrical protection of the appliance on the data plate, this specification shall comply with EN 60529:1992:

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

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

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

Interruption and subsequent restoration of the electricity supply at any time during the starting up or operation of the appliance shall result in the continued safe operation, non-volatile lock-out, volatile lock-out, or safety shut-down followed by automatic recycling.

Interruption and subsequent restoration of the electricity supply shall not override any lock-out condition except where the appliance is intended to be reset by means of switching off and on the electricity supply to the appliance (e.g. volatile lock-out). Such resetting shall only be possible if any interruption and subsequent restoration of the electricity supply cannot give rise to a hazardous appliance condition.

NOTE Requirements relating to the continued and safe operation of the appliance in the event of normal and abnormal fluctuation of auxiliary energy is specified in 6.6.1 d).

5.1.10 Motors and fans

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

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

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

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

Lubrication points, if provided, shall be readily accessible.

5.2 Requirements for 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.

The appliance shall not incorporate any controls which need to be manipulated by the user when the appliance is in normal operation.

5.2.2 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 these categories except II_{2E+3+} may have a gas rate adjuster consisting of an adjusting screw on the gas regulator.

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

For appliances in categories II_{2H3+} 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 5.2.6) when these appliances are supplied with a second family gas.

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

5.2.3 Range-rating devices

A range-rating device on an appliance is optional.

For appliances in categories 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.

5.2.4 Aeration adjusters

Aeration adjusters are not permitted.

5.2.5 Controls and safety devices

5.2.5.1 General

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

5.2.5.2 Manual controls

5.2.5.2.1 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 specified in the manufacturer's installation instructions.

5.2.5.2.2 Manual valves

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

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

5.2.6 Regulators

Regulators shall comply with EN 88-1:2007.

For an appliance burning first or second family gases, the gas supply to the burner and any ignition burner shall be under the control of an integral regulator fitted upstream of the automatic shut-off valves unless it is incorporated in the multifunctional control.

For an appliance burning third family gases, the fitting of a regulator is optional.

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 unauthorised interference with the adjustment difficult.

However, for appliances in categories I_{2E+},II_{2E+3+} and II_{2E+3P} the gas regulator 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_{2E+3+} and II_{2E+3P}, it shall be possible to put the regulator partially out of service when they are supplied with second family gases, such that the regulator is not operational in the range of the two normal pressures of the second family pressure couple (i.e. 20 mbar to 25 mbar).

5.2.7 Multifunctional controls

Multifunctional controls shall comply with EN 126:2004.

5.2.8 Automatic shut-off valves

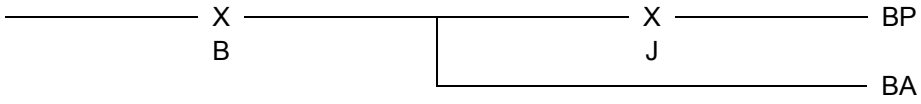
Automatic shut-off valves shall comply with EN 161:2007.

The gas supply to the main burner shall be under the control of two automatic shut-off valves connected in the gas line in series; one being of Class A or Class B, the other being of Class A, Class B, Class C or Class J. If a valve of Class J is utilised, 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 Class J valve.

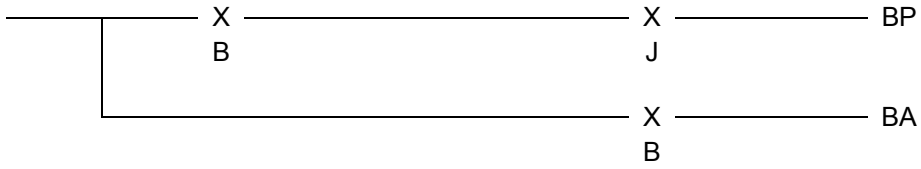
The start gas supply shall be under the control of one automatic shut-off valve of either Class A or Class B.

This valve may be the upstream valve in the gas supply to the main burner where it is of Class B and the start gas supply is taken from immediately downstream of this valve. Where the start gas supply is under the control of a single automatic shut-off valve, the heat input at the time of ignition shall not exceed 1 kW or 5 % of the main burner heat input, whichever is the smaller.

The arrangements shown in Figure 1 are given as examples. Any other arrangement giving at least an equivalent level of safety is permissible.



a) Appliances with an ignition burner with a heat input not exceeding 1 kW or 5 % of the main burner heat input



b) Appliances with direct ignition of the main burner

Key
BA Igniton burner
BP Main burner

Figure 1 — Automatic shut-off valve configuration

5.2.9 Gas strainers

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

In gas circuits incorporating more than one automatic shut-off valve, only one strainer needs to be fitted, provided it gives adequate protection to all valves.

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

5.2.10 Thermostats

Integral mechanical thermostats shall comply with EN 257:1992.

5.2.11 Air proving device

Each burner shall be fitted with a suitable device for proving adequate air-flow during the pre-purge, ignition and operation of the burner (see 6.6.1 e), 7.3.6.2 Test No 5, 6.6.2.2 and 7.3.6.3.2.)

The sensor shall be located at the burner.

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

Air-flow failure at any time during the pre-purge, ignition and operation of the burner shall cause non-volatile lock-out, volatile lock-out or safety shut-down such that re-start may only take place following automatic recycling.

5.2.12 Automatic burner control system

5.2.12.1 General

The appliance shall be fitted with an automatic burner control system complying with EN 298:2003.

5.2.12.2 Manually operated devices

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

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.

5.2.12.3 Pre-purging

Immediately before any attempt at ignition or the opening of automatic shut-off valves, the appliance shall be purged.

Under the test conditions described in 7.2.2, the purge period shall be at least 10 s.

5.2.12.4 Flame detector

The flame detector shall incorporate a means to prevent the energizing any gas valve and of the ignition device if a flame or flame simulating condition is present during the start-up period.

Upon flame failure in the running condition the flame detector shall cause:

a) a non-volatile lock-out; or

b) a volatile lock-out; or

c) one of the following, provided that such action cannot give rise to a hazardous condition:

   1) a safety shut-down followed by automatic recycling; or

   2) a spark restoration.

In the case of non-volatile lock-out or safety shut-down, the time for the flame detector system to de-energize the burner automatic shut-off valves upon flame failure shall not exceed 3 s. This shall be verified as described in 7.2.4.

In the case of spark restoration, the time for the flame detector system to de-energize the burner automatic shut-off valves upon flame failure shall not exceed 3 s. This shall be verified as described in 7.2.4. The spark restoration system shall be so designed that the ignition device is energized after loss of flame.

5.2.12.5 Start-gas flame establishment

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

The first safety time shall be not more than 20 s. The safety time shall be specified by the appliance manufacturer and verified under the test conditions described in 7.2.3.

The ignition spark (or other means of ignition) shall not be energized before the completion of the pre-purge period and shall be de-energized at or before the end of the first safety time.

The start-gas automatic shut-off valve(s) shall not be energized before the ignition spark (or other means of ignition) is energized.

If the start-gas flame is not detected by the end of the first safety time, volatile or non-volatile lock-out shall result.

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

The upstream automatic shut-off valve in the main gas supply may be opened to permit start-gas flow where the start-gas supply is taken from downstream of the first main gas automatic shut-off valve.

5.2.12.6 Direct main burner flame establishment

The safety time shall be not more than 10 s. The safety time shall be specified by the appliance manufacturer and verified under the test conditions described in 7.2.3.

The ignition spark (or other means of ignition) shall not be energized before the completion of the pre-purge period and shall be de-energized at or before the end of the 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 main gas valves shall not be energized before the ignition spark (or other means of ignition) is energized. If the main flame is not detected by the end of the safety time, volatile or non-volatile lock-out shall result.

5.2.12.7 Safety and controlled shut-down

When controlled or safety shut-down has been signalled, this shall result in closure of all automatic shut-off valves. On shut-down the fan shall not be de-energized before the automatic shut-off valves. Post-purging is optional.

5.2.12.8 Facility for remote control

Where the appliance is capable of being controlled remotely by means of thermostats or a time control, electrical connection of these controls shall be possible without disturbing any internal connection in the appliance, except for purpose made links.

5.3 Ignition devices

5.3.1 General

When installed in accordance with manufacturer's instructions, it shall be possible to light the appliance from an easily accessible position by means of an electrical or other convenient ignition device incorporated in the appliance.

Ignition burners and ignition devices shall be protected by design and position against diminution or extinction resulting from e.g. draughts, products of combustion, overheating, condensation, corrosion or matter falling from above.

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 other ignition device for direct ignition.

5.3.3 Ignition burners

If different ignition burners are used when the appliance is converted from one gas to another, 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.

5.4 Main burner

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

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

5.5 Pressure test points

The appliance shall be fitted with at least two 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.

For appliances only burning third family gases not fitted with a regulator, a single pressure test point may be fitted.

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

5.6 Injectors

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 tube assembly from its installed position. However, injectors shall only be removable with the aid of a tool.

6 Operational requirements

6.1 Soundness

6.1.1 Soundness of the gas circuit

The gas circuit shall be sound. It is deemed to be sound if, under the conditions described in 7.3.1.1, the leakage of air does not exceed 100 cm^3/h irrespective of the number of components, whether mounted in series or parallel on the appliance.

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

6.1.2.1 Correct evaluation of combustion products (Type B_{12} and Type B_{13} appliances)

When the appliance is tested under the conditions of 7.3.1.2.1 all products of combustion shall be evacuated through the flue.

6.1.2.2 Soundness of the combustion circuit (Type B_{23} appliances)

When the appliance is tested under the conditions of 7.3.1.2.2, the air leakage rate shall not exceed 0,05 m^3/h per kW of the nominal heat input of the appliance.

6.1.2.3 Soundness of the combustion circuit (Type B_{52} and B_{53} appliances)

When tested under the conditions of 7.3.1.2.3, the air leakage rate from any part of the combustion circuit, including its POCED, that is downstream of the fan shall not exceed 0,10 m^3/h per kW of the nominal heat input.

6.1.2.4 Soundness of the combustion circuit (Type C_1 and C_3 appliances)

When tested under the conditions of 7.3.1.2.4, the leakage from the appliance together with its air supply and combustion products evacuation ducts and all their joints, shall not exceed 0,5 m^3/h per kW of the nominal heat input of the appliance.

6.2 Heat inputs

6.2.1 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.

6.2.2 Start gas heat input

When measured under the conditions of 7.3.2.3 the 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.

6.2.3 Effectiveness of the range-rating device

For appliances fitted with a range-rating device distinct from a gas rate adjuster, it shall be checked under the conditions described in 7.3.2.4 that:

a) with the range-rating device in the position giving the maximum rate, the nominal heat input is obtained to within ± 5 %; and

b) with the range-rating device in the position giving the minimum rate, the heat input is within ± 5 % of the minimum heat input stated by the manufacturer; and

c) for appliances burning third family gases, with the range-rating device in the position giving the maximum rate, the rate obtained shall be that with the device wide open and operative.

6.3 Limiting temperatures

6.3.1 Wall and ceiling temperatures

When the appliance is tested under the conditions of 7.3.3.1, the wall and ceiling temperatures shall not exceed the ambient temperature by more than 50 K.

6.3.2 Component temperatures

When the appliance is tested under the conditions of 7.3.3.2 the maximum temperature of the appliance components shall not exceed the maximum temperature specified by the individual component manufacturer.

6.3.3 Fan motor temperatures

When tested under the conditions of 7.3.3.3, the maximum temperature rise of the motor windings shall not exceed the maximum temperature rise specified by the manufacturer.

6.3.4 POCED (Type B_4, B_5, C_1 and C_3 appliances)

When the appliance is tested under the conditions of 7.3.3.4.1, 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 7.3.3.4.2.

6.4 Ignition, cross-lighting and flame stability

6.4.1 All appliances (still air conditions)

6.4.1.1 Ignition and cross-lighting

Under the test conditions described in 7.3.4.1.1, correct and smooth ignition and cross-lighting shall be assured.

When the gas rate of any ignition burner is reduced under the test conditions described in 7.3.4.1.2 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 without undue noise.

Where the gas line is designed such that the gas supply to the ignition burner is taken from between the main burner gas valves, it shall be verified that ignition of the ignition burner under the test conditions described in 7.3.4.1.3 does not give rise to a hazardous situation.

Under the test conditions described in 7.3.4.1.4 ignition of any ignition burner, or the main burner where this is ignited directly, shall be safe and without undue noise when ignition is delayed by up to 50 % longer than the safety time declared by the manufacturer.

The appliance shall not sustain any damage likely to affect its safe operation.

6.4.1.2 Flame stability

Under the test conditions described in 7.3.4.2 the flames shall be stable. A slight tendency to lift at the moment of ignition is acceptable but the flames shall be stable in normal operation.

6.4.2 Supplementary tests for Type B_{12} , B_{13} , B_{42} and B_{43} appliances

The flames shall be stable under the test conditions described in 7.3.6.3.1.

6.4.3 Supplementary tests for Type C_1 and C_3 appliances

Under the test conditions of 7.3.4.3, ignition of the ignition burner, ignition of the main burner by the ignition burner or direct ignition of the main burner, complete cross-lighting of the main burner and also stability of the ignition burner when it alone is alight or of the ignition burner and main burner operating simultaneously shall be assured. Slight flame disturbance is permitted but there shall be no flame extinction.

6.5 Pressure regulator

When tested in accordance with the conditions given in 7.3.5 the rate shall not differ by more than + 7,5 % and - 10 % for first family gases and by more than ± 5 % for second and third family gases from the initial rate obtained under those conditions.

6.6 Combustion

6.6.1 All appliances (still air conditions)

When tested as described in 7.3.6.2:

a) Test No. 1, the CO concentration in the dry, air-free products of combustion shall not exceed 0,1 %.

b) Test No. 2, the CO concentration in the dry, air-free products of combustion shall not exceed 0,2 %.

c) Test No. 3, the CO concentration in the dry, air-free products of combustion shall not exceed 0,2 %.

In addition, when supplied with the sooting limit gas under the same conditions and the appliance is operated for 3 cycles of 30 min on and 30 min off, there shall be no significant deposit of soot on the inside of the radiant tube.

d) Test No. 4, the CO concentration in the dry, air-free products of combustion shall not exceed 0,2 %.

Under these conditions, it shall be verified that the appliance ignites and continues to operate.

e) Test No. 5, the CO concentration in the dry, air-free products of combustion shall not exceed 0,2 %.

6.6.2 Supplementary tests under special conditions

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

When tested as described in 7.3.6.3.1, the CO concentration in the dry-free products of combustion shall not exceed 0,1 %.

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

When supplied with reference gas under the conditions of 7.3.6.3.2, the CO concentration in the dry air-free products of combustion shall not exceed 0,2 %.

When tested in accordance with 7.3.6.3.2 a) 1), at the point of shut off, the increase in pressure at the outlet of the appliance shall not be less than 0,75 mbar.

When tested in accordance with 7.3.6.3.2 b) 1), at the point of shut off, the increase in pressure at the outlet of the appliance shall not be less than 0,5 mbar.

6.6.2.3 Type C_1 and C_3 appliances

When supplied with reference gas under the conditions of 7.3.4.3, the CO concentration in the dry air-free products of combustion shall not exceed 0,2 %.

6.7 Prolonged performance

After the appliance has been tested under the conditions of 7.3.7, the following requirements shall be met:

a) the requirements of 6.6.1 a);

b) whilst the requirements in a) above are being verified, there shall be no significant deposition of soot or any appreciable distortion or disturbance of the flames;

c) there shall be no sign of leakage of combustion products (e.g. from the combustion chamber or flue connections);

d) there shall be no breakdown or distortion in any part of the appliance that could affect its safety;

e) there shall be no significant deterioration in the external surface of the radiant tube for example flaking or excessive oxidation;

f) there shall be no signs of other corrosion that will adversely affect the life of the appliance;

g) following inspection at the end of the test there shall be no evidence of corrosion at the outlet bend and within any POCED.

6.8 Measurement of oxides of Nitrogen (NO_x)

The manufacturer shall declare the NO_x class in Table 2 that is applicable to the appliance.

When measured in accordance with the method of test given in 7.4.1, the NO_x concentration(s) in the dry, air free products of combustion shall be such that the weighted NO_x value, determined as appropriate in accordance with 7.4.2, does not exceed the maximum NO_x concentration of the NO_x class declared by the manufacturer.

Table 2 — NO_x classes

NO_x Class	**Maximum NO_x concentration** mg/kWh
1	260
2	200
3	150
4	100

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 pressure 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 437:2003.

The characteristics of the reference and limit gases are given in Tables 4 and 5. The values in Table 4, measured and expressed at 15 °C, are derived from ISO 6976:2005.

7.1.2 Conditions for preparation of the test gases

The composition of gases used for the tests shall be as close as possible to those given in Table 4. For the preparation of the test gases:

a) the Wobbe index of the gas used shall be within ± 2 % of the value indicated in Table 4 for the corresponding test gas (this tolerance includes the error due to measuring instruments);

b) the constituents used for the preparation of the mixtures shall have at least the purity shown in Table 3:

Table 3 — Test gas purity

Gas	Purity %
Nitrogen (N_2)	99
Hydrogen (H_2)	99
Methane (CH_4)	95 [a)]
Propene (C_3H_6)	95 [a)]
Propane (C_3H_8)	95 [a)]
Butane[4)] (C_4H_{10})	95 [a)]
[a)] With a total concentration of H_2, CO and O_2 below 1 % and a total concentration of N_2 and CO_2 below 2 %.	

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 conditions of Table 3. One can therefore, in order to make up a mixture, 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 4 for the corresponding reference gas;

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

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 4 for the corresponding limit gas and, the hydrogen content of the final mixture shall be as given in Table 4.

Table 4 — Test gas characteristics [a] (gas dry at 15 °C and 1 013,25 mbar)

Gas Family and Group	Test Gases	Desig-nation	Composition volume %	W_i MJ/m³	H_i MJ/m³	W_s MJ/m³	H_s MJ/m³	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	G 21	CH_4 = 87 C_3H_8 = 13	49,60	41,01	54,76	45,28	0,684
	Sooting limit gas 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
Gases of the second family								
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 Annex B.4.

[b] For other groups, see Annex B.4.

[c] See also Table 3.

[d] See 7.1.2 footnote [4].

Table 5 — 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, 7.3.3, 7.3.4, and 7.3.6 shall be as specified in 7.1.1 and made up in accordance with 7.1.2.

For those 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 4 and in accordance with 7.1.5.1 are used. The selected gases, for each appliance category, are listed in Table 6.

7.1.3.2 Conditions of supply and adjustment of the appliance

7.1.3.2.1 Initial adjustment of appliance

Before all the required tests are carried out, the appliance shall be fitted with the appropriate equipment (injector(s)) corresponding to the gas family or gas group to which the specified test gas belongs (see Table 4). Any gas rate adjuster(s) 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 7.1.4.

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

7.1.3.2.3 Adjustment of heat inputs

For tests requiring adjustment of the burner to the nominal heat input and/or any other heat input specified by the manufacturer, it shall be ensured that the pressure upstream of the injector(s) is such that the heat input obtained is within ± 2 % of that specified (by altering the pre-set adjuster(s) or the appliance regulator, if adjustable, or the appliance supply pressure).

The specified heat input shall be determined in accordance with 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 an appliance inlet pressure (p) different from the normal pressure (p_n), then those tests normally carried out at the

minimum (p_{min}) or maximum test pressure (p_{max}) shall be carried out at the corrected test pressures p'_{min} and p'_{max}.

Table 6 — 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
I_{3B}	G 30	G 30	G 32	G 31	G 30
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
$II_{2E3B/P}$ $II_{2E+3B/P}$ 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.					

The corrected test pressures are calculated using Equation 1:

$$\frac{p'_{\min}}{p_{\min}} = \frac{p'_{\max}}{p_{\max}} = \frac{p}{p_n} \qquad (1)$$

where

p_n is the normal test pressure;

p_{min} is the minimum test pressure;

p_{max} is the maximum test pressure;

p is the appliance inlet pressure;

p'_{min} is the corrected minimum test pressure;

p'_{max} is the corrected maximum test pressure.

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 7 and 8.

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

In certain circumstances the appliance manufacturer may specify a normal pressure at the appliance inlet other than that given in Tables 7 and 8. In these cases, the alternative pressure and corresponding injector(s) are used for testing the appliance and the values of p_{min} and p_{max} are determined in accordance with 7.1.3.2.4.

Table 7 — Test pressure where no pressure couple exists [a)]

Appliance category having an 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
Third family: 3B [c)]	G 30, G 31, G 32	29 [b)]	20	35

a) For test pressures corresponding to gases distributed nationally or locally, refer to Table A.4.

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

c) The tests with G 31 and G 32 are carried out at the normal pressure only (p_n = 29 mbar), these test gases being more severe than any gas of Group 3B. This condition covers the normal variations in the gas supply.

Table 8 — Test pressures where a pressure couple exists

Appliance category having an 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
Third family: 3+ (112/148 couple)	G 30	112	60	140
	G 31, G 32	148	100	180

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 F.

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 gas

The tests specified in 7.3.2, 7.3.4 and 7.3.6 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 Annex A.

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 the limit gases

These tests shall be carried out with the limit gases appropriate to the appliance category (see Table 4) and with the injector(s) and adjustment(s) 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 Test room

The appliance is installed in a well-ventilated, draught-free room which has an ambient temperature of (20 ± 5) °C. A wider temperature range is permitted provided that the test results are not affected.

7.1.6.2 Evacuation of combustion products

7.1.6.2.1 Type A_2 and Type A_3 appliances

When there is an option for fitting an appliance with a flue it shall also be tested according to the appropriate flue arrangements specified for a Type B appliance.

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

a) appliances with a vertical flue outlet shall be tested with:

   1) 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

   2) in the case of Type B_{42} and B_{43} appliances, with a vertical secondary flue as supplied or specified by the appliance manufacturer, having the minimum equivalent resistance specified in the manufacturer's instructions;

b) 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 adaption to a vertical flue. Thereafter the vertical flue shall be fitted in accordance with 7.1.6.2.2 a).

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.

7.1.6.2.3 Type B_{22}, B_{23}, B_{52} and B_{53} 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 shall be tested as follows:

a) appliances with a vertical flue outlet shall be tested with:

   1) a 1 m vertical secondary flue of the same nominal diameter of the flue outlet in the case of Type B_{22} and B_{23} appliances, or

   2) in the case of Type B_{52} and B_{53} appliances, with a vertical secondary flue as supplied or specified by the appliance manufacturer, having the minimum equivalent resistance specified in the manufacturer's instructions;

b) 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 adaption to a vertical flue. Thereafter, the vertical flue shall be fitted in accordance with 7.1.6.2.3 a).

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

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 round the appliance.

However, for the convenience of carrying out tests, the appliance may be installed at a height above the floor which is other than that specified in the manufacturer's instructions, provided that this does not affect the performance of 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 such operation 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.

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.

7.2 Construction and design

7.2.1 Manually operated devices (automatic burner control systems)

The appliance is installed as described in 7.1.6 and supplied with an appropriate reference gas (see Table 4) at the nominal heat input in accordance with 7.1.3.2.3. The start device is manually operated 10 times, once every 5 s.

7.2.2 Pre-purging

Ignite the appliance in accordance with the manufacturer's instructions, and measure the time between when the full combustion air flow is signalled and the moment when the ignition system is energized.

7.2.3 Safety time

Isolate the gas supply to the appliance. Attempt to ignite 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.

7.2.4 Extinction time

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

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. However, if the appliance is designed to use third family gases at the 112/148 mbar pressure couple, the tests are carried out at a pressure of 220 mbar. Any regulator may be locked in its maximum open position to avoid damage.

Verify compliance with 6.1.1 when:

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

b) all gas valves are open and the injectors for any ignition burner and main burner are sealed.

If the gas outlet of the ignition burner cannot be sealed, the test is carried out with the gas way 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 ignition burner when it is operating at its normal working pressure.

For the determination of the leakage rate a volumetric method is used 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 when the appliance is delivered and again, on completion of all tests given in this 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 5 times.

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

7.3.1.2.1 Correct evaluation of combustion products (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.

Possible leaks are looked for with a sampling probe connected to a CO_2 analyzer. Any instrument used shall have a sensitivity of the order 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.

7.3.1.2.2 Soundness of the combustion circuit (Type B_{23} appliances)

Assemble the appliance according to the manufacturer's instructions. Seal the flue outlet of the appliance and any air inlet. Seal the gas inlet to any pilot and the main burner. Pass air into the appliance and note the air flow rate when the pressure within the radiant tube is steady at the normal operating pressure (where the normal operating pressure is the static pressure measured at the burner).

Check that the leakage rate given in 6.1.2.2 is not exceeded.

7.3.1.2.3 Soundness of the combustion circuit (Type B_{52} and B_{53} appliances)

The appliance shall be tested in accordance with 7.3.1.2.3.1 or 7.3.1.2.3.2 as appropriate.

7.3.1.2.3.1 Type B_{52} appliances

The test is carried out using the POCED having the maximum equivalent resistance as specified in the manufacturer's instructions. Seal the inlet and outlet of the duct. Pass air into the duct and note the air flow rate when the pressure within the duct is equivalent to the maximum equivalent resistance.

Check that the leakage rate given in 6.1.2.3 is not exceeded.

7.3.1.2.3.2 Type B_{53} appliances

The test is carried out using the POCED duct having the maximum equivalent resistance as specified in the manufacturer's instructions.

Assemble the appliance according to the manufacturer's instructions. Seal the outlet of the combustion products evacuation duct and any appliance air inlets. Seal the gas inlet to any pilot and the main burner. Pass air into the appliance and note the air flow rate when the pressure within the radiant tube is steady at the normal operating pressure (where the normal pressure is the static pressure measured at the burner).

Check that the leakage rate given in 6.1.2.3 is not exceeded.

7.3.1.2.4 Soundness of the combustion circuit including the air supply and combustion products evacuation ducts together with their sealing joints (Type C_1 and C_3 appliances)

Assemble the appliance according to the manufacturer's instructions. Seal the flue outlet and the air inlet. Seal the gas inlet to any pilot and the main burner, then:

a) for Type C_{13} and C_{33} appliances, pass air into the appliance with a test pressure equal to the maximum equivalent resistance;

b) for Type C_{12} and C_{32} appliances, pass air into the appliance with a test pressure of 0,5 mbar.

Check that the leakage rate given in 6.1.2.4 is not exceeded.

7.3.2 Heat inputs

7.3.2.1 General

For the purposes of this standard all heat inputs are determined from the volumetric flow rate (V_0) or mass flow rate (M_0) 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_0) is based on the net and the gross calorific value [5)] and is given by Equation (2) or Equation (3):

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5) The heat input based on gross calorific value is related to the net value for the six reference gases as follows:

G 110: gross value = 1,14 x net value;
G 120: gross value = 1,13 x net value;
G 20: gross value = 1,11 x net value;
G 25: gross value = 1,11 x net value;
G 30: gross value = 1,08 x net value;
G 31: gross value = 1,09 x net value.

Q_0 = 0,278 $M_0 \times H_i$ (or H_s); or (2)

Q_0 = 0,278 $V_0 \times H_i$ (or H_s) (3)

where:

Q_0 is the heat input (kW);

M_0 is the mass flow rate (kg/h) obtained at reference conditions;

V_0 is the volumetric flow rate (m^3/h) obtained at reference conditions;

H_i is the net calorific value of the reference gas (MJ/kg for Equation (2) or MJ/m^3 (dry gas, 15 °C, 1 013,25 mbar)) for Equation (3);

H_s is the gross calorific value of the reference gas (MJ/kg for Equation (2) or MJ/m^3 (dry gas, 15 °C, 1 013,25 mbar)) for Equation (3).

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 (4) is used:

$$M_0 = M\sqrt{\frac{1013,25+p}{p_a+p}\times\frac{273+t_g}{288}\times\frac{d_r}{d}} \quad (4)$$

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 (5) is used:

$$V_0 = V\sqrt{\frac{1013,25+p}{1013,25}\times\frac{p_a+p}{1013,25}\times\frac{288}{273+t_g}\times\frac{d}{d_r}} \quad (5)$$

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 (6):

$$M_0 = 1{,}226\ V_0 \times d \qquad (6)$$

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 (7).

$$d_h = \frac{d\left(p_a + p - p_w\right) + 0{,}622 + p_w}{p_a + p} \qquad (7)$$

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 tests are carried out at the normal pressure (p_n) 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 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 (Q_o) obtained is compared with the nominal heat input (Q_n) in order to verify compliance with 6.2.1.

7.3.2.3 Start gas heat input

The tests are carried out at the normal pressure p_n 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 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 requirements of 6.2.2.

7.3.2.4 Effectiveness of the range-rating device

The tests are carried out as described in 7.3.2.1 for the two extreme positions of the range rating device.

7.3.3 Limiting temperatures

7.3.3.1 Wall and ceiling temperatures

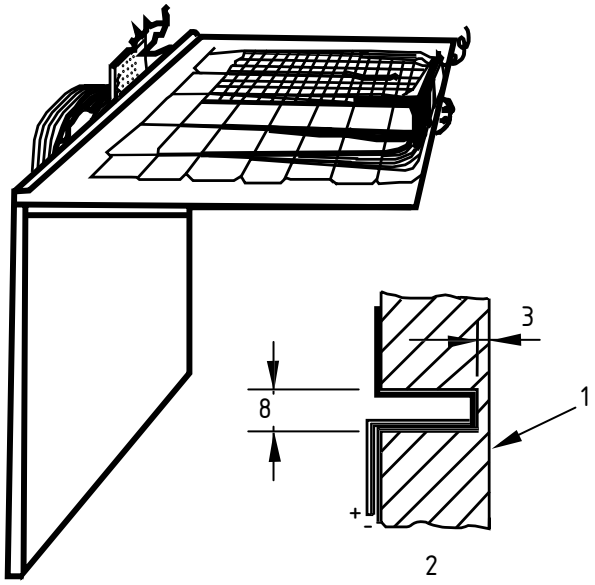
7.3.3.1.1 Apparatus

The apparatus consists of a vertical wooden wall and horizontal ceiling board. The vertical wall is at least 1 200 mm in height and at least 1 200 mm in width. The ceiling board is 1 200 mm in depth and of a similar width to that of the wall. The wall and ceiling are both 25 mm thick wood painted dull black.

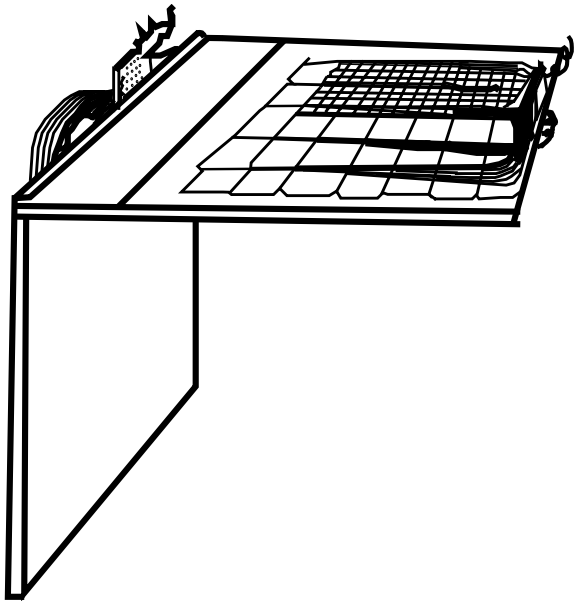
For wall mounted appliances, the ceiling board is arranged such that one edge is against the face of the wall (see Figure 2 a)).

This arrangement may not be suitable for other installations (e.g. ceiling suspension) if a large horizontal clearance is specified by the manufacturer. In this case a 25 mm thick wooden panel may be required to fill the gap between the ceiling board and the wall (see Figure 2 b)).

Thermocouples are embedded in each board at 100 mm centres. The thermocouples enter the board on the side remote from the appliance, the junctions being fixed 3 mm from the surface of the wood adjacent to the appliance.



a) Arrangement for wall mounted appliances



b) Arrangement for installations with large horizontal clearances

Key
1 Face of wall
2 Section at thermocouple

Figure 2 — Arrangement for measuring wall and ceiling temperatures

7.3.3.1.2 Procedure

a) fit the appliance to the apparatus in accordance with the manufacturer's instructions regarding clearances (see 8.2.2.1);

b) if the appliance is too long to allow the measurement of wall and ceiling temperatures for the appliance as a whole, the test is carried out with the apparatus positioned adjacent to the part(s) of the appliance producing the maximum heating effect;

c) if the manufacturer specifies a large horizontal clearance, the ceiling board shall be positioned centrally over the part(s) of the appliance producing the maximum heating effect. Any gap between the ceiling board and the wall shall be filled in as shown in Figure 1 b);

d) where the manufacturer's instructions specify alternative installation arrangements (for example wall mounting, ceiling suspension, etc.) repeat the test with the appliance fitted to the apparatus accordingly;

e) the appliance is supplied with one of the reference gases indicated in 7.1.1 according to its category and adjusted in accordance with 7.1.3.2.1;

f) the test is carried out with the appliance operating at its nominal heat input. All the 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.

7.3.3.2 Component temperatures

Component temperatures are measured when thermal equilibrium has been reached in the test described in 7.3.3.1.2 and after the appliance has been turned off at the end of the test. The temperatures are monitored immediately after the appliance has been turned off and the maximum temperatures are recorded.

The component temperatures are measured by means of attached thermocouples having thermoelectric junctions. Thermocouples shall be used in accordance with EN 60584-1:1995 with the limits of accuracy of the thermoelectric voltage used in accordance with Class 2 of EN 60584-2:1993.

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 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 (8) are met.

$$t_{measured} \leq (t_{max} + t_{ambient}) - 25\ °C \qquad (8)$$

where:

$t_{measured}$ is the maximum temperature (°C), measured in the test;

t_{max} is the maximum temperature (°C), specified by the component manufacturer;

$t_{ambient}$ is the ambient room temperature (°C).

7.3.3.3 Fan motor temperatures

The appliance is installed in accordance with 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 stated 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 input, using one of the reference gases indicated in 7.1.1 according to its category. 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.

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 (9):

$$\Delta t = \frac{R_2 - R_1}{R_1} (C + t_1) - (t_2 - t_1) \quad (9)$$

where:

Δt is the temperature rise (K);

R_1 is the resistance (ohm) at the beginning of the test;

R_2 is the maximum resistance (ohm) at the end of the test;

t_1 is the room temperature (°C) at the beginning of the test;

t_2 is the room temperature (°C) at the end of the test;

C is 234,5 °C for copper.

7.3.3.4 Combustion products evacuation duct (Type B_4, B_5, C_1 and C_3 appliances)

7.3.3.4.1 Test No. 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 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 EN 60584-1:1995 with the limits of accuracy of the thermoelectric voltage used in accordance with Class 2 of EN 60584-2:1993.

The appliance is supplied with one of the reference gases indicated in 7.1.1 according to its category and adjusted in accordance with 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 6.3.4.

7.3.3.4.2 Test No. 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 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 EN 60584-1:1995 with the limits of accuracy of the thermoelectric voltage used in accordance with Class 2 of EN 60584-2:1993.

The appliance is supplied with one of the reference gases indicated in 7.1.1 according to its category and adjusted in accordance with 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 6.3.3.4.

7.3.4 Ignition, cross-lighting and flame stability

7.3.4.1 Ignition and cross-lighting

7.3.4.1.1 Tests with all gases

These tests are carried out both with the installation cold and with the installation at thermal equilibrium.

These tests are carried out with appliance types A_2, A_3, B_{12}, B_{13}, B_{42} and B_{43} installed in accordance with 7.1.6.2.

Type B_{22}, B_{23}, B_{52} and B_{53} appliances are installed as follows:

a) An appliance intended to be fitted with a flue having a wall termination shall be connected in turn to a flue of the manufacturer's minimum and maximum equivalent resistance.

b) An appliance intended to be fitted with a vertical flue having a termination above roof level shall be connected in turn to:

   1) a flue of 1 m height and a flue of the manufacturer's maximum equivalent resistance in the case of Type B_{22} and B_{23} appliances, or

   2) in the case of Type B_{52} and B_{53} appliances, with a vertical flue of the manufacturer's minimum and maximum equivalent resistance.

The appliance is initially adjusted in accordance with 7.1.3.2.1 and the tests described in 7.3.4.1.1 c), d) and e) shall be carried out.

c) Test No. 1:

The appliance is supplied with the appropriate reference and limit gases (see Table 4) at the normal pressure given in 7.1.4.

Under these conditions it is checked that ignition of the main burner or the ignition burner (if fitted) 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.

d) Test No. 2:

For this test, the initial adjustments of the main burner and ignition burner 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 (if fitted) 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 also occurs correctly.

e) Test No. 3:

Without altering the initial adjustments of the main burner or the ignition burner, the appropriate flame lift and light-back limit gases are substituted successively for the reference gas and the pressure at the appliance inlet is reduced to the minimum pressure given in 7.1.4.

Under these conditions it is checked that ignition of the main burner or the ignition burner (if fitted) 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.

7.3.4.1.2 Ignition burner flame reduction

This test is carried out both with the installation cold and with the installation at thermal equilibrium, in accordance with 7.1.6.3.

The appliance is initially adjusted in accordance with 7.1.3.2.1 and supplied with the appropriate reference gases (see Table 4) 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 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.

The 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 is producing the flame which is to be detected by the flame detector.

7.3.4.1.3 Defective closure of the downstream main burner gas valve

This test is carried out both with the installation cold and with the installation at thermal equilibrium, in accordance with 7.1.6.3. The appliance is initially adjusted in accordance with 7.1.3.2.1 and supplied with the appropriate reference gases (see Table 4) at the nominal heat input. With the downstream automatic gas valve in the main gas line kept open. Correct ignition of the appliance is checked.

7.3.4.1.4 Delayed ignition test

This test is carried out both with the installation cold and with the installation at thermal equilibrium under still air conditions, in accordance with 7.1.6.3.

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 4) at the nominal heat input.

Ignition of the ignition burner or the main burner, if this ignited directly, is then checked. The test is carried out, progressively delaying the ignition by up to a maximum of 50 % 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 burner or ignition burner 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. For safety reasons the ignition delay should be increased in stages.

7.3.4.2 Flame stability

These tests are carried out with appliance types A_2, A_3, B_{12}, B_{13}, B_{42} and B_{43} installed in accordance with 7.1.6.2.

Type B_{22}, B_{23}, B_{52} and B_{53} appliances shall be installed as follows:

a) An appliance intended to be fitted with a flue having a wall termination shall be connected in turn to a flue of the manufacturer's minimum and maximum equivalent resistance.

b) An appliance intended to be fitted with a vertical flue having a termination above roof level shall be connected in turn to:

   1) a flue of 1 m height and a flue of the manufacturer's maximum equivalent resistance in the case of Type B_{22} and B_{23} appliances; or

   2) in the case of Type B_{52} and B_{53} appliances, with a vertical flue of the manufacturer's minimum and maximum equivalent resistance.

The appliance is initially adjusted in accordance with the requirements of 7.1.3.2.1 and the tests described in 7.3.4.2 c) and d) shall be carried out.

c) Without altering the initial main burner or ignition burner adjustment, the appropriate light-back 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.

d) 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.

7.3.4.3 Supplementary tests for Type C_1 and C_3 appliances

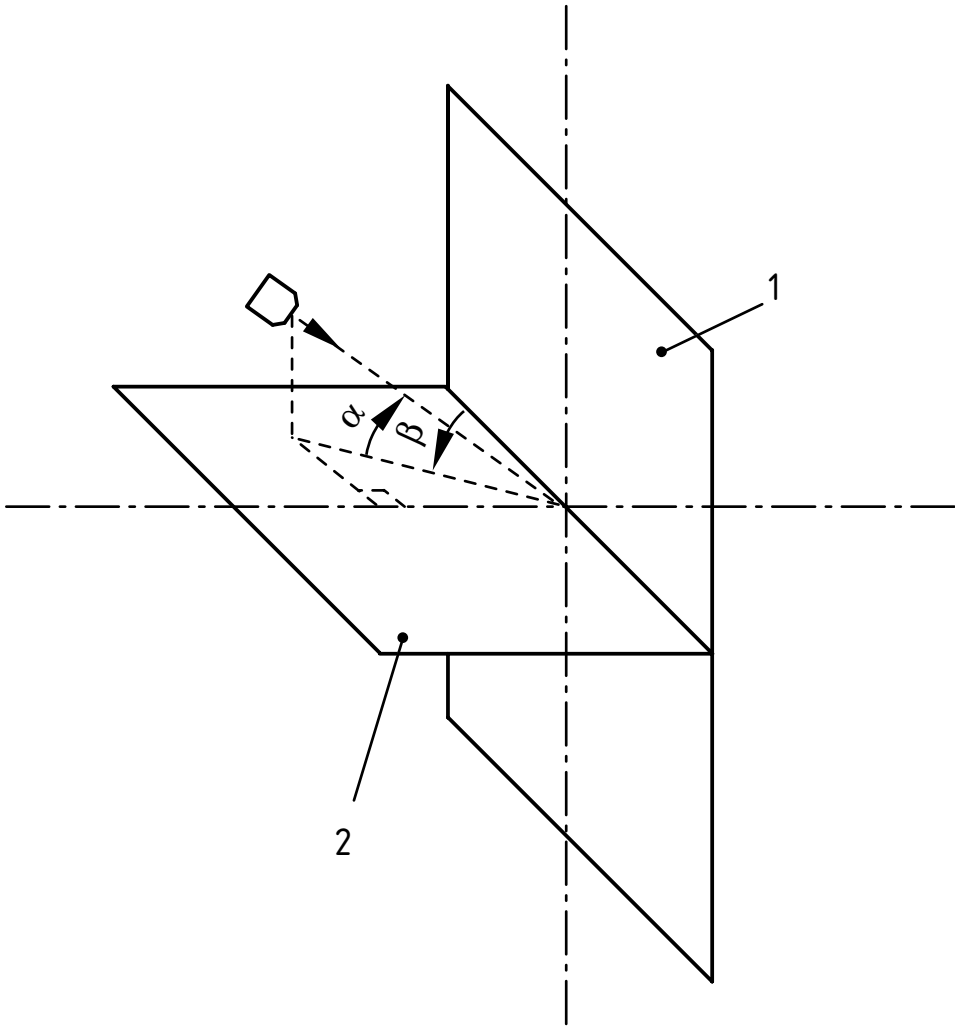
7.3.4.3.1 General

The appliance is supplied with one of the reference gases for its category at the nominal heat input and the minimum heat input given by the controls, if such operation is intended by the manufacturer.

The tests are carried out with the shortest and longest air supply and combustion products evacuation ducts, or with corresponding pressure losses, unless otherwise stated.

7.3.4.3.2 Type C_1 and C_3 appliances

The appliance is installed in accordance with the information in the technical instructions, with accessories supplied by the manufacturer, on the applicable test apparatus shown in Figure 3 for Type C_1 appliances and Figures 4 or 5 for Type C_3 appliances.



Key
1 Vertical
2 Horizontal

α = 0° (horizontal winds), + 30° and - 30°. β = 0° (glancing winds), 15°, 30°, 45°, 60°, 75°, 90° (perpendicular to the wall). For appliances fitted with a non-symmetrical terminal, the examination is continued for the following values: 105°, 120°, 135°, 150°, 165°, 180°.

Angle β may be 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 of at least 1,8 m x 1,8 m, with a removable panel at its centre. The device for supplying combustion air and discharging combustion products is mounted so that its geometric centre is at the centre 0 of the test wall, and its projection from the wall is as recommended by the manufacturer.

The characteristics of the wind generator and its distance from the test wall at which it is placed are chosen such that at the level of the test wall, after the central panel has been removed:

a) the wind front is either approximately 90 cm square or of circular section with a diameter of 60 cm;

b) wind speeds of 1 m/s, 2,5 m/s and 12,5 m/s with an accuracy of 10 % can be obtained;

c) the wind stream is essentially parallel and has no residual rotational movement. If the central removable panel is not large enough to allow checking of these criteria, they are checked without the wall and measured at a distance corresponding to the distance existing in practice between the test wall and the wind generator discharge nozzle.

Figure 3 — Test rig for Type C appliances fitted with a horizontal terminal installed on a vertical wall

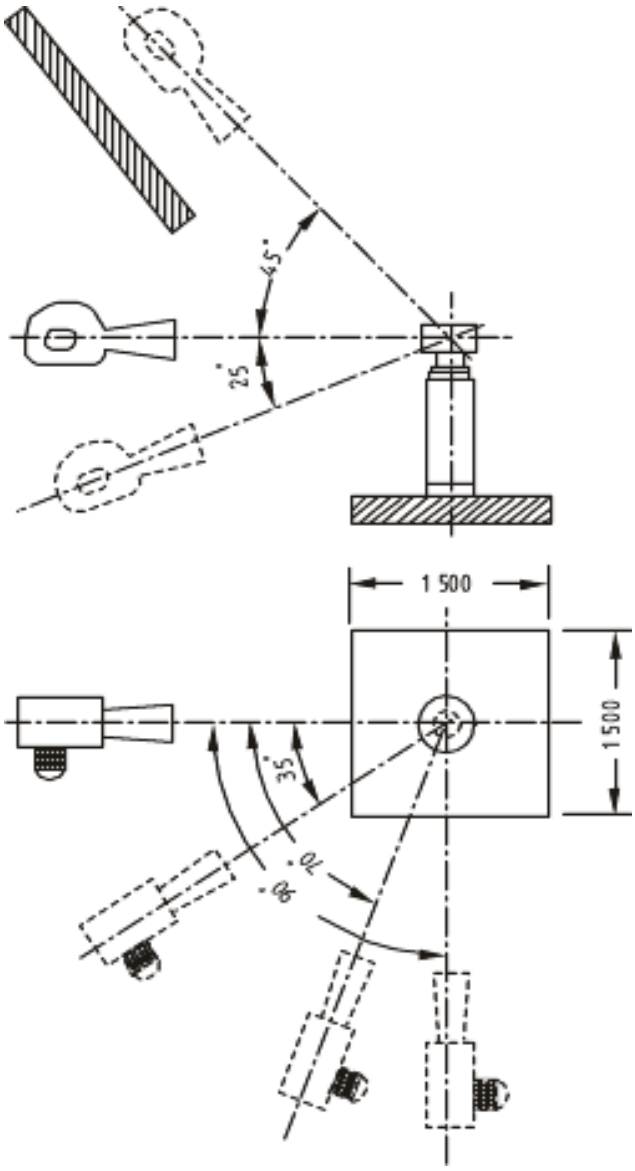


Figure 4 — Test rig for Type C appliances fitted with a vertical terminal on a flat roof

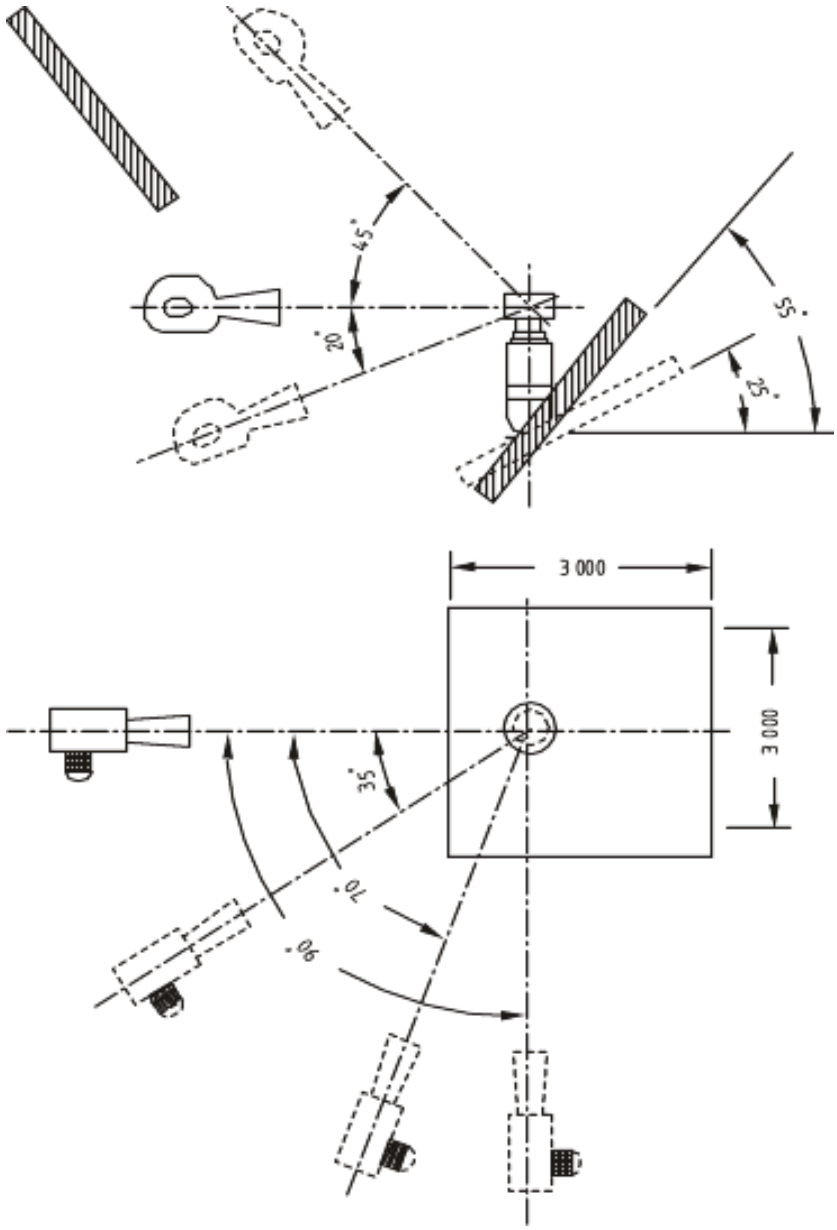


Figure 5 — Test rig for Type C appliances fitted with a vertical terminal on a roof

The tests shown in 7.3.4.3.2 a), b) and c) shall then be carried out.

a) First test series:

The terminal is subjected successively to winds of three different speeds (1 m/s, 2,5 m/s and 12,5 m/s) and with directions in three planes as given in Figures 3 to 5 depending on the appliance type and the situation.

For each of the three planes of incidence:

1) the three combinations of wind speed and angle of incidence are found giving the lowest CO_2 concentration (for evaluating 6.4.3);

2) the three combinations for which the highest CO concentration are measured, in the dry air-free combustion products (for evaluating 6.6.2.3).

b) Second test series:

The appliance is at thermal equilibrium.

For each of the nine combinations that produce the lowest CO_2 concentration, noted in the first test series, it is checked that the requirements of 6.4.3 are met.

c) Third test series:

If the manufacturer makes provision for a terminal guard, this is fitted in accordance with the instructions, and the nine tests in the first series that gave the highest CO concentrations in the dry air-free combustion products are repeated.

7.3.5 Pressure regulator

If the appliance has an adjustable regulator, this is adjusted if necessary to give the nominal heat input with reference gas at the normal pressure given in 7.1.4. Keeping the initial adjustment, the appliance inlet 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.

7.3.6 Combustion

7.3.6.1 General

These tests are carried out with appliance types A_2, A_3, B_{12}, B_{13}, B_{42} and B_{43} installed in accordance with 7.1.6.2.

Type B_{22}, B_{23}, B_{52} and B_{53} appliances are installed as follows:

a) an appliance intended to be fitted with a flue having a wall termination shall be connected in turn to a flue of the manufacturer's minimum and maximum equivalent resistance;

b) an appliance intended to be fitted with a vertical flue having a termination above roof level shall be connected in turn to:

   1) a flue of 1 m height and a flue of the manufacturer's maximum equivalent resistance in the case of Type B_{22} and B_{23} appliances; or

   2) in the case of Type B_{52} and B_{53} appliances, with a vertical flue of the manufacturer's minimum and maximum equivalent resistance.

The appliance is initially adjusted to the nominal heat input in accordance with 7.1.3.2.

The products of combustion are collected in such a manner as to ensure a representative sample without affecting the performance and the carbon monoxide and carbon dioxide concentrations shall be determined.

The carbon monoxide, CO, concentration is measured by an instrument capable of determining carbon monoxide concentrations between 5×10^{-5} and 100×10^{-5} parts by volume.

The carbon monoxide, CO, and carbon dioxide, CO_2, concentrations are measured by a method accurate to within $\pm$ 6 %.

For all tests the sample is taken when the appliance has reached thermal equilibrium whilst operating under the specified conditions.

The carbon monoxide concentration of the dry, air-free products of combustion (neutral combustion) is given by Equation (10).

$$V_{CO,N} = V_{CO_2,N} \times \frac{V_{CO,M}}{V_{CO_2,M}} \quad (10)$$

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 9.

Table 9 — $V_{CO_2,N}$ 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 (11).

$$V_{CO,N} = \frac{21}{21 - V_{O_2,M}} \times V_{CO,M} \quad (11)$$

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.

7.3.6.2 All appliances (still air conditions)

With the appliance installed and the combustion measured as described in 7.3.6.1, the tests described in 7.3.6.2 a), b), c), d) and e) shall be carried out in still air conditions.

a) Test No. 1:

Without altering the initial burner adjustment given in 7.1.3.2 the appliance shall be supplied with the appropriate reference gases (see Table 4) according to its category and the pressure at the appliance inlet increased to the maximum pressure given in 7.1.4.

b) Test No. 2:

Without altering the initial burner adjustment given in 7.1.3.2, the appliance shall be supplied with the appropriate reference gases (see Table 4) 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 No. 3:

Without altering the initial burner adjustment given in 7.1.3.2, 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.

Where necessary, the appropriate sooting limit gases are substituted successively for the incomplete combustion limit gases and the appliance is operated for 3 cycles of 30 min on and 30 min off. Following the test, the appliance is inspected for soot deposition within the radiant tube.

d) Test No. 4:

Without altering the initial burner adjustment given in 7.1.3.2, the appliance shall be supplied with the appropriate reference gases (see Table 4) 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 No. 5:

Without altering the initial burner adjustment given in 7.1.3.2, the appliance shall be supplied with the appropriate reference gases (see Table 4) according to its category and operated at the nominal heat input.

For the purposes of this test the appliance fan only shall be supplied with electricity by means of a suitable device which permits variations 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. Sample the products of combustion until the moment the gas supply is shut off.

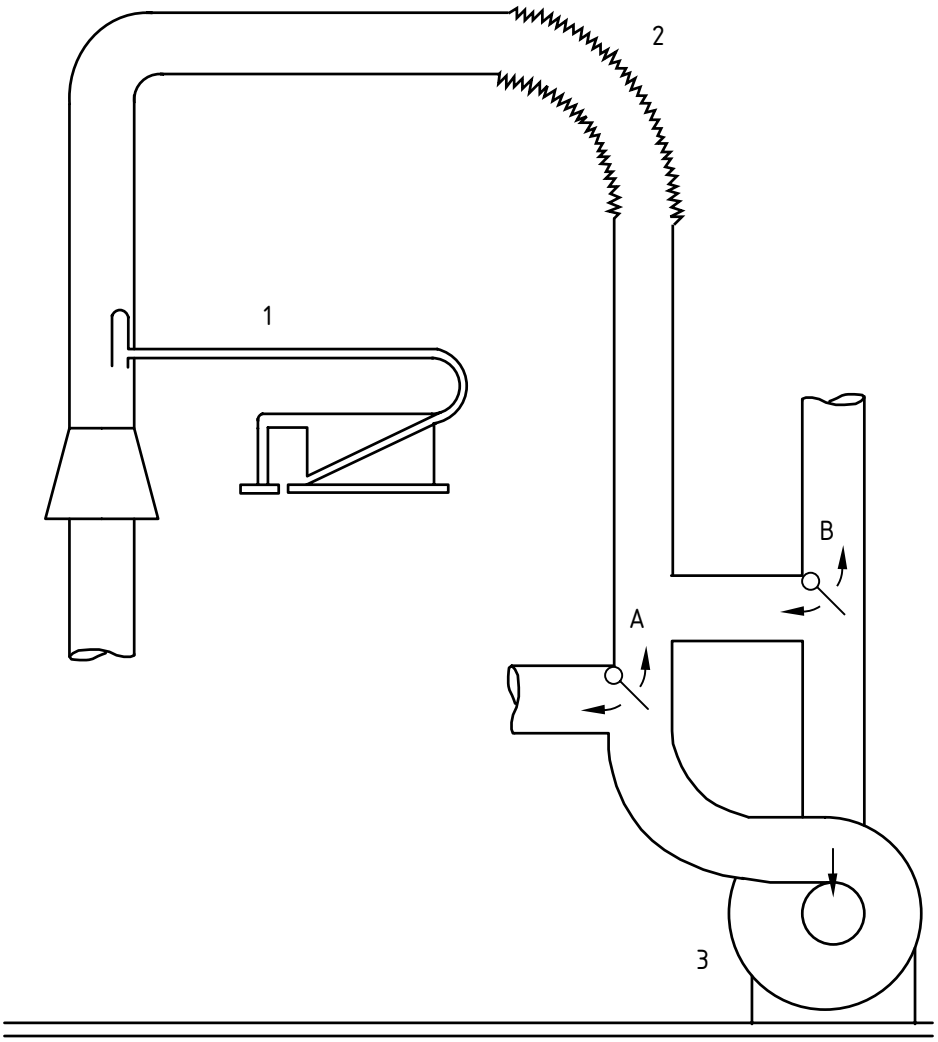
7.3.6.3 Supplementary tests under special conditions

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

Without altering the initial burner adjustment given in 7.1.3.2, the appliance is supplied with the appropriate reference gases (see Table 4) according to its category and operated at the nominal heat input.

The test described in 7.3.6.2 a) is carried out with the flue blocked.

The test described in 7.3.6.2 b) is carried out by applying a continuous down-draught of 3 m/s and 1 m/s within the test flue using a suitable down-draught apparatus (see Figure 6).



Key

1	Velocity measurement by means of pitot tube
2	Flexible pipe
3	Fan
A and B	Diverter values to obtain either downdraught or updraught

Figure 6 — Test of an appliance under abnormal draught conditions

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

Without altering the initial adjustment given in 7.1.3.2, the appliance is supplied with the appropriate reference gases (see Table 4) according to its category and operated at the nominal heat input and then:

a) An appliance intended to be used with a flue having a wall termination shall be tested:

   1) with the appliance connected to a flue of the manufacturer's maximum equivalent resistance that is progressively restricted at its outlet until the gas is shut off by the air flow failure control;

   2) 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.

b) An appliance intended to be used with a vertical flue having a termination above roof level shall be tested:

1) with the appliance connected to a flue of the manufacturer's maximum equivalent resistance that is progressively restricted at its outlet until the gas is shut off by the air flow failure control;

2) 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.

7.3.6.3.3 Type C_1 and C_3 appliances

The test is carried out as stated in 7.3.4.3.2 a) and if appropriate 7.3.4.3.2 c).

For each of the tests, the value of the arithmetic mean of the CO concentrations determined at the nine combinations of wind speed and angle of incidence that produce the highest CO concentration in the combustion products shall be calculated.

The requirements of 6.6.2.3 shall be met.

7.3.7 Prolonged performance

The test shall be carried out after all other tests in 7.3 have been performed.

The appliance shall be installed in accordance with 7.1.6.3 and initially adjusted as described in 7.1.3.2.1.

The test shall be carried out with the appliance supplied with one of the appropriate reference gases (see Table 4) according to its category. The pressure at the appliance inlet is then increased to the maximum pressure given in 7.1.4.

The appliance is operated continuously for 20 h under these adjustment conditions.

7.4 Other pollutants

7.4.1 General

The appliance shall be installed as specified in 7.1.6 and connected to a flue as described in 7.1.6.2.

For appliances intended to use second family gases, the tests are carried out using test gas G 20, if the appliance category is such that this test gas is used as a reference gas. If G 20 is not used as a reference gas, the tests are carried out using G 25 exclusively.

For appliances intended to use all gases of the third family, the tests are carried out with reference gas G 30 and the maximum NO_x concentration (see Table 9) is multiplied by a factor of 1,30.

For appliances intended to use propane only, the tests are carried out with reference gas G 31 and the maximum NO_x concentration is multiplied by a factor of 1,20.

The appliance is adjusted to its nominal heat input.

The NO_x measurements are carried out when the appliance is at thermal equilibrium, conforming to details given in CR 1404:1994.

No wet meters are used.

The reference conditions for the combustion air are:

a) temperature: 20 °C;

b) relative humidity H_o: 10 g (H_2O)/kg(air).

If the test conditions are different to these reference conditions, it is necessary to correct the NO_x values using Equation (12).

$$NO_{x,reference} = NO_{x,m} + \frac{0,02\ NO_{x,m} - 0,34}{1 - 0,02\ (h_m - 10)}(h_m - 10) + 0,85(20 - T_m) \quad (12)$$

where:

$NO_{x,reference}$ is the value of NO_x corrected to the reference conditions (mg/kWh);

$NO_{x,m}$ is the NO_x measured at h_m and T_m (mg/kWh) in the range 50 mg/kWh to 300 mg/kWh;

NOTE Where NO_x is measured in ppm, convert it to mg/kWh in accordance with Annex H.

h_m is the humidity during the measurement of $NO_{x,m}$ (g/kg) in the range 5 g/kg to 15 g/kg;

T_m is the ambient temperature (°C) during the measurement of $NO_{x,m}$ in the range 15 °C to 25 °C.

The measured NO_x values are weighted in accordance with 7.4.2.

It is checked that the weighted NO_x values comply with the values of Table 9, depending on the NO_x class chosen.

7.4.2 Weighting

7.4.2.1 General

The weighting of the NO_x measured values shall be calculated as described in 7.4.2.2 to 7.4.2.5, on the basis of the values in Table 10.

Table 10 — Weighting factors

Partial heat input $Q_{pi,\%}$ as % of Q_n	**Weighting factor** F_{pi}
70	0,15
60	0,25
40	0,30
20	0,30

For range rated appliances Q_n is replaced by Q_a, the arithmetic mean of the maximum and the minimum heat input of the range, as stated by the manufacturer.

7.4.2.2 On/off appliances

The NO_x concentration is measured (and possibly corrected as specified in 7.4.1) at the nominal heat input, Q_n.

7.4.2.3 Appliances with several rates

The NO_x concentration is measured (and possibly corrected as specified in 7.4.1) at the partial heat input corresponding to each of the rates and weighted in accordance with Table 10.

If necessary, the weighting factor specified in Table 10 is recalculated for each rate as specified below.

If the heat inputs of two rates are between the partial heat inputs specified in Table 10, it is necessary to apportion the weighting factor between the heat inputs of the higher rate using Equation (13):

$$F_{\text{p,high rate}} = F_{\text{pi}} \times \frac{Q_{\text{pi,\%}} - Q_{\text{low rate,\%}}}{Q_{\text{high rate,\%}} - Q_{\text{low rate,\%}}} \times \frac{Q_{\text{high rate,\%}}}{\text{Q}_{\text{pi,\%}}} \quad (13)$$

where:

$F_{\text{p,high rate}}$ is the apportioned weighting factor, high rate;

F_{pi} is the weighting factor corresponding to the partial heat input $Q_{\text{pi,\%}}$;

$Q_{\text{pi,\%}}$ is the partial heat input for weighting, expressed in percent of Q_{n};

$Q_{\text{low rate,\%}}$ is the heat input rate less than $Q_{\text{pi,\%}}$;

$Q_{\text{high rate,\%}}$ is the heat input rate greater than $Q_{\text{pi,\%}}$;

and the lower rate using Equation (14).

$$F_{\text{p,low rate}} = F_{\text{pi}} - F_{\text{p,high rate}} \quad (14)$$

where:

F_{pi} is the weighting factor corresponding to the partial heat input $Q_{\text{pi,\%}}$;

$F_{\text{p,low rate}}$ is the apportioned weighting factor, low rate;

$F_{\text{p,high rate}}$ is the apportioned weighting factor, high rate.

If the heat inputs of two rates cover more than one partial heat input specified in Table 10, then it is necessary to apportion each weighting factor between the heat inputs of the higher and lower rate as indicated above.

The weighted NO_x value ($NO_{x,pond}$) is then equal to the sum of the products of the measured NO_x values at the different rates, multiplied by their weighting factor as given by Equation (15).

$$\text{NO}_{\text{x,pond}} = \sum \left(\text{NO}_{\text{x,mes high}} \times F_{\text{p,high rate}} \right) \quad (15)$$

where:

$\text{NO}_{\text{x,pond}}$ is the weighted NO_X value (mg/kWh);

$\text{NO}_{\text{x,mes high}}$ is the measured (and possibly corrected) NO_X value (mg/kWh), high rate;

$F_{\text{p,high rate}}$ is the apportioned weighting factor, high rate.

(See calculation example in Annex G and NO_X conversion calculations in Annex H.)

7.4.2.4 Modulating appliances in which the minimum modulating heat input is no greater than 0,20 Q_n

The NO_x concentration is measured (and possibly corrected as specified in 7.4.1) at the partial heat inputs specified in Table10.

The weighted NO_x value ($NO_{x,pond}$) is determined using Equation (16).

$$NO_{x,pond} = 0{,}15 \times NO_{x,mes(70)} + 0{,}25 \times NO_{x,mes(60)} + 0{,}3 \times NO_{x,mes(40)} + 0{,}3 \times NO_{x,mes(20)} \quad (16)$$

where:

$NO_{x,pond}$ is the weighted NO_X value (mg/kWh);

$NO_{x,mes(70)}$ is the measured (and possibly corrected) NO_X value (mg/kWh), 70 % heat input;

$NO_{x,mes(60)}$ is the measured (and possibly corrected) NO_X value (mg/kWh), 60 % heat input;

$NO_{x,mes(40)}$ is the measured (and possibly corrected) NO_X value (mg/kWh), 40 % heat input;

$NO_{x,mes(20)}$ is the measured (and possibly corrected) NO_X value (mg/kWh), 20 % heat input.

7.4.2.5 Modulating appliances in which the minimum modulating heat input is greater than 0,20 Q_n

The NO_x concentration is measured (and possibly corrected as specified in 7.4.1) at the minimum modulating rate and at the partial heat inputs $Q_{pi,\%}$, specified in Table 10, which are greater than the minimum modulation rate.

The weighting factors for the partial heat inputs in Table 10, which are no greater than the minimum modulation rate are added and multiplied by $NO_{x,mes,Qmin}$.

The weighted NO_x value, $NO_{x,pond}$, is determined using Equation (17).

$$NO_{x,pond} = NO_{x,mes,Qmin} \sum F_{pi}\left(Q_{pi\%} \le Q_{min\%}\right) + \sum \left(NO_{x,mes} \times F_{pi}\left[Q_{pi\%} > Q_{min\%}\right]\right) \quad (17)$$

where:

$NO_{x,pond}$ is the weighted NO_X value (mg/kWh);

$NO_{x,mes}$ is the measured (and possibly corrected) NO_X value (mg/kWh) at the partial heat input(s), $Q_{pi,\%}$, greater than the minimum modulating rate, $Q_{min\%}$;

$NO_{x,mes,Qmin}$ is the measured (and possibly corrected) NO_X value (mg/kWh) at the minimum heat input (modulating appliances);

$Q_{min\%}$ is the minimum modulating rate, expressed as a percentage of Q_n;

F_{pi} is the weighting factor corresponding to the partial heat input $Q_{pi,\%}$.

8 Marking and instructions

8.1 Marking of the appliance and the packaging

8.1.1 Data plate

The appliance burner housing 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 give at least the following information in indelible characters:

a) the manufacturer's [6] name or identification symbol;

NOTE The PIN-number is acceptable as identification symbol of the manufacturer.

b) the nominal heat input and, where necessary, the range of input for an appliance with an adjustable input, expressed in kW, stating whether it is based on net or gross calorific value;

c) the trade name of the appliance;

d) the serial number;

e) the commercial identification symbol of the appliance;

f) the type of gas in relation to the pressure and/or the pressure couple, for which the appliance has been adjusted; and pressure indication 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;

g) the direct country or countries of destination of the appliance;

h) the appliance category or categories. If more than one appliance category is specified, each of these categories shall be identified in relation to the appropriate direct country or countries of destination;

i) the setting pressure for regulated appliances;

j) the nature and voltage of the current used and the maximum electrical power used, in volts, amperes, frequency and kilowatts for all intended electrical supply conditions;

k) the NO_x class of the appliance;

l) the appliance flue type (see 4.3 and Annex B).

No other information shall be included on the appliance burner housing 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 input value for which it has been adjusted on commissioning.

The indelibility of the marking shall be checked by a test carried out in accordance with 7.14 of EN 60335-1:2002.

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[6] “Manufacturer” means the organization or company which assumes responsibility for the product.

8.1.2 Other marking

The appliance burner housing shall be marked:

> "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."

The manufacturer shall also provide a suitable plate or durable label for attachment on, or adjacent to, a low level user control. This plate or label shall be indelibly marked with the instructions for the safe operation of the appliance including its lighting and shut-down procedures.

Permanent warning notices shall be provided in a readily visible position on the appliance requiring the appliance to be switched off and the gas isolated before carrying out any service operation.

8.1.3 Marking of the packaging containing the burner

The packaging shall carry at least the following information:

a) the type of gas, in relation to the pressure and/or the pressure couple, for which the appliance has been adjusted; any pressure indication 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) the direct country or countries of destination of the appliance;

c) the appliance category or categories. If more than one appliance category is specified, each of these categories shall be identified in relation to the appropriate direct country or countries of destination.

In addition, it shall be marked with the following text:

> "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.

8.1.4 Utilization of symbols on the appliance and packaging

8.1.4.1 Electrical supply

The marking concerning electrical values shall be in conformity with EN 60335-1:2002.

8.1.4.2 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 Table 11.

Table 11 — Gas type symbol

Gas type symbol		Corresponding category index
First family [a]	G 110	1a
	G 120	1b
	G 130	1c
	G 150	1e
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.

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 E.

8.1.4.3 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.

8.1.4.4 Country of destination

In accordance with EN ISO 3166-1:2006, the names of countries shall be represented by the codes shown in Table 12.

Table 12 – Country codes

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	MT	Malta
DK	Denmark	NL	Netherlands
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

8.1.4.5 Category

The category can be expressed uniquely by its designation in accordance with EN 437:1993+A2:1999. Nevertheless, if it is necessary to explain it, the term "category" shall be symbolized by "cat".

8.1.4.6 Other information

The symbols for nominal heat input of a burner Q_n and nominal heat input of all appliance burners ΣQ_n 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.

8.2 Instructions

8.2.1 General

They shall be written in the official language(s) of the country or countries of destination stated on the appliance 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 8.1.4.4.

Instructions for countries other than those stated on the appliance may be supplied with the appliance, on condition that each set of instructions includes an initial statement saying:

"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."

8.2.2 Technical instructions

8.2.2.1 Technical instructions for installation and adjustment

In addition to the information given in 8.1.1, 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 necessary for safe and correct use in the countries concerned.

The technical instructions for installation and adjustment, intended for the installer, shall be supplied with the appliance. The instructions shall be clear and simple and the terms shall be those in common usage. Wherever necessary, diagrams and/or photographs shall augment the text.

The technical instructions shall include a statement saying:

"Before installation, check that the local distribution conditions, nature of gas and pressure, and adjustment of the appliance are compatible."

The instructions shall refer to:

a) the method of flue connection and the installation regulations in the country where the appliance is to be installed (if such regulations exist). The flue dimensions shall be given for the purposes of installation in those countries where there are no appropriate regulations;

b) the construction of the flue;

c) the method of assembly;

d) the use and siting of thermostats and other controls;

e) the siting of the appliance, including the minimum clearances around the appliance and where applicable its combustion products evacuation duct (Type B_4, B_5, C_1 and C_3 appliances), any insulation or sleeve required, and the minimum fixing height above the floor which shall be in accordance with National Installation Regulations;

f) the method of installing any integral combustion products evacuation duct (Type B_4, B_5, C_1 and C_3 appliances), 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;

g) fluing, including its maximum equivalent resistance and, if the appliance is suitable for wall termination, or is Type B_4 or Type B_5, its minimum equivalent resistance [8];

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7) Indirect country of destination.

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.

h) the heat loss via the flue, if required (see Annex K);

i) the combustion and ventilation air requirements;

j) the gas and electricity supply and connections;

k) the procedure to be followed for commissioning the appliance.

In particular, the manufacturer shall in the case of appliances intended for flueless application state the ventilation requirements necessary to comply with the installation regulations in the country where the appliance is to be installed. For such applications the ventilation must be in accordance with the requirements of EN 13410.

In addition, the installation instructions shall include a complete wiring diagram and a technical data table. The technical data table shall include:

l) the appliance heat input;

m) the rating of any ignition burner;

n) burner pressure, and for an appliance with an adjustable regulator, the setting pressure as measured upstream of the burner but downstream of any adjuster, in relation to the nature of the gas used;

o) identification of the injector;

p) number of injectors;

q) gas connection size;

r) flue size;

s) physical dimensions of the appliance;

t) weight of the appliance;

u) electric motor details;

v) fan ratings;

w) any other technical data as may be required by the installer and commissioning engineer.

The installation instructions shall state that an isolation valve, or valves, has to be fitted immediately adjacent to the appliance which, when closed, allow(s) the complete burner and control assembly to be disconnected for maintenance or repair.

In addition, for an appliance with a draught diverter, the instructions shall specify the method of checking for spillage of products of combustion from the draught diverter.

8.2.2.2 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 draw attention to the necessity for recommissioning the appliance after servicing.

They shall deal with the assembly of parts which are likely to be replaced, and with the greasing taps, the electric motor and the fan, and with cleaning.

8.2.2.3 Conversion instructions

The manufacturer's conversion instructions are to be sent, on request, to all qualified installers. They may form part of the installation instructions.

The parts required for conversion to another type of gas or another pressure shall be supplied with clear and adequate instructions regarding the change of parts, and the cleaning, adjustment and checking of the appliance.

In addition, a self-adhesive label shall be supplied to be placed on the appliance, indicating the nature and pressure of the gas for which it has been adjusted and also, where appropriate, the heat input set during commissioning.

8.2.3 Instructions for use and maintenance

Instructions for use and maintenance shall be supplied with every appliance.

These instructions, which are intended for the user, shall provide all the necessary information for the safe and sensible use of the appliance.

The instructions shall be clear and simple and the terms shall be acceptable in common usage. Wherever necessary, diagrams and/or photographs shall augment the text. The instructions shall contain notes on the care and safe operation of the appliance including its lighting and shut-down procedures.

They shall also stress that a qualified installer is required to install the appliance, and, if the need arises, to convert it for use with other gases. They shall state the recommended frequency of periodic servicing and draw particular attention to the need for periodic sweeping of the flue of Type B appliances, according to the regulations in the country where the appliance is to be installed. Finally, they shall deal briefly with the installation regulations (connection, ventilation) in the country where the appliance is to be installed.

8.3 Presentation

All the information specified in 8.1.1, 8.1.2, 8.1.3, 8.1.4, 8.2.1, 8.2.2 and 8.2.3 shall be given in the language(s) of the country in which the appliance is to be installed. Calorific values shall be net or gross according to the custom of that country.

9 Evaluation of conformity of POCEDs and their associated terminals

9.1 General

The compliance of a POCED and its associated terminal with the requirements of this standard shall be demonstrated by:

a) initial type testing;

b) factory production control by the manufacturer, including product assessment.

NOTE Requirements are given in Annex ZB.1 and Annex ZB.2.

9.2 Type testing

9.2.1 Initial type testing

Initial type testing shall be performed to show conformity to the requirements of this standard. Tests previously performed in accordance with the provisions of this standard (same product, same characteristic(s), test method, sampling procedure, system of attestation of conformity, etc.) 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 (for 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.

NOTE Requirements are given in the relevant tables ZB.1 or ZB.2.

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 of this standard, 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 9001:2000, 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 system performance (e.g. control 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.

The manufacturer shall 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 J.

9.3.5 Non-conforming products

The manufacturer shall establish procedures for dealing with non-conforming products.

Annex A
(informative)

National situations

NOTE This Annex does not apply to POCEDs (chimneys).

A.1 General

In each country in which this standard applies, appliances can only be installed if the category corresponds to the national situations of that country. Categories corresponding to the national situations in the EU countries are listed in tables A.1 and A.2.

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.

Table A.1 — Category I (single) categories marketed

Country	I_{2H}	I_{2L}	I_{2E}	I_{2E+}	I_{2N}	I_{2R}	$I_{3B/P}$	I_{3+}	I_{3P}	I_{3B}	I_{3R}
AT	X						X				
BE				X				X	X		
BG											
CH	X						X	X	X		
CY [a]											
CZ	X						X		X		
DE			X				X		X		
DK	X						X				
EE [a]											
ES	X							X	X		
FI	X						X				
FR				X				X	X		
GB	X							X	X		
GR	X							X	X		
HU	X						X		X	X	
IE	X							X	X		
IS											
IT	X							X			
LT [a]											
LU			X								
LV [a]											
MT [a]											
NL	X [b]	X					X		X		
NO							X				
PL [a]											
PT	X							X	X		
RO											
SE	X						X				
SI	X				X	X	X	X	X		X
SK [a]											

[a)] Information on categories to be supplied by new CEN member.
[b)] 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) (Netherlands to clarify if applicable here).

Table A.2 — Category II (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}
AT		X										
BE												
BG												
CH		X	X	X								
CY [a]												
CZ		X		X								
DE								X				
DK	X	X										
EE [a]												
ES			X [b]	X								
FI		X										
FR										X	X	
GB			X	X								
GR		X	X	X								
HU		X		X	X							
IE			X	X								
IS												
IT	X		X									
LT [a]												
LU												
LV [a]												
MT [a]												
NL						X	X					
NO												
PL [a]												
PT			X	X								
RO												
SE	X	X										
SI		X	X	X								X
SK [a]												

[a] Information on categories to be supplied by new CEN member.
[b] 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.

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.

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	X	X
BG												
CH		X					X			X	X	
CY[a)]												
CZ		X [b)]					X [c)]	X	X	X [d)]		
DE		X	X			x	X			X		
DK	X	X						X				
EE [a)]												
ES		X				x			X	x	X	
FI		X				X		X				
FR					X	x	x		x	x	X	
GB		X [e)]				X			X	x	X	
GR		X				X		X	X	X	x	
HU		X [f)]				x	x	x		x		
IE		X				x			X		X	
IS												
IT	X	X									X	
LT [a)]												
LU		x										
LV [a)]												
MT [a)]												
NL				X				X		X		
NO						X		X				
PL [a)]												
PT		X				X			X		X	
RO												
SE	X	X				X		X				
SI		X				X			X		X	
SK [a)]												

[a)] Information on supply pressures to be supplied by new CEN member.
[b)] Currently 18 mbar.
[c)] For certain types of industrial appliances (CZ to clarify).
[d)] For certain types of appliances (CZ to clarify).
[e)] Normal supply pressure for this appliance: 17,5 mbar.
[f)] 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.

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, G30	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 G31	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, G32	HU[a]
II_{2S3B}	G 25.1, G30	G 26.1, G30	G 32	G 27.1, G31	G 26.1, G 30	HU[a]
$II_{2HS3B/P}$	G 20, G 25.1 G 30	G 21, G26.1, G 30	G 222 G 32	G 23, G27.1, 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

Table A.4 (concluded)

Category	Reference gas	Incomplete combustion limit gas	Light back limit gas	Lift limit gas	Sooting limit gas	Country
$III_{1c2E+3+}$	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.

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

Category II_{1c2H}: appliances capable of using gases of Group C linked to the first family and gases of Group H of the second 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_{2H}.

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 $III_{1c2H3B/P}$: appliances capable of using gases of Group C linked to 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_{1c}. 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_{1c2H3+}: appliances capable of using gases of Group C linked to 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_{1c}. 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 III_{1c2H3P}: appliances capable of using gases of Group C linked to 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_{1c}. 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 $III_{1c2E+3+}$: 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 %	WI MJ/m3	HI MJ/m3	Ws MJ/m3	Hs 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	0,413	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	0,367		
	Group C	Reference (Propane–air)	G 130	C_3H_8 = 26,9 Air = 73,1 [a]	22,14	23,66	24,07	25,72	1,142	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[a] = 72,4	22,10	23,56	23,84	25,41	1,136		
Gases inked to the second family	Group LL	Reference	G 25[2]	CH_4 = 86 N_2 = 14	37,38	29,25	41,52	32,49	0,612	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	0,678		
		Flame lift	G 271	CH_4 = 74 N_2 = 26	30,94	25,17	34,36	27,96	0,662		
	Group S	Reference	G 25.1	CH_4 = 86 CO_2 = 14	35,25	29,30	39,11	32,51	0,691	p_n = 25 p_{min} = 20 p_{max} = 33 0r 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	0,751		
		Lift limit	G 27.1	CH_4 = 82 CO_2 = 18	32,70	27,94	36,29	31,00	0,730		
Gases of the second family	Range Es of Group E	Reference	G 20[b]	CH_4 = 100	45,67	34,02	50,72	37,78	0,555	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	0,684		
		Light back	G 222	CH_4 = 77 H_2 = 23	42,87	28,53	47,87	31,86	0,443		
		Lift limit	G 26	CH_4 = 80 C_3H_8 = 7 N_2 = 13	40,52	33,36	44,83	36,91	0,678		
	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	0,612	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	0,678		
		Lift limit	G 231	CH_4 = 85 N_2 = 15	36,82	28,91	40,90	32,11	0,617		

[a] Composition of the air (%): 0_2 = 20,95; N_2 = 79,05.
[b] 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 :2004 and EN 10226-2 : 2005	EN ISO 228-1: 2003		EN 10226-1 :2004 and EN 10226-2 : 2005	EN ISO 228-1: 2003	
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	—	—
LU	—	—	—	—	—	—
LV	—	—	—	—	—	—
MT	—	—	—	—	—	—

NL	**Yes**	**—**	**—**	**Yes**	**—**	**—**
NO	**Yes**	**Yes**	**Yes**	**—**	**—**	**—**
PL	**—**	**—**	**—**	**—**	**—**	**—**
PT	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
RO	**—**	**—**	**—**	**—**	**—**	**—**
SE	**—**	**—**	**—**	**—**	**—**	**—**
SI	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
SK	**Yes**	**Yes**	**—**	**Yes**	**Yes**	**—**

A.7 Flue connections in the various countries

Table A.7 shows the national situations concerning the diameters of standard flue pipes.

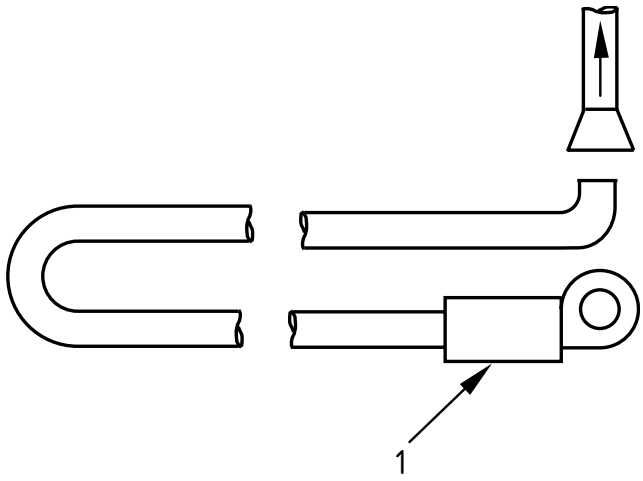
Table A.7 — Standard flue pipe diameters

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						
HU																	
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
SE																	
SI	**60**	**70**	**80**	**90**	**100**	**110**	**120**	**130**	**140**	**150**	**160**	**180**	**200**				
SK																	

Annex B
(normative)

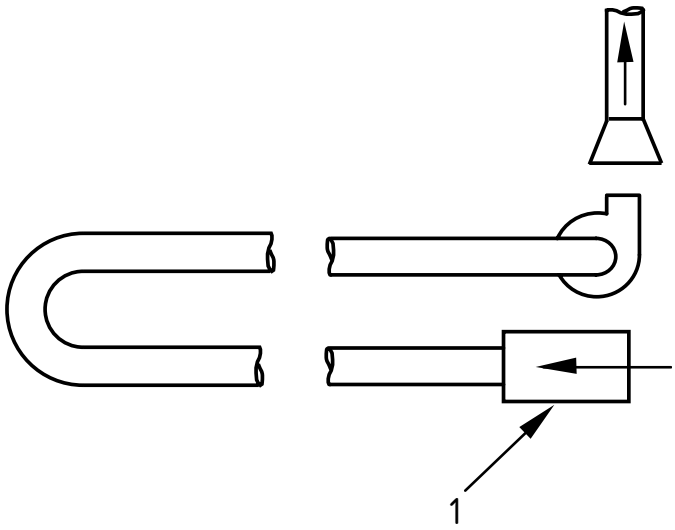
Appliance (flue) types

B.1 Type B appliances with a fan in the combustion circuit



Key
1 Burner

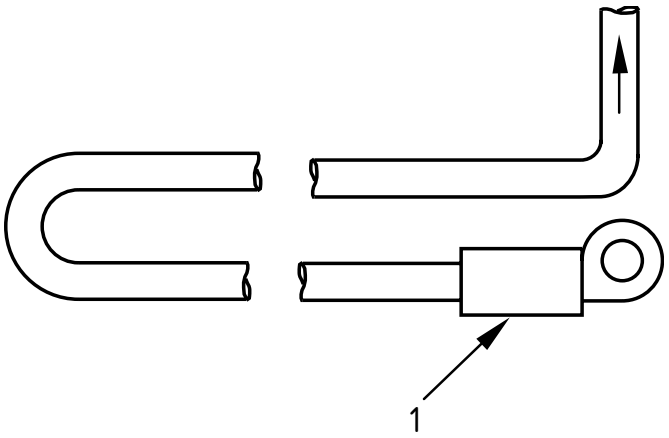
a) Type B_{13}



Key
1 Burner

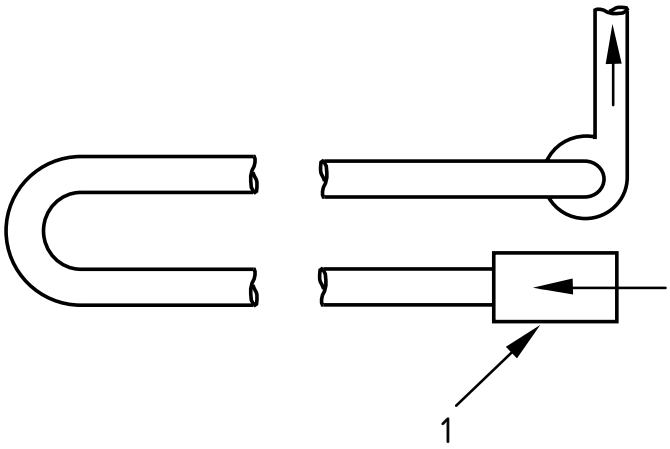
b) Type B_{12}

Figure B.1 — Type B_1 appliances



Key
1 Burner

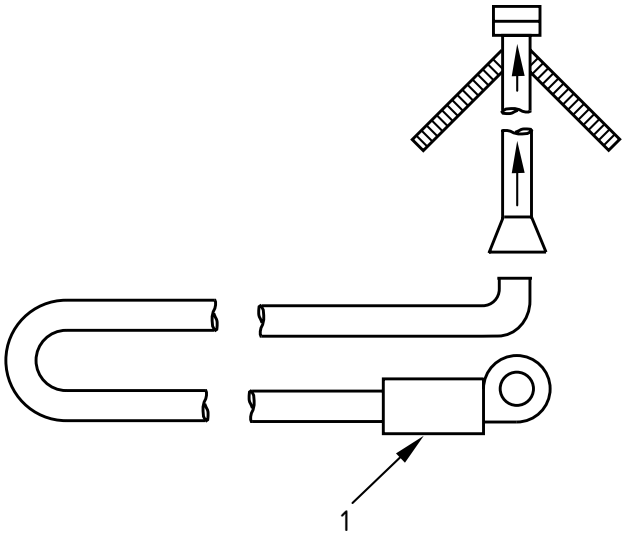
a) Type B_{23}



Key
1 Burner

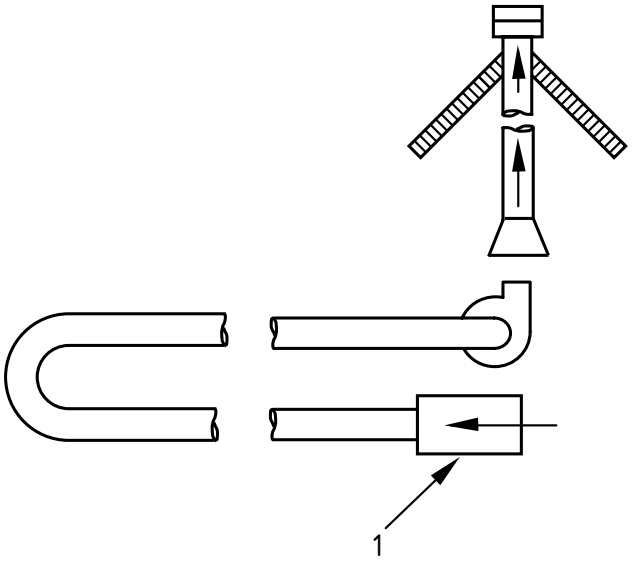
b) Type B_{22}

Figure B.2 — Type B_2 appliances



Key
1 Burner

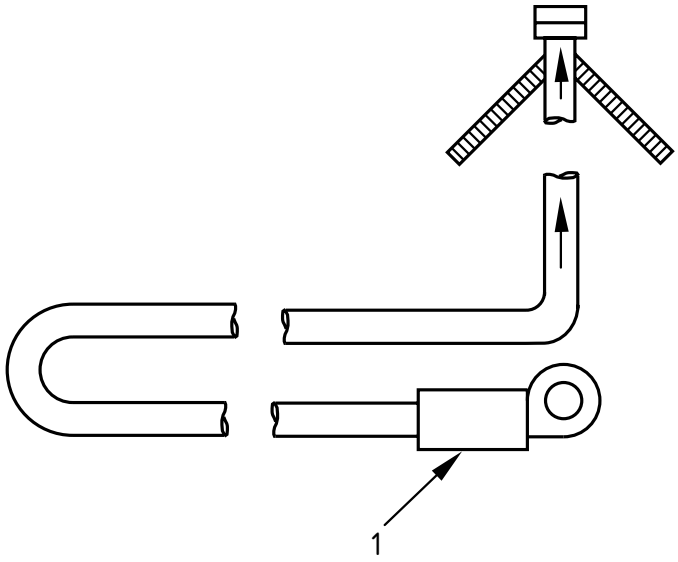
a) Type B_{42}



Key
1 Burner

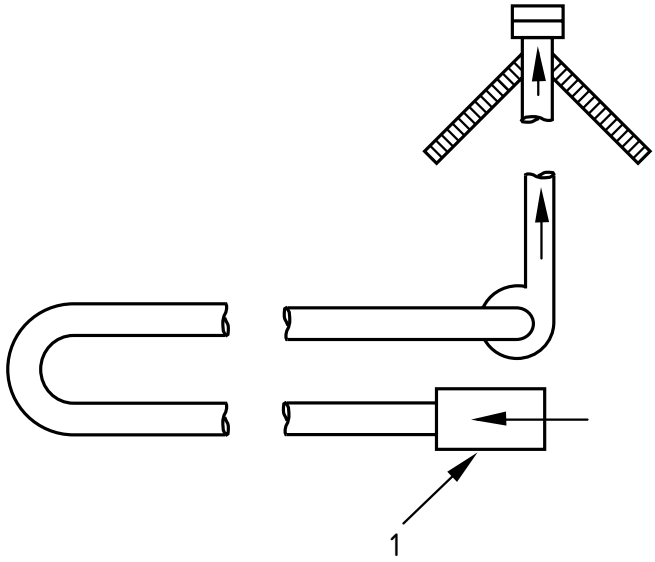
b) Type B_{43}

Figure B.3 — Type B_4 appliances



Key
1 Burner

a) Type B_{52}

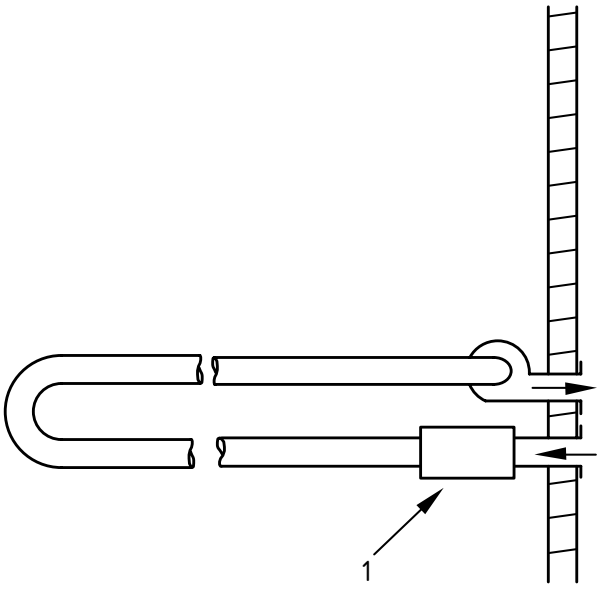


Key
1 Burner

b) Type B_{53}

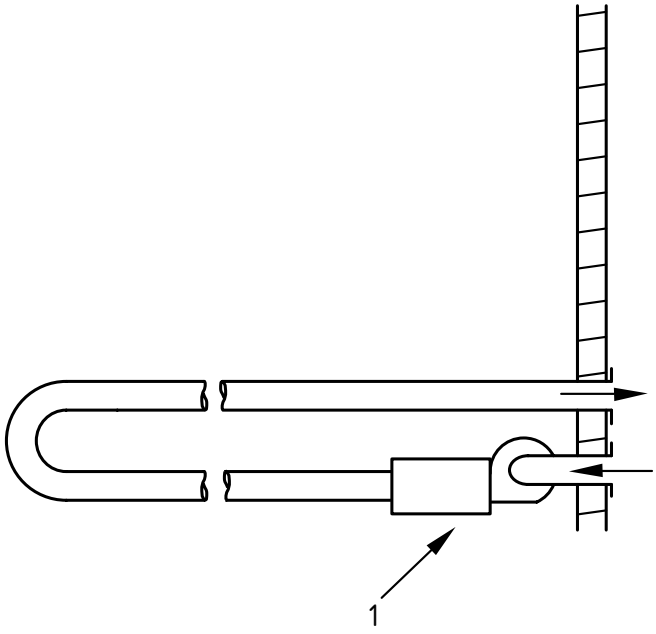
Figure B.4 — Type B_5 appliances

B.2 Type C appliances with a fan in the combustion circuit



Key
1 Burner

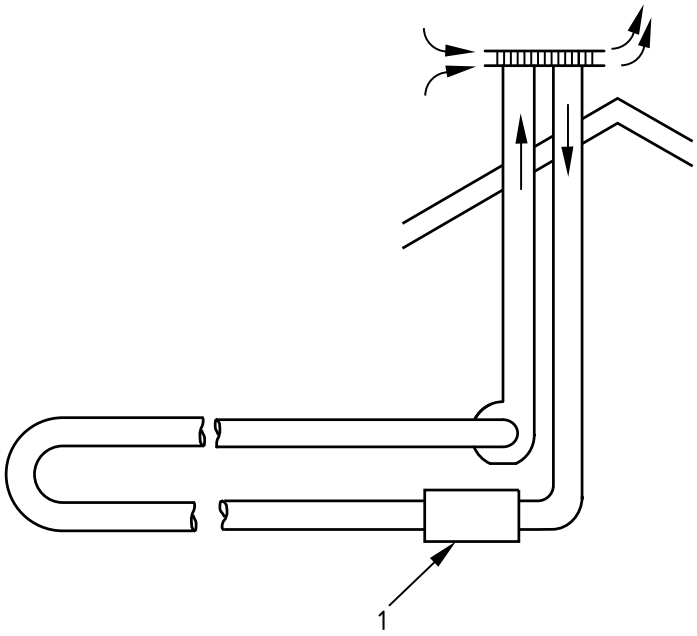
a) Type C_{12}



Key
1 Burner

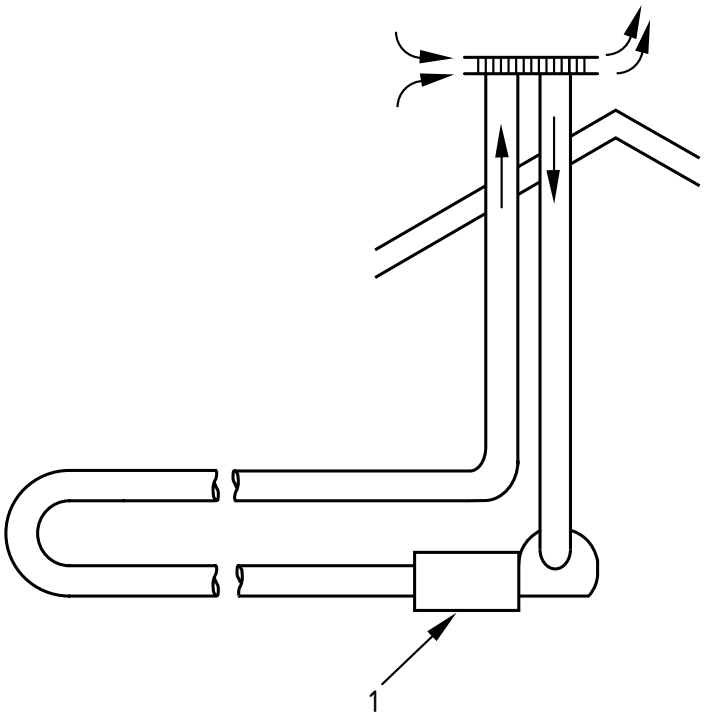
b) Type C_{13}

Figure B.5 — Type C_{12} and Type C_{13} appliances



Key
1 Burner

a) Type C_{32}



Key
1 Burner

b) Type C_{33}

Figure B.6 — Type C_{32} and Type C_{33} appliances

Annex C
(informative)

Equivalence rules

C.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 of 5.2.2, 5.2.3 and 5.2.6 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 [8)], 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 5.2.6) 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 categorised 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 7.1.5.1 are carried out, after changing the injectors, if necessary.

EXAMPLE 2: An appliance in category I_{2E+} for G 20 at 20 mbar may be categorised 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 5.2.6.

C.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 a more restricted range of Wobbe Index provided that the requirements of 5.2.2, 5.2.3 and 5.2.6 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.

[8)] Throughout Annex C the word “adjuster” refers to gas rate adjusters and to fixed primary aeration adjusters as appropriate.

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 [8], 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 5.2.6) 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 categorised 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} [9] and with the corresponding injectors and adjustments. These adjustments take into account the requirements of 5.2.6.

EXAMPLE 2: An appliance in category I_{2Esi} or I_{2Er} may be categorised 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+} [9] In addition, any adjusters are locked and sealed in the appropriate positions, taking account of the requirements of 5.2.6.

C.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 is 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 should be taken of the special national conditions given in Annex G.

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[8] Throughout Annex C the word “adjuster” refers to gas rate adjusters and to fixed primary aeration adjusters as appropriate.

[9] Where the intended country of destination is Belgium account should be taken of the special national conditions given in Annex G.

Annex D
(informative)

Calculation of flue gas mass flow rate

D.1 Flue gas mass flow rate

The mass flow rate (M_{fg}) of flue gas is calculated using Equation (D.1) (also see Table D.1):

$$M_{fg} = \left(m_{H2O} + m_{N_2} + m_{O_2} + m_{CO_2}\right) \times \frac{Q}{3600 H_i} \quad \text{(D.1)}$$

where:

M_{fg} is the flue gas mass flow rate (kg/s);

m_{H_20} is the quantity of water vapour, H_2O (kg/m^3);

m_{N_2} is the quantity of nitrogen, N_2 (kg/m^3);

m_{O_2} is the quantity of oxygen, O_2 (kg/m^3);

m_{CO_2} is the quantity of carbon dioxide, CO_2 (kg/m^3);

Q is the measured heat input (kW);

H_i is the net calorific value (kWh/m^3).

D.2 Quantity of air in the flue gas

The quantity of air in the flue gas (L) is calculated using Equation (D.2).

$$L = L_{min} + V_{at}\left(\frac{V_{CO_2N}}{V_{CO_2M}} - 1\right) \quad \text{(D.2)}$$

where:

L is the quantity of air in the flue gas (m^3/m^3);

L_{min} is the air requirement (m^3/m^3);

V_{at} is the quantity of dry flue gas (m^3/m^3);

V_{CO_2N} is the calculated carbon dioxide content (%) of the dry, air-free products of combustion;

V_{CO_2M} is the carbon dioxide concentration (%) measured in the sample during the combustion test.

D.3 Flue gas excess air ratio (λ)

The excess air ratio (λ) in the flue gas is calculated using Equation (D.3).

$$\lambda = \frac{L}{L_{\min}} \qquad \text{(D.3)}$$

where:

λ is the excess air ratio in the flue gas;

L is the quantity of air in the flue gas (m^3/m^3);

L_{min} is the air requirement (m^3/m^3).

D.4 Quantity of water vapour in the flue gas

The quantity of water vapour $\left(m_{H_2O}\right)$ in the flue gas is calculated using Equation (D.4).

$$m_{H_20} = 0{,}854\ (V_{af} - V_{at}) \qquad \text{(D.4)}$$

where:

m_{H_20} is the quantity of water vapour in the flue gas (kg/m^3);

V_{at} is the quantity of dry flue gas (m^3/m^3);

V_{af} is the quantity of wet flue gas (m^3/m^3).

D.5 Quantity of Nitrogen in the flue gas

The quantity of nitrogen (m_{N_2}) in the flue gas is calculated using Equation (D.5).

$$m_{N_2} = 0{,}79 \times 1{,}25\ \lambda \times L_{\min} \qquad \text{(D.5)}$$

where:

m_{N_2} is the quantity of nitrogen in the flue gas (kg/m^3);

λ the excess air ratio in the flue gases is 1;

L_{min} is the air requirement (m^3/m^3)

D.6 Quantity of Oxygen in the flue gas

The quantity of oxygen (m_{O_2}) in the flue gas is calculated using Equation (D.6).

$$m_{O_2} = 0{,}21 \times 1{,}429(\lambda - 1)L_{min} \quad \text{(D.6)}$$

where:

m_{O_2} is the quantity of oxygen in the flue gas (kg/m^3);

λ the excess air ratio in the flue gases is 1;

L_{min} is the air requirement (m^3/m^3)

D.7 Dry quantity of flue gas

The dry quantity of flue gases with excess air ratio (V_t) is calculated using Equation (D.7).

$$V_t = V_{at} + (\lambda - 1)\, L_{min} \quad \text{(D.7)}$$

where:

V_t is the dry quantity of flue gas (kg/m^3);

V_{at} is the quantity of dry flue gas (m^3/m^3);

λ the excess air ratio in the flue gases is 1;

L_{min} is the air requirement (m^3/m^3).

D.8 Quantity of carbon dioxide in the flue gas

The quantity of carbon dioxide (m_{CO_2}) in the flue gas is calculated using Equation (D.8).

$$m_{CO_2} = 1{,}977\left(V_t - \left(\frac{m_{N_2}}{1{,}25} + \frac{m_{O_2}}{1{,}429}\right)\right) \quad \text{(D.8)}$$

where:

m_{CO_2} is the quantity of carbon dioxide in the flue gas (kg/m^3);

m_{N_2} is the quantity of nitrogen in the flue gas (kg/m^3);

m_{O_2} is the quantity of oxygen in the flue gas (kg/m^3);

V_t is the dry quantity of flue gas (kg/m^3).

Table D.1 — Characteristic values for flue gas mass flow rate calculations

Gas		Quantity of flue gases (λ - 1) m^3/m^3		V_{CO2N} %	Air requirement (λ = 1)	Net calorific value
		dry V_{at}	wet V_{af}		L_{min} m^3/m^3	H_i kWh/m^3
First family	Group A (G 110)	3,40	4,42	7,66	3,66	4,09
	Group b (G 120)	3,82	4,93	8,37	4,16	5,59
Second family	Group L/LL (G 25)	7,46	9,18	11,51	8,19	8,57
	Group H/E (G 20)	8,52	10,52	11,73	9,52	9,97
Third family	Group B/P (G 30) G 31	28,45 21, 8	33,45 25, 8	14,06 13,8	30,95 23,8	34,39 25,9

Annex E
(informative)

Identification of gas types in use in various countries

Table E.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		Υγραèριο Μείγμα	Προπανιο
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
RO								
SE								
SI					Zemeljski plin		Utekočinjeni naftni plin (UNP) Butan	Propan,
SK					Zemný plyn		Bután	Propán

[a)] The meaning of the symbol corresponding to the type of gas shall 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 shall be in conformity with the description given in this table. In the case of pressure couples, the two descriptions of the family shall be mentioned.
[b)] See 8.1.4.4 for codes.

Annex F
(normative)

Special national conditions

F.1 General

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.

F.1.1 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, cross lighting and flame stability with the limit gas G 231 at the minimum pressure of 15 mbar.

F.1.2 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.

Annex G
(informative)

Calculation example of the weighting factors for an appliance with several rates

G.1 Appliance rates

The appliance rates used are 100 %, 50 % and 30 %.

Table G.1 — Weighting Qpi,% and Fpi

$Q_{pi,\%}$ (%)	70	60	40	20
F_{pi}	0,15	0,25	0,3	0,3

G.2 Weighting of Qpi,% = 20

Q_{min} is 30 %, which is larger than 20 %, so the F_{pi} of 20 % is added to the F_{pi} of 30 %.

$$F_{pi}(30\%) = 0,3$$

G.3 Weighting of $Q_{pi,\%}$ = 40

$Q_{pi,\%}$ = 40 has to be apportioned between $Q_{pi,\%}$ = 30 (low rate) and $Q_{pi,\%}$ = 50 (high rate).

$$\text{High rate}: F_{pi}(50\%) = F_{pi}(40\%) \times \frac{Q_{pi,\%}40 - Q_{pi,\%}30}{Q_{pi,\%}50 - Q_{pi,\%}30} \times \frac{Q_{pi,\%}50}{Q_{pi,\%}40}$$

$$F_{pi}(50\%) = 0,3 \times \frac{40 - 30}{50 - 30} \times \frac{50}{40} = 0,1875$$

$$\text{Low rate}: F_{pi}(30\%) = F_{pi}(40\%) - F_{pi}(50\%) = 0,3 - 0,1875 = 0,1125$$

G.4 Weighting of $Q_{pi,\%}$ = 60

$Q_{pi,\%}$ = 60 has to be apportioned between $Q_{pi,\%}$ = 50 (low rate) and $Q_{pi,\%}$ = 100 (high rate).

$$\text{High rate}: F_{\text{pi}}(100\%) = F_{\text{pi}}(60\%) \bullet \frac{Q_{\text{pi},\%}60 - Q_{\text{pi},\%}50}{Q_{\text{pi},\%}100 - Q_{\text{pi},\%}50} \bullet \frac{Q_{\text{pi},\%}100}{Q_{\text{pi},\%}60}$$

$$F_{\text{pi}}(100\%) = 0{,}25 \times \frac{60 - 50}{100 - 50} \times \frac{100}{60} = 0{,}0833$$

$$\text{Low rate}: F_{\text{pi}}(50\%) = F_{\text{pi}}(60\%) - F_{\text{pi}}(100\%) = 0{,}25 - 0{,}0833 = 0{,}1667$$

G.5 Weighting of $Q_{\text{pi},\%}$ = 70

$Q_{\text{pi},\%}$ = 70 has to be apportioned between $Q_{\text{pi},\%}$ = 50 (low rate) and $Q_{\text{pi},\%}$ = 100 (high rate).

$$\text{High rate}: F_{\text{pi}}(100\%) = F_{\text{pi}}(70\%) \times \frac{Q_{\text{pi},\%}70 - Q_{\text{pi},\%}50}{Q_{\text{pi},\%}100 - Q_{\text{pi},\%}50} \times \frac{Q_{\text{pi},\%}100}{Q_{\text{pi},\%}70}$$

$$F_{\text{pi}}(100) = 0{,}15 \times \frac{70 - 50}{100 - 50} \times \frac{100}{70} = 0{,}0857$$

$$\text{Low rate}: F_{\text{pi}}(50\%) = F_{\text{pi}}(70\%) - F_{\text{pi}}(100\%) = 0{,}15 - 0{,}0857 = 0{,}0643$$

G.6 Total weighting

Table G.2 — Total weighting

Rate	20 %	40 %	60 %	70 %	Total
30 %	0,30	0,1125	—	—	0,412 5
50 %	—	0,1875	0,1667	0,0643	0,418 5
100 %	—	—	0,0833	0,0857	0,169 0
Total	0,30	0,30	0,25	0,15	1

The ponderation is given by Equation G.1.

$$\text{NO}_{\text{x,pond}} = 0{,}412\,5 \times \text{NO}_{\text{x,mes(30\%)}} + 0{,}418\,5 \times \text{NO}_{\text{x,mes(50\%)}} + 0{,}169 \times \text{NO}_{\text{x,mes(100\%)}} \qquad \text{(G.1)}$$

Annex H
(informative)

NO_x conversion calculation

H.1 NO_x emission conversion factors

Table H.1 — NO_x emission value conversion for first family gases

		G 110	
		mg/kWh	mg/MJ
O_2 = 0 %	1 ppm[a)]	1,714	0,476
	1 mg/m^3 [a)]	0,834	0,232
O_2 = 3 %	1 ppm	2,000	0,556
	1 mg/m^3	0,974	0,270
a) 1 ppm = 2,054 mg/m^3 and 1 ppm = 1 cm^3/m^3			

Table H.2 — NO_x emission value conversion for second family gases

		G 20		G 25	
		mg/kWh	mg/MJ	mg/kWh	mg/MJ
O_2 = 0 %	1 ppm [a)]	1,764	0,490	1,797	0,499
	1 mg/m^3 [a)a]	0,859	0,239	0,875	0,243
O_2 = 3 %	1 ppm	2,059	0,572	2,098	0,583
	1 mg/m^3	1,002	0,278	1,021	0,284
a) 1 ppm = 2,054 mg/m^3 and 1 ppm = 1 cm^3/m^3					

Table H.3 — NO_x emission value conversion for third family gases

		G 30		G 31	
		mg/kWh	mg/MJ	mg/kWh	mg/MJ
O_2 = 0 %	1 ppm[a)]	1,792	0,498	1,778	0,494
	1 mg/m^3 [a)]	0,872	0,242	0,866	0,240
O_2 = 3 %	1 ppm	2,091	0,581	2,075	0,576
	1 mg/m^3	1,018	0,283	1,010	0,281
a) 1 ppm = 2,054 mg/m^3 and 1 ppm = 1 cm^3/m^3					

H.2 NO_X conversion calculation

Flowchart for the calculation of the NO_x emission to the reference conditions mg/MJ, mg/kWh and ppm; dry, with a certain amount of O_2.

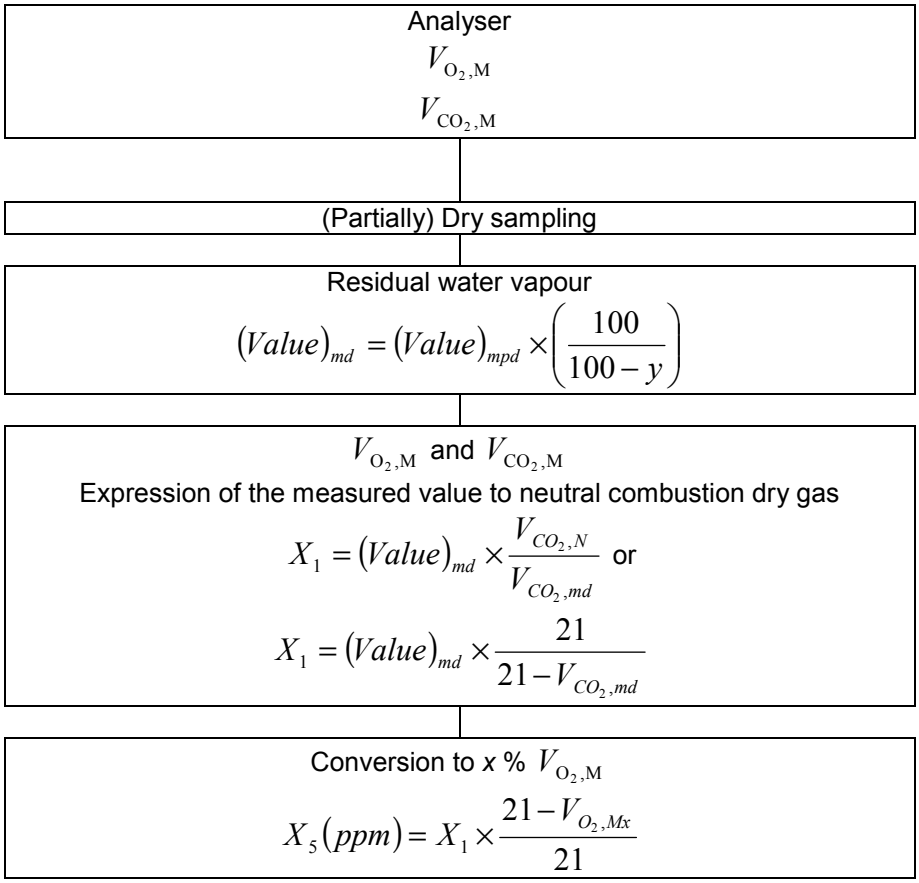


Table H.4 — Relationship of symbols in EN 416-1:2008 and CR 1404:1994

EN 416-1:2008	CR 1404:1994	Explanation
$V_{CO,M}$ $V_{NO_x,M}$ $V_{NO,M}$ $V_{NO_2,M}$	$(CO)_m$ $(NO_x)_m$ $(NO)_m$ $(NO_2)_m$	are measured concentrations in the sample taken during the combustion test (ppm, *V/V*): $V_{NO_x,M} = V_{NO,M} + V_{NO_2,M}$
$V_{CO_2,M}$ $V_{O_2,M}$	(CO_2) (O_2)	are measured concentrations in the sample taken during the combustion test (%, *V/V*),
$V_{CO_2,N}$	$(CO_2)_n$	is the maximum carbon dioxide content of the dry, air-free combustion products (%, *V/V*)
$V_{O_2,md}$ $V_{CO_2,md}$	$(O_2)_{md}$ $(CO_2)_{md}$	is the correction of measured value at partially dry (mpd) sample gas to dry (md) sample gas
y	*y*	is the content of water vapour in dried sample gas (%,V/V)
x	*x*	is the reference level of O_2 dry gas (%) (e.g. 3 % O_2)
X_1	X_1	is the NO_x value at neutral combustion conditions dry gas at 0 % O_2 (ppm, mg/MJ or mg/kWh)
X_5	X_5	is the NO_x value at *x* % O_2 dry gas converted from neutral combustion conditions (ppm, mg/MJ or mg/kWh)

Annex I
(informative)

National situations for countries whose national bodies are CEN Associate Members

NOTE This annex has been retained to enable the current associate members of CEN to provide information concerning any national situations. At present no information has been received from any associate member state of CEN.

Annex J
(informative)

An example of sampling plans

J.1 Sampling plans

In this example sampling plans are selected from the tables published in ISO 2859-1.

J.1.1 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.

J.1.2 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.

J.1.3 Normal, tightened or reduced inspection

In this example the normal inspection is used initially on all incoming materials, after which, the following rules apply:

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.

J.1.4 Single, double, multiple or sequential sampling

Unless otherwise specified, all incoming material should be subjected to single sampling plans.

J.1.5 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.

J.2 Inspection levels and procedures

J.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.

J.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.

J.2.3 Finished goods checks

a) At the end of the manufacturing process, each unit should be visually inspected for damage.

b) 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.

Annex K
(informative)

Flue Loss determination

(Types B and C appliances only)

K.1 General conditions of test

K.1.1 Principle of method

The heat loss from a building via the flue system is determined from measurements of CO_2 concentration and the temperature of the products of combustion.

K.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.

K.1.3 Preparation of appliance

The appliance is installed in accordance with 7.1.6 and operated, in accordance with the manufacturer's instructions, with reference gas (see Table 6) except that Type C appliances are installed with combustion air and combustion products ducts of the maximum equivalent resistance declared by the manufacturer.

K.2 Test conditions

The appliance is supplied with the reference test gas(es) corresponding to its category and operated within ± 2 % of the nominal heat input.

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 in the combustion products outlet 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 K.1 and is positioned at least 800 mm above the flue outlet connection on the appliance in accordance with the manufacturer's instructions.

For Type C_1 appliances, the test probe to be used is as shown in Figure K.2. Where possible, it is positioned as shown in Figure K.3.

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.

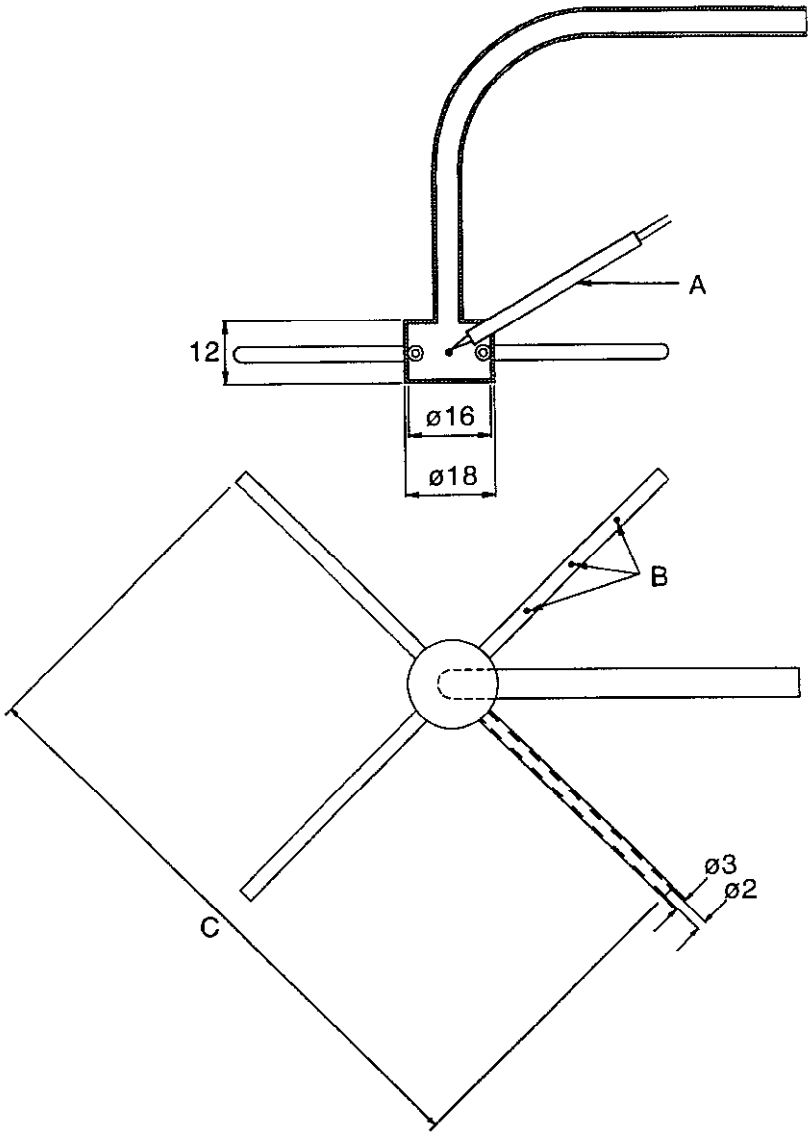
For Type C_3 appliances, the test probe to be used is as shown in Figure K.3. It is positioned at least 800 mm above the flue outlet connection on the appliance in accordance with the manufacturer's instructions.

K.3 Test procedure

With the appliance installed and adjusted as described in K.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.

Dimensions are in mm

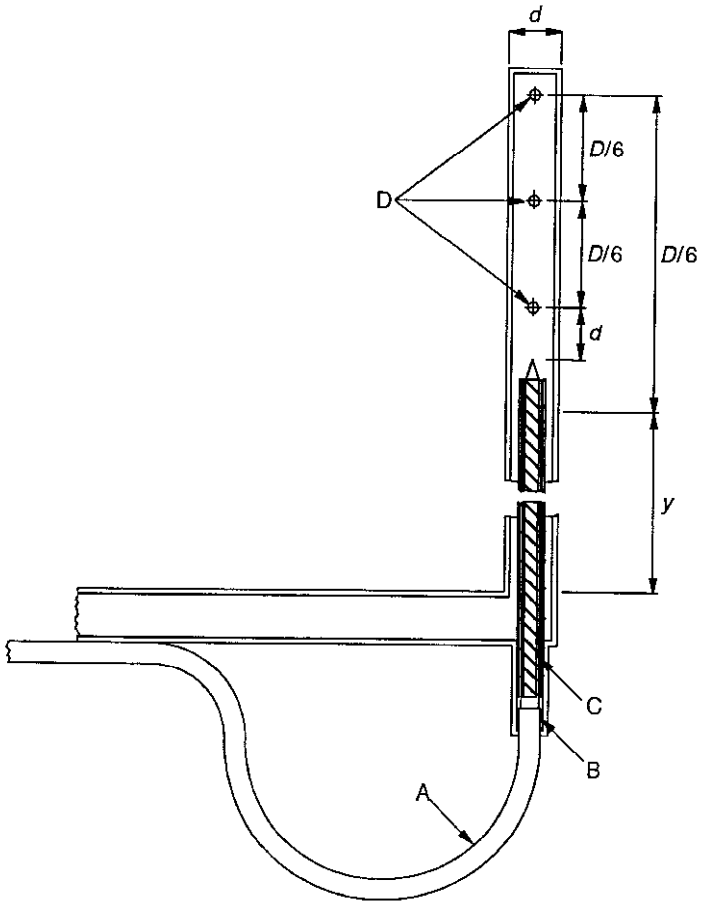


Key

NOTE Sampling probe material is stainless steel with a polished finish.

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 K.1 — Sampling probe for type B_1 appliances



Key

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;

dampling hole diameter (D): 1,0 mm;

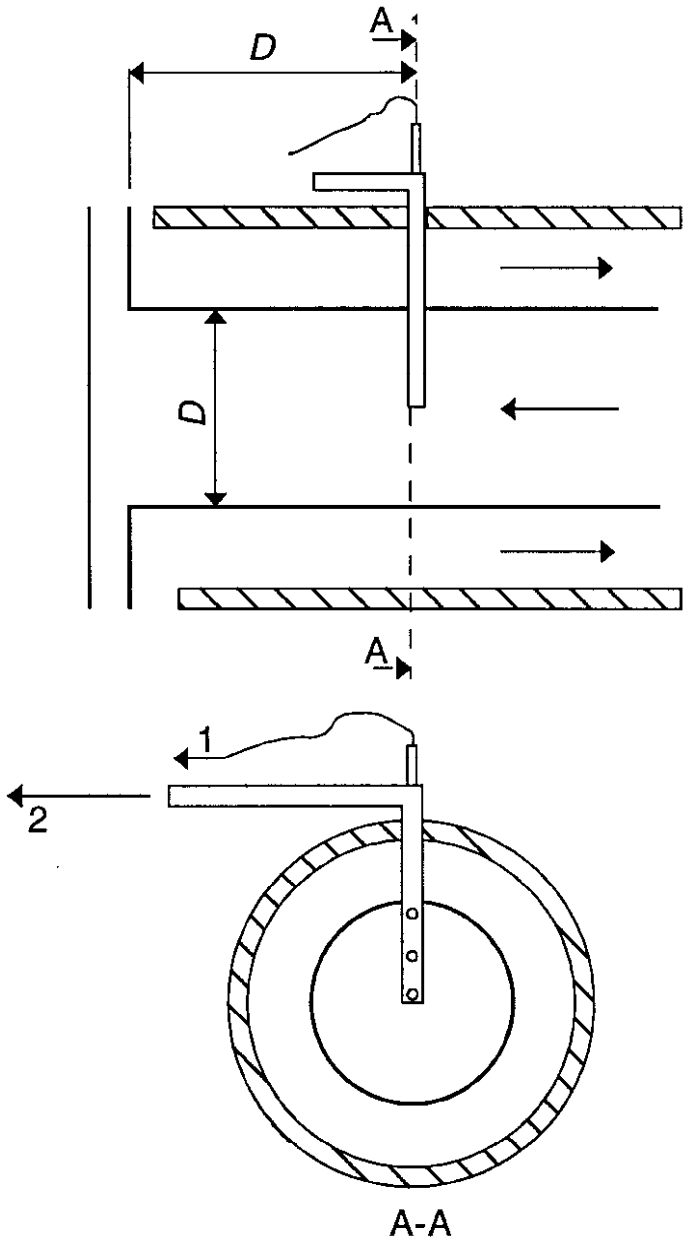
twin bore ceramic sleeve: Ø 3 mm x 0,5 mm bore;

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.

A Chrome/Alumel thermocouple wire
B Insulating cement
C Twin bore ceramic sleeve
C Three Ø 1 mm sampling holes

Figure K.2 — Sampling probe for Type C_1 and C_3 appliances



Key

1 To temperature sensor
2 To sampling pump

Figure K.3 — Sampling probe position for Type C1 appliances

K.4 Accuracy of measurement

Measurements are made to the following accuracy.

Table K.1 — 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 %

K.5 Calculation of Flue Loss

The symbols used in the determination are defined as follows:

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 K.4);

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;

V_f is calculated from the volume of CO_2 (V_{CO2}) produced by the combustion of one cubic metre of gas (see Table K.2), and from the CO_2 concentration of the products of combustion ($V_{CO2,M}$).

Table K.2 — 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 flue loss, q_L, (in %) is given by:

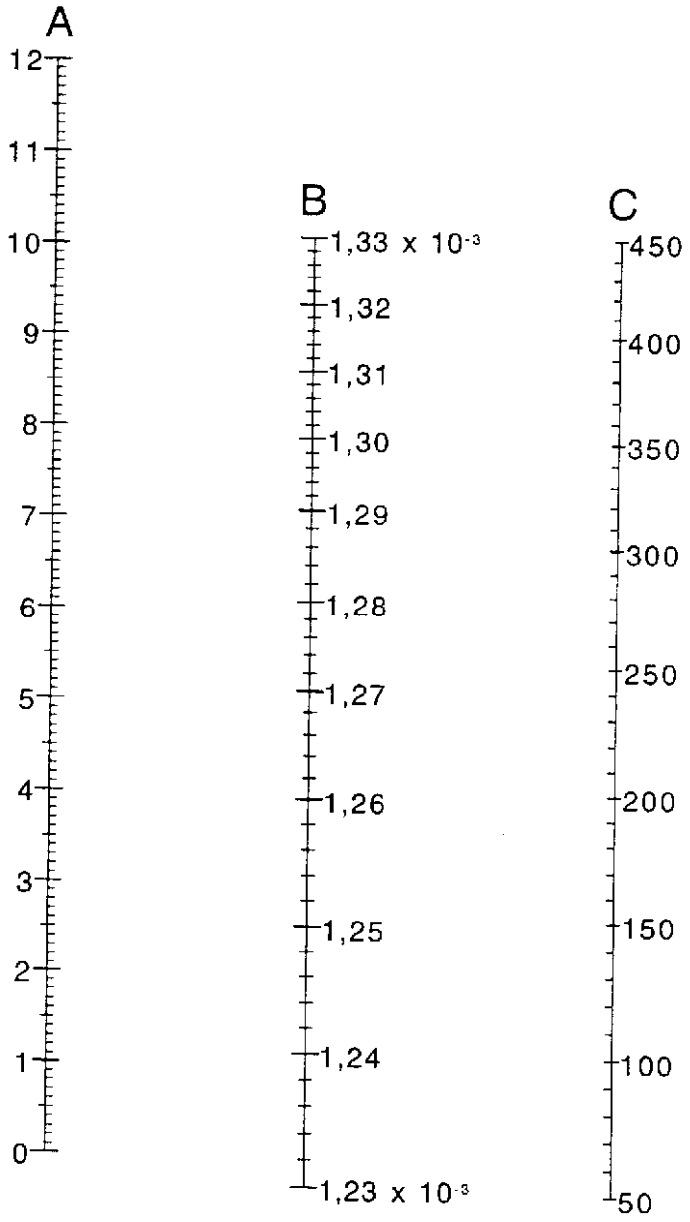
$$q_L = q_1 + q_2$$

where:

q_1 is the heat of the dry products of combustion (percentage of heat released per unit volume of gas);

and:

q_2 is the heat of the water vapour contained in the products of combustion (percentage of heat released per unit volume of gas);



Key
1 % CO_2 in combustion products minus % CO_2 in air
2 Mean specific heat of dry products of combustion in MJ/m^3K
3 Temperature of combustion products in °C

Figure K.4. —Mean specific heat of dry products of combustion

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 90/396/EEC – The approximation of the laws of Member States concerning gas appliances

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.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Table ZA — Correspondence between this European Standard and Directive (Add the reference and title of the Directive)

Essential requirement	Subject	Relevant clauses in EN 416-1
1.1	Safe design and construction	Whole standard
1.2	Instructions and warning notices	
1.2.1	Installation instructions Type of gas used Gas supply pressure Fresh air for combustion - products dispersal Forced draught burners	8.2.2.1 8.1.1 8.1.1, 8.1.3 8.1.2, 8.1.3 8.1.3, 8.2.2.1 Not applicable
1.2.2	Instructions for use and servicing	8.2.1, 8.2.3
1.2.3	Warning notices on appliance and packaging	8.1.2, 8.1.3
1.3	Fittings Instructions	5.2 Not applicable
2.1	Characteristic of material	5.1.2, 6.7
2.2	Properties of materials	1
3.1.1	Durability	5.1.2
3.1.2	Condensation	6.7 f)
3.1.3	Explosion risk	5.1.2, 5.1.4.1
3.1.4	Air/water penetration	6.1.1
3.1.5	Normal auxiliary energy fluctuation	5.1.9, 6.6.1.d)
3.1.6	Abnormal auxiliary energy fluctuation	5.1.9, 6.6.1.d)
3.1.7	Electrical hazards	5.1.8
3.1.8	Parts under pressure	Not applicable
3.1.9	Safety/control device failure : - automatic burner control systems - multifunctional control - automatic shut-off valves - thermostats/cut-off device - air proving device	 5.2.12.1 5.2.7 5.2.8, 5.2.12.6 5.2.12.7 5.2.11, 6.6.1.e), 6.6.2.2
3.1.10	Overruling of safety devices	5.2.5.1

Essential requirement	Subject	Relevant clauses in EN 416-1
3.1.11	Pre-set adjuster protection	5.2.2
3.1.12	Levers and setting devices	5.2.5.2.2
3.2.1	Gas leakage	5.1.4, 6.1
3.2.2	Gas release during ignition, extinction, re-ignition	5.2.7, 5.2.8 5.2.12
3.2.3	Unburned gas accumulation	5.2.12
3.3	Ignition - ignition, re-ignition - cross-lighting	5.2.12.5, 5.2.12, 5.3.1, 6, 6.4 5.2.12.5, 5.2.12.6 5.3.3, 6.4
3.4.1	Flame stability Harmful substances	6.4 6.6
3.4.2	Combustion products release - normal use	 6.1.2
3.4.3	Combustion products release - abnormal draught condition	 6.1.2 (See NOTE)
3.4.4	Flueless domestic appliances	Not applicable
3.5	Rational use of energy	(see EN 416-2)
3.6.1	Floor etc. temperatures	6.3.1
3.6.2	Temperature of knobs/levers	Not applicable (see 5.2)
3.6.3	External parts	Not applicable
3.7	Foodstuffs and water	Not applicable

NOTE These appliances are installed at such a height relative to the persons who may be exposed to the combustion products, that natural ventilation would prevent the build up of a dangerous quantity.

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 M/105 “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://europa.eu.int/comm/enterprise/ construction/internal/dangsub/dangmain.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	8.2.2.1 f)	None	Manufacturer's declaration
Fire reaction	None	None	Not applicable [a]
Resistance to fire	None	None	Not applicable [b c]
Gas tightness /leakage	6.1	None	Pass/fail criteria
Flow resistance	8.2.2.1 g)	None	Manufacturer's declaration of minimum and maximum equivalent resistance
Thermal resistance/ Dimensioning	None 8.2.2.1	None None	Not applicable [d] Manufacturer's declaration
Thermal shock resistance	None	None	Not applicable [b]
Flexural tensile strength	5.1.5 8.2.2.1	None	Pass/ fail criteria. Manufacturer's declared value
Durability against chemicals	5.1.2 6.7	None	Pass-fail criteria
Durability against corrosion	5.1.2 6.7	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	8.2.2.2 g)	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 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 standards indicated therein.

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	Certification 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 in Table ZB.2

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks for the manufacturer	Factory production control (F.P.C)	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, etc.) 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, the following:

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, etc.), 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:

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 416-1 Metal POCED	*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 125:1991, *Flame supervision devices for gas burning appliances - Thermo-electric flame supervision devices*

[2] EN 60730-1:2000, *Automatic electrical controls for household and similar use - Part 1: General requirements*

[3] EN 60730-2-1:1997, *Automatic electrical controls for household and similar use - Part 2: Particular requirements for electrical controls for household appliances*

[4] EN 60730-2-9:2002, *Automatic electrical controls for household and similar use - Part 2: Particular requirements for temperature sensing controls*

[5] CEN/TR 1749:2005, *European scheme for the classification of gas appliances according to the method of evacuation of the combustion products (types)*

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