BS EN 13278:2013

BSI Standards Publication

Open fronted gas-fired independent space heaters

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National foreword

This British Standard is the UK implementation of EN 13278:2013. It supersedes BS EN 13278:2003 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GSE/36, Independent gas-fired space heaters.

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

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Open fronted gas-fired independent space heaters

Appareils de chauffage indépendants à foyer ouvert utilisant les combustibles gazeux

Konvektions-Raumheizer für gasförmige Brennstoffe mit offener Verbrennungskammer

This European Standard was approved by CEN on 8 August 2013.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (EN 13278:2013) has been prepared by Technical Committee CEN/TC 62 “Indepedent gas-fired space heaters”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2014, and conflicting national standards shall be withdrawn at the latest by April 2014.

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 13278:2003.

Annex K provides details of significant technical changes between this European Standard and EN 13278:2003.

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 EU Directive(s).

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

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

1 Scope

This European Standard specifies the requirements and test methods for the construction, safety, marking and rational use of energy of open fronted gas-fired independent space heaters with and without a fan to assist with the transportation of flue gases, hereafter referred to as appliances. Although the fan may be mounted outdoors, this standard only covers appliances where the body of the appliance is indoors.

This standard applies to types B_{11AS}, B_{11BS}, B_{14AS}, and B_{14BS} (commonly referred to in this standard as type B_1 appliances) open fronted gas-fired independent space heating appliances:

— that incorporate an atmospheric burner;

— that are connected directly to an open flue (see Figure 1), or to a device to evacuate the products of combustion (open-flued appliances);

— that have a nominal heat input not exceeding 20 kW (based on the net calorific value);

— that are delivered with the gas-carrying components, burner(s), combustion chamber and heat exchanger fully assembled.

It does not apply to:

— closed-fronted appliances;

— decorative fuel effect appliances as specified in EN 509;

— catalytic combustion appliances;

— ducted-air appliances;

— appliances installed by means of a closure plate (see 3.3.3.3).

2 Normative references

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

EN 88 (all parts), *Pressure regulators and associated safety devices for gas appliances*

EN 125, *Flame supervision devices for gas burning appliances — Thermoelectric flame supervision devices*

EN 126, *Multifunctional controls for gas burning appliances*

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

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

EN 298, *Automatic burner control systems for burners and appliances burning gaseous or liquid fuels*

EN 437:2003+A1:2009, *Test gases — Test pressures — Appliance categories*

EN 1057:2006+A1:2010, *Copper and copper alloys — Seamless, round copper tubes for water and gas in sanitary and heating applications*

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

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

EN 60068-2-75, *Environmental testing — Part 2-75: Tests — Test Eh: Hammer tests (IEC 60068-2-75)*

EN 60335-1:1994, *Safety of household and similar electrical appliances — Part 1: General requirements (IEC 60335-1:1991, modified)*

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

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

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

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

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

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

3 Terms and definitions

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

3.1 open fronted gas-fired independent space heaters

3.1.1
convection heater
appliance that is designed to heat a room mainly by the emission of air heated by convection

Note 1 to entry: Such an appliance can also contain radiant heating elements provided that it complies with all the requirements of this standard.

3.1.2
forced convection heater
convection appliance that incorporates a fan and thus allows an acceleration of the circulation of the air in contact with the heating body

Note 1 to entry: Such an appliance is designed to discharge air directly into the room in which the appliance is installed and not to be connected to a warm air distribution system.

3.1.3
live fuel-effect convection heater
convection appliance which simulates the visual effect of a solid fuel appliance

3.1.4
open-fronted appliance
appliance which has exposed flames or exposed incandescent areas

3.1.5
closed-fronted appliance
appliance which does not have exposed flames or exposed incandescent areas

3.1.6
working surfaces
parts of an appliance, which, due to the nature of the appliance, have temperatures exceeding the limits specified in 6.4.1 excluding parts that are likely to be touched during operations carried out in the normal use of the appliance, for example, the area adjacent to control knobs

Note 1 to entry: Working surfaces do not include that part of any surface within 25 mm of parts that have to be touched or removed during normal operation of the appliance.

3.2 gases

3.2.1
reference conditions
for calorific values, temperature: 15 °C;
for gas and air volumes dry, brought to 15 °C and to an absolute pressure of 1 013,25 mbar

3.2.2
calorific value
quantity of heat produced by the combustion, at a constant pressure of 1 013,25 mbar, of unit volume or mass of gas, the constituents of the combustible mixture being taken at reference conditions and the products of combustion being brought back to the same conditions

Note 1 to entry: A distinction is made between:

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

Symbol: H_s

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

Symbol: H_i

Units: either

— megajoules per cubic metre (MJ/m^3) of dry gas at reference conditions; or

— megajoules per kilogram (MJ/kg) of dry gas.

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

3.2.3
relative density
d
ratio of the masses of equal volumes of dry gas and dry air at the same conditions of temperature and pressure

3.2.4
Wobbe index
ratio of the calorific value of a gas per unit volume to the square root of its relative density under the same reference conditions

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

Symbols: gross Wobbe index: W_s

net Wobbe index: W_i

Units: either:

— megajoules per cubic metre (MJ/m^3) of dry gas at the reference conditions; or

— megajoules per kilogram (MJ/kg) of dry gas.

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

3.2.5
test pressures
gas pressures used to verify the operational characteristics of appliances using combustible gases

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

Note 2 to entry: They are expressed in millibar (mbar).

1 mbar = 100 Pa.

3.2.6
normal pressure
p_n
pressure under which appliances operate in nominal conditions, when they are supplied with the corresponding reference gas

3.2.7
limit pressures
pressures representative of the extreme variations in the appliance supply conditions

Note 1 to entry: Symbols: maximum pressure: p_{max}

minimum pressure: p_{min}

3.2.8
pressure couple
combination of two distinct gas distribution pressures applied by reason of the significant difference existing between the Wobbe indices within a single family or group in which

— the higher pressure corresponds only to gases of low Wobbe index; and

— the lower pressure corresponds to gases of high Wobbe index

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

3.3 appliance construction

3.3.1 the gas circuit

3.3.1.1
inlet connection
part of the appliance intended to be connected to the gas supply

3.3.1.2
mechanical joint
connection device assuring soundness in an assembly of several parts, generally of metal

Note 1 to entry: For example the following:

— cone seated joints,

— torroidal sealing rings ('O' rings),

— flat joints,

— metal to metal joints.

3.3.1.3
gas circuit
part of an appliance that conveys or contains the gas between the appliance gas inlet connection and the burner(s)

3.3.1.4
gas restrictor
non-adjustable device 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

3.3.1.5
gas rate adjuster
component intended for the manufacturer or installer to set the gas rate to each burner at a predetermined value according to the supply conditions

Note 1 to entry: The adjustment can be progressive (screw adjuster) or discontinuous (changing restrictors).

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

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

3.3.1.6
gas rate control
component allowing the user to open or close the gas supply to one or more burners

Note 1 to entry: It can also be used to adjust the gas rate of certain burners to a predetermined value, called the 'reduced rate'. This device can be a 'tap'.

3.3.1.7
injector
component that admits the gas into a burner

3.3.1.8
start gas
initial quantity of gas ignited to give a flame which is used to ignite the main burner

Note 1 to entry: It can be discharged through a separate ignition burner or part of the main burner.

3.3.2 burner

3.3.2.1
main burner
burner that assures the thermal function of an appliance

Note 1 to entry: It is usually called simply 'burner'.

3.3.2.2
pan burner
main burner which utilises a particulate medium (e.g. sand) for the distribution of gas over a defined area

3.3.2.3
ignition burner
separate burner intended to light the main burner

3.3.2.3.1
permanent ignition burner
ignition burner that operates continuously throughout the whole period that the appliance is in use

3.3.2.3.2
intermittent ignition burner
ignition burner that is ignited before and extinguished at the same time as the main burner

3.3.2.4
fixed primary aeration restrictor
non-adjustable device which limits the supply of primary air to a burner

3.3.3 combustion products circuit

3.3.3.1
flue outlet
part of a type B appliance (see 4.2) that connects with a flue to evacuate the products of combustion

3.3.3.2
draught diverter
part of the combustion products circuit to reduce the influence of flue-pull and to minimise the effect of down-draught on the burner flame stability and combustion

3.3.3.3
closure plate
non-combustible plate used to cover and seal the front plane of a builder's opening, or fireplace opening, such that when the appliance is installed, any air flowing from the room into the flue does so in accordance with the design requirements of the appliance

Note 1 to entry: This plate contains an aperture through which the flue outlet spigot of the appliance projects into the cavity of the builder's opening, or fireplace recess, but is not connected to the flue.

Note 2 to entry: The plate can be a separate component, or an integral part of the appliance, e.g. the back panel, but in either case it is to be considered as part of the appliance.

Note 3 to entry: See Figure 2.

3.3.3.4
builder's opening
enclosure constructed by the builder to accommodate fireplace components

3.3.3.5
fireplace opening
aperture formed in the face of the builder's opening, the fireplace recess or fire surround if fitted

3.3.3.6
fireplace recess
recess formed by the inclusion of fireplace components in the builder's opening

3.3.3.7
hearth
floor area in front of the plane of the builder's opening or fireplace opening

3.3.3.8
flue box
non-combustible enclosure that provides a substitute builder's opening or fireplace recess

3.3.4 auxiliary equipment

3.3.4.1
pressure regulator
device that maintains, within a fixed range, a constant downstream pressure, independent of the upstream pressure and/or the gas rate

3.3.4.2
ignition device
device that ignites one or more burners

3.3.4.3
flame supervision device
device, including a sensing element, that causes the gas supply to a burner to be opened or closed according to the presence or absence of the flame that activates the sensing element

3.3.4.4
combustion products discharge safety device
device that automatically shuts off the gas supply to the main burner, and perhaps to the ignition burner, when there is unacceptably high spillage of combustion products from the draught diverter

3.3.4.5
atmosphere sensing device
device designed to shut off the gas supply before the combustion products of the surrounding atmosphere reaches a set value

3.3.4.6
control knob
component designed to be moved by hand in order to operate an appliance control (tap, thermostat, etc.)

3.3.4.7
programming unit
unit which reacts to signals from control and safety devices, gives control commands, controls the start-up sequence, supervises the burner operation and causes controlled shut-down, and if necessary safety shut-down and lock-out

Note 1 to entry: The programming unit follows a predetermined sequence of actions and always operates in conjunction with a flame detector device.

3.3.4.8
flame detector device
device by which the presence of a flame is detected and signalled

Note 1 to entry: It can consist of a flame sensor, an amplifier and a relay for signal transmission. These parts, with the possible exception of the actual flame sensor, can be assembled in a single housing for use in conjunction with a programming unit.

3.3.4.9
automatic burner system
burner system in which, when starting from the completely shut-down condition, the gas is ignited and the flame is detected and proved and the main gas valve(s) is actuated without manual intervention

3.3.4.10
non-automatic burner system
burner system with an ignition device which is operated under manual supervision

3.3.4.11
restart interlock (manual)
device which prevents the restoration of the gas supply to the main burner, or to the main burner and ignition burner, until the end of the extinction delay time

3.3.4.12
flue gas monitoring device
device intended to cause safety shut-down in the event of abnormal conditions of air admission or of combustion products evacuation

3.3.4.13
remote control
device used to operate an appliance from a distance

Note 1 to entry: This can be achieved by utilising a hand-held transmitter which communicates by electromagnetic or sonic means with a receiver that is part of the appliance.

3.3.5
dress guards
integral part of the appliance designed to prevent objects accidentally coming into contact with flames or incandescent surfaces

3.4 adjusters and controls

3.4.1
setting an adjuster
the action of immobilising an adjuster (by some means, e.g. a screw)

Note 1 to entry: It is said that the adjuster is "set" in this position.

3.4.2
sealing an adjuster
procedure by which after setting an adjuster, material is added such that any attempt to alter the adjustment setting is apparent

3.4.3
putting a control out of service
procedure by which a control (of temperature, pressure, etc.) is put out of action and sealed in this position

Note 1 to entry: The appliance then functions as if this device had been removed.

3.5 appliance performance

3.5.1 gas rates

3.5.1.1
volumetric flow rate
V
volume of gas consumed by the appliance in unit time during continuous operation

Note 1 to entry: Units: cubic metres per hour (m^3/h), litres per minute (l/min), cubic decimetres per hour (dm^3/h), or cubic decimetres per second (dm^3/s).

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

3.5.1.2
mass flow rate
M
mass of gas consumed by the appliance in unit time during continuous operation

Note 1 to entry: Units: kilograms per hour (kg/h), or grams per hour (g/h).

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

3.5.1.3
heat input
Q
quantity of energy used in unit time corresponding to the volumetric or mass flow rates, the calorific value to be used being the net or gross calorific value

Note 1 to entry: Unit: kilowatts (kW).

3.5.1.4
nominal heat input
Q_n
value of the heat input as stated in the instructions

Note 1 to entry: Unit: kilowatts (kW).

3.5.2 gas combustion

3.5.2.1
flame stability
state of the flames resting in a stable manner on the burner ports or the flame contact area provided

3.5.2.2
flame lift
phenomenon characterised by the total or partial lifting of the base of the flame from the burner port or the flame contact area provided

3.5.2.3
light-back
phenomenon characterised by the entry of a flame into the body of a burner

3.5.2.4
light-back at the injector
phenomenon characterised by ignition of the gas at the injector, either as a result of the flame entering the burner or by the propagation of a flame around the outside of the burner

3.5.2.5
sooting
phenomenon characterised by deposits of soot on the surfaces of parts of the appliance in contact with the products of combustion or with the flame, or as particulate matter in the combustion products

3.5.2.6
yellow tipping
phenomenon characterised by the appearance of yellow colouring at the top of the blue cone of an aerated flame

3.5.3
safety time
interval between the ignition burner gas valve, the start gas valve or main gas valve, as applicable, being energised and the ignition burner gas valve, start gas valve or main gas valve, as applicable, being de-energised if the flame detector signals the absence of a flame

3.5.4
extinction delay time
time that elapses between the disappearance of the flame and the interruption of the gas supply

3.5.5
ignition delay time
for a thermoelectric flame supervision device, time that elapses between ignition of the supervised flame and the moment when the closure element is held open by the flame signal

3.5.6
thermal equilibrium
operating state of the appliance, corresponding to a particular setting of the input, after 1 h on the reference gas

3.5.7
controlled shutdown
process by which a control device (on the appliance or external to it) causes the gas supply to the main burner to be stopped immediately

3.5.8
safety shutdown
process which is initiated immediately in response to the signal from a limiting device or sensor and which causes any burner to shut down

3.5.9
non-volatile lockout
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

3.5.10
volatile lockout
safety shut-down condition of the system, such that a restart can only be accomplished by either the manual reset of the system, or an interruption of the main power and its subsequent restoration

3.5.11
equivalent resistance (of the flue system)
resistance to flow in millibars, measured at the outlet of the appliance, which is equivalent to that of the actual flue

3.5.12
equivalent length
length of straight duct which has the same effect as the ducts to be used

3.6 marking of the appliance and packaging

3.6.1
direct country of destination (voluntary declaration by the manufacturer)
country for which the appliance has been certified and which is specified by the manufacturer as the intended country of destination.

Note 1 to entry: At the time of putting the appliance on the market and/or installation, the appliance is capable of operating, without adjustment or modification, with one of the gases distributed in the country concerned, at the appropriate supply pressure.

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

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

Note 1 to entry: Subsequent modification or adjustment is essential in order that it can be utilised safely and correctly in the country.

4 Classification of appliances

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

4.1.1 Classification of gases

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

Table 1 — Classification of gases

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

4.1.2 Appliance categories

Appliances are classified into categories defined according to the gases and the pressures for which they are designed. These are referenced in EN 437.

The national situations concerning the marketing of these appliance categories in each country, and the corresponding supply pressures, are given in Table A.1 and Table A.2 (see also in A.4 the special categories marketed locally nationally or corresponding to special gases and supply pressures indicated in Table A.4; conditions which are particular to a country are given in Annex G).

4.2 Classification according to the method of evacuation of the products of combustion

In accordance with CEN/TR 1749 appliances shall be classified into types according to the method of evacuation of the products of combustion and of admission of the combustion air:

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

Type B_1: A type B appliance incorporating a draught diverter which is upstream of the heat exchanger. For the purposes of this standard the open front is considered a draught diverter.

For the purposes of this European Standard a type B_1 appliance is an appliance that is connected directly or by means of an adaptor to a flue. A closure plate is not considered to be an adaptor.

Type B_{11}: A natural draught B_1 appliance.

Type B_{11AS}: A type B_{11} appliance fitted with an atmospheric sensing device.

Type B_{11BS}: A type B_{11} appliance fitted with a combustion products discharge safety device.

Type B_{14}: A type B_1 appliance having an integral fan downstream of both the combustion chamber/heat exchanger and the draught diverter.

Type B_{14AS}: A type B_{14} appliance fitted with an atmospheric sensing device.

Type B_{14BS}: A type B_{14} appliance fitted with a combustion products discharge safety device.

5 Constructional requirements

5.1 General

5.1.1 Conversion to different gases

5.1.1.1 General

In accordance with the definitions given in 5.1.1.2, 5.1.1.3 and 5.1.1.4 the only acceptable modifications and/or adjustments when converting from a gas of one group or family to another group or family and/or for adapting to a different gas distribution pressure, are given in 5.1.1.2 to 5.1.1.4 for each appliance category.

For type B_{11AS} appliances, when the operation of atmospheric sensing devices depends upon the characteristics of the gas (including pressure), a change of the complete atmosphere sensing device is required when converting from a gas of one family to a gas of another family, or from one pressure or pressure couple to another within the 3rd family, if this is specified in the technical instructions of the appliance.

5.1.1.2 Category I

Categories I_{2H},I_{2L},I_{2E}, I_{2E+}: Modification and/or adjustment of the appliance is not applicable.

Category I_{3+}: No modification and/or adjustment of the appliance except for replacement of the injectors or restrictors in order to convert from one pressure couple to another (e.g. 28 mbar to 30 mbar/37 mbar <=> 50 mbar/67 mbar). Exchange of fixed primary aeration restrictor when changing from one pressure couple to another or from one pressure to another within a pressure couple is permitted.

Category I_{3P}, $I_{3B/P}$: No modification and/or adjustment of the appliance with respect to a change of gas. For a change of pressure range, replacement of injectors, and adjustment of gas rates and exchange of fixed primary aeration restrictor is permitted.

5.1.1.3 Category II

5.1.1.3.1 Appliance categories designed for use on gases of the first and second families

The following modifications and/or adjustments are permitted but only when converting from a gas of one family to a gas of another family:

— adjustment of the gas rate with, if necessary, a change of injectors, restrictors or regulator;

— replacement of a burner assembly;

— replacement of complete ignition burners or some of its parts;

— exchange of fixed primary aeration restrictor.

If the appliance is intended to function without an operational regulator for use with gases of the second family, it is obligatory to put the regulator out of service in these circumstances (see 5.2.5).

It is obligatory to put gas rate adjusters out of service for use with gases of the second family (see 5.2.2).

5.1.1.3.2 Appliance categories designed for use on gases of the second and third families

The following modifications and/or adjustments are permitted but only when converting from a gas of one family to a gas of another family:

— adjustment of the gas rate with, if necessary, a change of injectors, restrictors or regulator;

— replacement of a burner assembly;

— replacement of complete ignition burners or some of its parts;

— exchange of the fixed primary aeration restrictor.

The regulator shall be put out of service where this is required in accordance with the requirements of 5.2.5.

Gas rate adjusters shall be put out of service in accordance with requirements of 5.2.2.

The following modifications and/or adjustments are permitted when changing from one pressure couple to another or from one pressure range to another:

— Replacement of the injectors or restrictors in order to convert from one pressure couple to another within the third family (e.g. 28 mbar to 30 mbar/37 mbar <=> 50 mbar/67 mbar).

— Exchange of fixed primary aeration restrictor when changing from one pressure couple to another or from one pressure to another within a pressure couple is permitted.

For a change of pressure range in the case of appliance categories using third family gases without a pressure couple (i.e. "3P" and "3B/P"), replacement of injectors, adjustment of the gas rates and exchange of fixed primary aeration restrictor is permitted.

5.1.1.4 Category III

Category III appliances admitted in certain countries are given in A.4.

5.1.2 Materials and method of construction

The quality and thickness of the materials used in the construction of the appliance, and the method of assembling the various parts, shall be such that the constructional and operational characteristics do not alter significantly

during a reasonable life under normal conditions of installation and use, when the appliance is installed according to the technical instructions of the appliance.

For built-in appliances, if an appliance is supplied in several sub-groups which have to be assembled on installation, it shall be possible to carry out this operation without ambiguity when assembling in accordance with the technical instructions. If a special tool is required, it shall be detailed in the technical instructions appliance or supplied with the appliance. Any components or materials necessary to assemble these sub-groups shall be supplied by the manufacturer.

Parts which may be removed for routine maintenance by a service engineer shall be so designed and arranged that soundness is assured after reassembly.

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

If condensation is produced at start-up, this shall not:

— affect the operational safety;

— escape from the appliance into the room.

If the appliance has any bricks, radiants or imitation fuel that is not fixed, then the appliance when installed shall incorporate an enclosure or fire front or both, to retain the fuel. When the fire front is removable without the use of tools its removal shall not allow the imitation fuel to fall out.

Asbestos or materials containing asbestos shall not be used.

Sheet metal parts in contact with products of combustion and not made of corrosion-resistant material shall be coated with an effective protection against corrosion, e.g. enamel.

Thermal or acoustic insulation shall be non-combustible, securely located and protected against mechanical damage.

Copper shall not be used for those parts of the gas circuit which exceed 100 °C when the appliance is in normal use, when tested in accordance with 7.4.

5.1.3 Accessibility for use and maintenance

Any control placed in the gas circuit shall be so arranged that any adjustment, maintenance or exchange is easy.

Removable parts shall be so designed or marked that they are easy to reassemble correctly according to the manufacturer's instructions and obviously incorrect when reassembled incorrectly.

It shall be possible to complete all the operations of removal and reassembly of parts which the user has to carry out in the course of routine maintenance as explained in the instructions, without the aid of a tool.

Removable parts shall be dismountable for maintenance.

An appliance shall be capable of being fixed securely. The technical installation instructions of the appliance shall give relevant and precise information.

Parts that are not intended to be removed by the user and that on removal may result in a hazard, e.g. injector jets, shall require the use of tools for their removal.

If the manufacturer’s instructions specify the removal of the appliance for servicing, any joint specified in the gas circuit for this purpose shall be capable of being checked for gas soundness after re-assembly.

5.1.4 Connections

5.1.4.1 Appliance inlet connections

For appliance inlet connections see A.6.

Appliances shall not be supported by their connections.

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

a) a thread conforming to EN ISO 228-1. In this case the end of the gas inlet connection shall have a flat annular surface at least 3 mm wide for thread sizes1/2" and 3/8" and at least 2,5 mm wide for thread size1/4", to allow the interposition of a sealing washer. When the end of the gas inlet connection has a thread of nominal size 1/2", 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 ISO 7-1;

c) a compression fitting suitable for copper tube conforming to Table 2 of EN 1057:2006+A1:2010;

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

e) a cone-seated union.

5.1.4.2 Access to the inlet connection

The position of the connection shall be such that connection to the gas supply can be made easily with tools in common use.

5.1.5 Soundness of the gas circuit

Holes for screws, studs, etc., intended for the assembly of components shall not open into the gasways. The residual wall thickness shall be at least 1 mm. Brackets for supporting components shall not be interposed in any gas-carrying joints.

The soundness of components and assemblies connected to the gas circuit and likely to be dismantled for routine maintenance at the consumer's premises with the exception of taps and cocks shall be assured by means of mechanical joints, e.g. metal to metal joints, o-ring joints or packing, but excluding the use of any sealing compound such as tape, mastic or paste. The soundness shall be maintained after dismantling and reassembly.

Sealing compounds may be used for permanent threaded assemblies and injectors and grease for taps and cocks. The sealing material shall remain effective under normal conditions of use.

The soundness of the gas circuit assemblies shall not be achieved by means of soft solder for which the lowest temperature of the melting range, after application, is less than 450 °C.

5.1.6 Soundness of the combustion circuit (Type B_1 appliances)

The soundness of an appliance up to the draught-diverter shall be effected 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 conditions of use.

Parts which may be removed for routine maintenance by a service engineer shall be so designed and arranged that soundness is assured after reassembly.

5.1.7 Evacuation of combustion products

5.1.7.1 Type B_1 appliances

For vertical flues, the flue socket shall be female. All sockets shall have a circular terminal section, and allow connection, if necessary by means of an adapting piece supplied with the appliance, to a flue pipe of a diameter which meets the requirements in force in the country where the appliance is to be installed (see Table A.6).

It shall be possible to insert into the socket a pipe, with an outside diameter of (D - 2) mm, for a distance of at least equal to:

a) 30 mm for a horizontal connection,

b) 15 mm for a vertical connection,

but it shall be impossible to insert it to such a depth that the evacuation of the products of combustion is impaired.

The appliance shall be constructed to prevent the release of combustion products in a dangerous quantity into the room under abnormal draught conditions (see 6.9).

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

As these appliances use the open front as the draught diverter, no additional draught diverters are permitted.

5.1.7.2 Type B_{14} appliances

The appliance may be fitted with a means of adjustment in the combustion circuit in order to keep the flue losses constant independently of the flue length. This adjustment is effected either by restrictors or by fixing the means of adjustment to predetermined positions in accordance with detailed instructions from the manufacturer. The assembly of the various parts during installation shall be such that no work is necessary other than adjusting the length of the combustion products evacuation duct (possibly by cutting them). Such adaption shall not impair the correct operation of the appliance.

It shall be possible to connect these ducts to the appliance using ordinary tools if necessary. The accessories and fitting instructions shall be supplied by the manufacturer.

Where the appliance is intended to be fitted to a flue having a wall termination:

— the manufacturer shall either supply a flue terminal or state the type of termination which shall be used. The design of this shall be such that it will not allow entry of a ball of 16 mm diameter applied with a force of 5 N. The design of the flue system shall be such that any condensate formed when operating the appliance from cold shall either be retained and subsequently re-evaporated or discharged clear of the wall. In addition, a terminal guard shall be fitted in accordance with the National Regulations applicable in the various member countries;

— any accessories (e.g. wall liner, terminal guard) shall be specified or supplied by the manufacturer;

— 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.

5.1.7.3 Built-in appliances

A built-in appliance shall be so designed that the combustion air inlet is unimpaired when the appliance is installed in accordance with the manufacturer's instructions.

5.1.8 Electrical equipment

The electrical equipment of the appliance shall be so designed and constructed as to obviate hazards of an electrical origin and shall comply with the requirements of EN 60335-2-102 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 with regard to electromagnetic compatibility immunity levels.

If the technical instructions specify the nature of the electrical protection of the appliance on the data plate, this specification shall comply with EN 60529 to give the degree of personal protection against contact with dangerous electrical components.

5.1.9 Safety in the event of interruption and restoration of the auxiliary energy

When interruption and subsequent restoration affects safety, then interruption and subsequent restoration of the electricity supply at any time during the starting up or operation of the appliance shall result in safety shutdown.

The appliance is deemed to be safe in the event of normal and abnormal fluctuation of the mains voltage supply by carrying out the test 7.7.3.1 and complying with the requirements of 6.5.3 and 6.7.1 b).

5.1.10 Guarding

Appliances which are to be marketed for installation such that all or part of the flame or incandescent material project more than 50 mm into the room or living space shall be tested with a dress guard which meets the requirements of Annex I. Where the dress guard is not supplied with the appliance, the appliance shall carry a warning label, which states the following:

> 'An optional dress guard is available from the manufacturer. If this dress guard is not fitted, the user is warned of the hazard caused by the open flames.'

Appliances which are to be marketed for installation such that no part of the flame or incandescent material project more than 50 mm into the room or living space are not required to be tested with a dress guard, but, depending on national installation standards, regulations, or rules in force, shall include in the installation instructions the statement specified in the final paragraph of 8.3.2.1.

5.2 Adjusting, control and safety devices

5.2.1 General

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

Any adjuster or control which is not intended to be altered by the user or the installer shall be sealed such that any unauthorised adjustment is obvious.

NOTE Paint can be used for sealing provided that it withstands the temperature to which it is subjected during normal operation of the appliance.

5.2.2 Gas rate adjusters

It shall be possible to seal gas rate adjusters after adjustment; this seal shall resist the heat to which it is subjected during normal operation of the appliance. The adjusting screws shall be so located that they cannot fall into the gasways.

Gas rate adjusters shall be so designed that they are protected against adjustment by the user once the appliance has been installed and put into service.

The soundness of the gas circuit shall not be put at risk by the presence of gas rate adjusters.

Appliances in categories $I_{2H,}$, I_{2L}, I_{2E}, $I_{2E+,}$ I_{3+}, $I_{3B/P,}$ $I_{3P,}$ $II_{2H3B/P,}$ II_{2H3+}, $II_{2H3P,}$ II_{2L3P}, $II_{2L3B/P,}$ $II_{2E3B/P,}$ II_{2E+3+} and II_{2E+3P} shall not be fitted with gas rate adjusters. However, appliances with regulator in all of these categories except category I_{2E+} and II_{2E+3+} may have a gas rate adjuster consisting of an adjusting screw on the gas regulator.

Appliance in category II_{1a2H} and all categories in III shall have a gas rate adjuster for 1st family gases.

For appliances in category II_{2H3+} having an adjuster which is the regulator adjusting screw (see 3.3.1.5), it shall be possible to put this device out of service when these appliances are supplied with a 3rd family gas, and the same applies for appliances in category II_{1a2H} when they are supplied with a 2nd family gas. For appliances in category II_{2E+3P} having a gas rate adjuster, it shall be possible to put these devices out of service fully or partially (see 5.2.5) when these appliances are supplied with a 2nd family gas.

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

5.2.3 Shut-off valves

5.2.3.1 General

An appliance shall have a device that will allow the gas to the burner and to any ignition burner to be shut off as required. Operation of this device may be manual or automatic, but the shut-off shall be effected without delay, for example it shall not be subject to the inertia time of the safety device.

The gas line shall be fitted with either a thermoelectric device or a valve of class A, B or C to shut off the gas supply to the main burner and ignition burner, if any.

NOTE The flame detector can operate on this valve.

Appliances shall have, in addition, a second valve of either class A, B or C.

Any electrically operated automatic shut-off valve shall comply with EN 161.

Any multifunctional control shall comply with EN 126.

Examples of gas valve arrangements for automatic controls are given in Annex C. Any other arrangement giving at least an equivalent level of safety is permissible.

When a single push button operates a safety device that controls both burner and ignition burner, no markings are required if incorrect operation is not possible.

5.2.3.2 Taps

To indicate a reduced rate position, the tap shall have either a stop at the end of the travel when the reduced rate position is beyond the full-on position, or an arrest position when the reduced rate position is situated between the full-on and the off positions.

If an appliance has two separate shut-off devices, one for the burner and one for the ignition burner, the controls for these devices shall be interlocked in such a way that it is impossible for the main burner to be supplied before the ignition burner. If the burner and ignition burner are served by a single shut-off device the ignition burner ignition position shall be indicated by a stop or notch that provides a definite arrest. It shall be possible to operate the shut-off and unlocking device with one hand only.

If a control knob operates by turning, movement in a clockwise direction by a user facing the knob shall close the gasway.

NOTE The thermoelectric device/main valve and tap/second valve can be either combined or in separate units.

5.2.3.3 Control knob

A control knob shall be designed and placed so that it can neither be mounted incorrectly nor move by itself.

The "off" position on a tap or control shall be marked indelibly and clearly, as a disc. The markings for other positions are optional.

5.2.4 Flame supervision devices

An appliance shall have a flame supervision device. It shall control the gas supply to the main burner and to any ignition burner, if fitted.

The flame supervision device shall be securely located in relation to every component with which it is designed to operate.

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

Failure of the means of sensing shall lead to safety shut down.

An atmospheric sensing device can serve as a flame supervision device providing it satisfies the requirements of 6.9.

5.2.5 Pressure regulators

Pressure regulators shall comply with EN 88.

An appliance in category I_{3+} shall not have a pressure regulator.

The pressure of appliances of category I_{2E+}, and all other categories which have the index "E+", shall not be governed. However, if a gas pressure regulator is fitted, it shall not function within the range of the two normal pressures of the second family pressure couple, i.e. 20 mbar to 25 mbar.

Regulators are optional for an appliance in the other categories.

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

The design and accessibility of the pressure 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.

5.2.6 Automatic burner control system

Automatic burner control systems shall comply with EN 298.

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

When tested as described in 7.10.2.1, the rapid (on and off) manual operation of any start switch shall not set up a hazardous condition.

5.2.7 Thermostats

Any mechanical thermostat shall comply with EN 257.

Any electrical thermostat shall comply with type 2 of EN 60730-2-9.

Any thermostat control handle shall be placed in an accessible location; its positions shall be marked with graduations.

5.2.8 Spillage monitoring system

Appliances shall be so constructed that in abnormal draught conditions there is no release of combustion products in a dangerous quantity into the room concerned.

Any safety device used for this purpose shall:

— not have any adjustment other than that made and sealed by the manufacturer;

— be so designed that it cannot be removed or dismantled without the use of a tool;

— have electrical insulation that will withstand the thermal and chemical stresses resulting from spillage of the combustion products;

— be designed such that interruption of any link between the sensor and the device shall cause safety shutdown, if necessary after a waiting time;

— for fan-flued appliances, not operate on the same gas valve as the device used to ensure the evacuation of flue gases (see 5.4).

5.3 Ignition devices

5.3.1 General

Ignition of the ignition burner (or main burner if there is no ignition burner) shall be possible from a safe and easily accessible position.

If an appliance is not fitted with an automatic burner control system, it shall be possible to light the ignition burner safely with a match or a wooden spill in the event of failure of the ignition device (e.g. piezo).

The appliance shall be designed such that it shall not be possible to achieve ignition of the ignition burner and/or main burner by any means when the appliance is left unattended.

The appliance shall be designed such that it shall only be possible to achieve ignition of the ignition burner and/or main burner by a person in the room in which it is installed. A thermostat shall also meet the requirement. A thermostat may be used to regulate the input of the appliance, but shall not be able to turn the appliance, or its main burner, on or off.

It shall be possible to determine readily that the ignition burner (or main burner if there is no ignition burner) is alight.

Ignition burners and ignition devices shall be protected by design and position against diminution or extinction resulting from, for example, 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 burners

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

Ignition burners shall be protected against blockage by gas borne particulate matter.

Any ignition burner aeration adjuster shall be pre-set and locked or sealed by the manufacturer.

5.4 Evacuation of flue gases (Type B_{14} appliances only)

Appliances shall be fitted with a suitable device to ensure satisfactory evacuation of flue gases.

The flue gas monitoring device shall be proved in the 'no flow' state prior to start-up. Failure to prove 'no flow' shall prevent start-up.

Failure to prove adequate flow of flue gases shall cause safety shut-down.

Flue gas flow failure during operation of the appliance shall result in closure of both shut-off valves (including a thermoelectric device) in the main gas line. The appliance shall clear its products of combustion at all times prior to closure of the shut-off valves. Compliance with 6.2.2.1 shall be checked. This is regarded as the appliance spillage monitoring system (see 5.2.8) and the requirements of 6.9 are not applicable.

5.5 Flame supervision systems (Appliances with automatic burner systems only)

The technical instructions manufacturer shall specify the safety time (see 6.10.2.2).

Upon flame failure during the running condition the flame supervision device shall cause non-volatile lock-out. In the case of appliances with direct ignition of the main burner, one of the following is allowable, provided that such attempts cannot give rise to a hazardous condition:

a) spark restoration within 1 s of the disappearance of the flame signal and within the safety time specified by the manufacturer,

   or

b) a single restart attempt.

In the event that re-ignition is unsuccessful, non-volatile lock-out shall occur.

5.6 Ignition burner or start-gas flame establishment

5.6.1 Appliances with non-automatic burner systems

If an appliance is fitted with a separate ignition burner, the heat input of the ignition burner shall not exceed 0,3 kW.

5.6.2 Appliances with automatic burner systems

A start gas flame may be established at the main burner.

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

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

5.7 Main flame establishment

5.7.1 General

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

5.7.2 Appliances with non-automatic burner systems

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

5.7.3 Appliances with automatic burner systems

The main gas safety shut-off valves (see Annex C, b) 2)) shall not be energised to admit the main gas flow to the burner until after the start-gas flame has been detected.

5.7.4 Direct establishment of the main flame

Direct ignition of the main burner is allowable for appliances which:

a) incorporate an automatic ignition system;

or

b) have a start-gas heat input ≤ 4 kW.

The ignition source shall not be energised before a safe-start check has been made of the flame supervision system and shall be de-energised at, or before, the end of the safety time.

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

5.8 Burners

5.8.1 General

Every removable injector and/or removable restrictor shall carry an indelible means of identification preventing any confusion.

The section of the flame ports shall not be adjustable.

Removal and replacement of the burner, in accordance with the manufacturer's instructions shall be possible using commercial tools (i.e. tools which are available on the open retail market).

The burner position shall be well defined and the burner shall be difficult to fit incorrectly.

The relative position between the burner(s) and injector(s) shall be well defined.

5.8.2 Pan burners

For those appliances using a pan burner, the pan shall hold and define the quantity of distribution medium.

5.9 Motors and fans

Fan to assist in the evacuation of flue gases

The parts of a fan in contact with combustion products shall be effectively protected against corrosion unless they are of corrosion resistant material. Furthermore, they shall withstand the temperature of the combustion products.

5.10 Pressure test points

A pressure test point shall be provided on the appliance for measurement of the manufacturer's stated operating pressure. An appliance without regulator shall have one pressure test point and an appliance with regulator shall have two test points, one to measure pressure at the appliance inlet and another downstream of the regulator.

The pressure test nipple shall have an external diameter of $(9\,^{0}_{-0,5})$ mm and a useful length of at least 10 mm for connection to tubing. The diameter of the hole in the test point shall be not greater than 1 mm at its narrowest point.

5.11 Additional requirements for appliances where a fan is supplied for outdoor installation and is fitted to assist the evacuation of flue gases

5.11.1 General

The fan and compartment shall be so constructed that it is fully protected against the rigours of the environmental conditions under which it is expected to operate. It shall comply with EN 60529, IP44. The appliance manufacturer shall state the ambient temperature range and it shall be verified that the operation of the fan is suitable for this range.

5.11.2 Access panels and doors

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

5.11.3 Dimensions of openings

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

5.11.4 Fixing screws

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

6 Operational requirements

6.1 General

Unless otherwise specified the test gases and conditions of test are given in 7.1.

6.2 Soundness

6.2.1 Soundness of the gas circuit

The gas circuit shall be sound. It is deemed to be sound if, when tested as described in 7.2.1, the external 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.

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

6.2.2.1 General

a) When tested as described in 7.2.2.1 a), any leakage shall not exceed 0,04 m^3/h per kW of heat input.

   Alternatively,

b) when tested as described in 7.2.2.1 b), any leakage of products of combustion from the appliance shall not exceed the ambient CO_2 by more than 0,02 %.

6.2.2.2 Supplementary tests

For an appliance incorporating a door which is required to be opened, or a panel which is required to be removed, during ignition of the ignition burner and/or maintenance of the appliance, when tested as described in 7.2.2.2 it shall comply with 6.2.2.1 a) or 6.2.2.1 b), as appropriate.

6.2.3 Escape of unburnt gas

When the appliance is tested as described in 7.2.3, there shall be no escape of an ignitable quantity of gas between the injector outlet and the external surface of the burner, excluding the flame ports.

6.3 Heat inputs

6.3.1 Nominal heat input

When measured in accordance with the procedures described in 7.3.1:

a) for an appliance without a gas rate adjuster, under the test conditions described in 7.3.2, the heat input obtained at normal test pressure shall be within ± 5 % of the nominal heat input;

b) for an appliance with a gas rate adjuster but no regulator, the heat input shall be at least equal to the nominal heat input when measured under the conditions described in 7.3.3, test No.1, and shall not exceed the nominal heat input when measured under the conditions described in 7.3.3, test No. 2;

c) an appliance with a regulator shall comply with 6.6.

6.3.2 Start gas heat input

The heat input shall be measured in accordance with 7.3.4. If there is a gas rate adjuster, it shall allow an ignition burner rate necessary for assured ignition of the burner at all gas inlet pressures between the minimum and maximum values given in 7.1.4.

6.3.3 Reduced rate

When tested as described in 7.3.5, any reduced rate specified by the manufacturer shall be within ± 10 % of the specified rate.

6.4 Temperature of various parts of the appliance

6.4.1 Temperature of external parts of the appliance

When tested as described in 7.4.1 and 7.4.2, the surface temperature of the control handles and of all the parts that have to be manipulated during normal operation of the appliance, measured only in the areas intended to be touched shall not exceed the ambient temperature by more than:

35 K for metals and equivalent materials;

45 K for porcelain and equivalent materials;

60 K for plastics and equivalent materials.

The temperature of those parts of the appliance other than working surfaces (see 3.1.6) shall not exceed the ambient temperature by more than:

80 K for base metal;

95 K for glass enamelled steel, coated or painted metals and equivalent materials;

100 K for plastics, rubber or wood.

6.4.2 Temperature of components

When the appliance is tested as described in 7.4.1 and 7.4.3, the temperature of any component (including taps) shall not exceed that declared by the component manufacturer.

In addition, at the end of the test any taps fitted shall be easy to turn.

6.4.3 Temperature of floor, shelf and walls

6.4.3.1 Tests shall be carried out as described in 7.4.1 and 7.4.4.

6.4.3.2 For appliances intended to be installed on, or against, non-combustible surfaces, the temperature at any user touchable point of the floor on which an appliance is to be placed and that of the walls at the sides and back of the appliance and shelf, shall not exceed the ambient temperature by more than 80 K.

6.4.3.3 For appliances intended to be installed on combustible surfaces, the temperature at any point of any floor on which an appliance is to be placed and that of the walls at the sides and back of the appliance and shelf, shall not exceed the ambient temperature by more than 60 K.

6.4.3.4 For built-in appliances, which are exclusively for installation in an enclosure made of refractory material, the temperature of the surfaces of the enclosure are not measured.

6.5 Ignition, cross-lighting and flame stability

6.5.1 Ignition and cross-lighting (for all appliances)

6.5.1.1 General

When tested as described in Test No.1 to 3 of 7.5.1.1, correct ignition of the ignition burner and main burner by the ignition burner, or, main burner if this is ignited directly, shall be smooth and cross-lighting assured.

For piezo ignition devices, the appliance shall successfully ignite eight out of ten operations of the device.

When tested as described in Test No.4 of 7.5.1.1, the main burner shall not cause a hazard to the user or deformation to the appliance and/or its components which affects safety.

Test No.4 is not carried out if the appliance is fitted with a re-start interlock, or, if the safety time (i.e. for automatic burner systems) is $\leq$ 5 s.

6.5.1.2 Effect of down draughts (for type B_{11} appliances)

Under the conditions of 7.5.1.2, ignition of any ignition burner, ignition of the main burner and complete cross-lighting of the main burner shall be correct.

6.5.2 Flame stability

6.5.2.1 General

When tested as described in 7.5.2.1, the flames shall be stable. In general, stability implies that the flames do not lift from the burner ports, combustion surfaces or jets. However, with some burners, flames may lift intermittently because of the effects of local heating or vitiation, and this should be taken into account.

6.5.2.2 Special conditions

6.5.2.2.1 Effect of room draughts

Under the test conditions described in 7.5.2.2.1, the main burner and/or ignition burner shall not light-back or be permanently extinguished.

6.5.2.2.2 Effect of down draughts (for type B_{11} appliances)

Under the test conditions described in 7.5.2.2.2, the flames shall be stable.

6.5.2.2.3 Type B_{14} appliances

Under the test conditions described in 7.5.2.2.3, the main burner and any ignition burner flames shall remain stable up until the time at which the gas supply to the main burner, and where appropriate the ignition burner, is shut off by the device according to 5.4.

6.5.3 Fluctuation of auxiliary energy

When tested as described in 7.7.3.1, the appliance shall ignite and continue to operate.

6.6 Pressure regulators

When tested in accordance with 7.6.1 the rate shall not differ by more than + 7,5 % and - 10 % for 1st family gases, and by more than ± 5 % for 2nd and 3rd family gases, from the rate obtained at the normal test pressure, when the upstream pressure is varied between the minimum and maximum values given in 7.1.4 for the reference gases of the relevant category.

Where the function of the regulator has been immobilised by the manufacturer, as given in 7.6.2 the relationship between the flow rate and the pressure shall remain constant when the inlet pressure is varied between its minimum and maximum values.

6.7 Combustion

6.7.1 CO concentration for all appliances

The CO concentration in the air-free, dry products of combustion measured as described in 7.7.1 shall not exceed:

a) 0,10 % when the appliance is supplied with reference gas under the test conditions described in 7.7.2;

b) 0,20 % when the appliance is supplied with the incomplete combustion limit gas under the test conditions described in 7.7.2, and, under all test conditions described in 7.7.3.

6.7.2 Measurement of oxides of nitrogen, NO_x, (all appliances)

When tested as described in 7.7.4, the NO_x concentration in the air-free, dry products of combustion shall not exceed the limit for the declared class given in Table 2.

For 3rd family gases and for appliances required to be tested on the reference gas G 30 the limits are multiplied by a factor of 1,3. For appliances required to be tested on the reference gas G 31 the limits are multiplied by a factor of 1,2.

Table 2 — NOx concentration limits

Classes	NO_x concentration/limits mg/kWh
1	350
2	260
3	200
4	150
5	100

6.8 Sooting

6.8.1 Cold condition

When tested as described in 7.8.3.1 and 7.8.3.2, the smoke number shall be ≤ 3.

6.8.2 Hot condition

When tested as described in 7.8.3.1 and 7.8.3.3, the smoke number shall be ≤ 2.

A limit of ≤ 3 is acceptable for appliances with a category index E+.

6.8.3 Long cycle condition

If, on completion of the tests in accordance with 6.8.1 and 6.8.2, soot is observed[1)] on the burner or fuel bed then test 7.8.3.4 shall be carried out.

When tested as described in 7.8.3.4, the increase in the CO concentration of the dry, air-free products of combustion shall not exceed 0,06 units of percent.

If, before the end of the test, this increase is exceeded, or an excessive amount of soot has been deposited on the burner or fuel bed, the appliance shall be deemed unsatisfactory.

6.9 Spillage monitoring system

6.9.1 Atmosphere sensing device (type B_{11AS}, and, B_{14AS} appliances only)

When tested as described in 7.9.1 and 7.9.2, the appliance shall go to safety shutdown before the CO concentration of the atmosphere of the test room exceeds 200×10^{-6} (*V/V*).

6.9.2 Combustion products discharge safety device (type B_{11BS}, and B_{14BS} appliances only)

6.9.2.1 Nuisance shutdown

When the appliance is tested as described in 7.9.1, 7.9.3.1 and 7.9.3.2, shutdown shall not occur.

6.9.2.2 Shutdown times

When the appliance is tested as described in 7.9.1, 7.9.3.1 and 7.9.3.3, the shutdown times given in Table 3 shall not be exceeded.

Table 3 — Shutdown times

Degree of blockage	**Diameter of opening in blocking plate**	**Maximum shutdown time s**	
	d	Q_n	Q_m
Complete blockage	0	200	$200 \bullet \frac{Q_n}{Q_m}$
Partial blockage	0,6 *D* or 0,6 D'	600	
where *D* is the internal diameter of the test flue at its top D' is the hole diameter necessary to obtain spillage Q_n is the nominal heat input Q_m is the minimum heat input for modulating appliances or appliances with several rates			

1) Fine powdery deposits are ignored.

Where safety shutdown occurs, automatic restart shall be possible only after a minimum waiting time of 10 min. The manufacturer shall state in the technical instructions the actual waiting time of the appliance.

6.10 Flame supervision device

6.10.1 Thermoelectric device

6.10.1.1 Cold condition

When tested as described in 7.10.1.1, any flame supervision device shall open fully from cold in not more than 60 s.

No device shall require more than 20 s of sustained manual operation before opening.

6.10.1.2 Hot condition

When tested as described in 7.10.1.2, any flame supervision device shall close from the fully heated condition within 60 s.

6.10.2 Automatic burner control system

6.10.2.1 General

When tested as described in 7.10.2.1, the rapid (on and off) manual operation of any start switch shall not set up a hazardous condition.

6.10.2.2 Safety time

The safety time specified by the manufacturer (see 5.5) is verified as described in 7.10.2.2.

6.10.2.3 Extinction delay time

When tested as described in 7.10.2.3, the time for the flame supervision device to de-energise the burner safety shut-off valves upon flame failure shall be not more than 3 s.

6.11 Flue gas monitoring device (For Type B_{14} appliances only)

6.11.1 General

One of the following requirements, 6.11.2 to 6.11.3, shall be met, depending on the principle of air proving (see also 5.4).

6.11.2 Voltage reduction

Under the conditions of 7.11.2, when the fan supply voltage is progressively reduced, the gas supply shall be shut off before the CO concentration exceeds 0,2 %.

6.11.3 Restricted flue

Under the conditions of 7.11.3, the gas supply shall be shut off before the CO concentration exceeds 0,2 %.

6.12 Efficiency

The technical instructions shall specify the efficiency class of the appliance.

When the appliance is tested as described in 7.12.1, the efficiency obtained (see 7.12.2) with the appliance operating at its nominal heat input shall be at least as given in Table 4, depending upon class:

— Convection heaters shall be of Class 1.

— Other appliances shall be of either Class 1 or Class 2.

Table 4 — Efficiency

Efficiency Class	**Minimum net Efficiency[a]**	**Appliances of heat input less than or equal to** 5 kW[b]
1	82 % [a]	80 % [a]
2	50 % [a]	50 % [a]

[a] The efficiency value η based on gross calorific value is related to the net value for the five reference gases as follows:

G 110 net value = 0,880 × gross value

G 120 net value = 0,882 × gross value

G 20 net value = 0,900 × gross value

G 25 net value = 0,901 × gross value

G 30 net value = 0,923 × gross value

[b] The heat input based on gross calorific value is related to the net value for the five reference gases as follows:

G 110 gross value = 1,136 × net value

G 120 gross value = 1,133 × net value

G 20 gross value = 1,111 × net value

G 25 gross value = 1,110 × net value

G 30 gross value = 1,083 × net value

7 Test methods

7.1 General

7.1.1 Characteristics of test gases: reference and limit gases

Refer to EN 437.

7.1.2 General test conditions

7.1.2.1 General

These general test conditions apply unless the test method states otherwise.

Appliances requiring assembly on installation shall be tested in the fully assembled condition.

NOTE This assembly includes all components (e.g. fascias, decorative castings).

7.1.2.2 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 acceptable provided that the test results are not affected.

7.1.2.3 Test installation

The appliance is to be installed in accordance with the manufacturer's instructions.

The gas connection and system up to and including the burner is to be examined for soundness both before and after test. The test results are deemed invalid unless the system is sound (see 7.2.1).

Test pressures are to be measured correct to 0,2 mbar and controlled so that the variation does not exceed ± 0,2 mbar.

Type B_{11} appliances: Unless otherwise specified, tests are carried out with a 1 m long flue (see Figure 3).

Type B_{14} appliances: Appliances shall be tested with a flue of diameter and maximum equivalent resistance as specified by the manufacturer.

7.1.2.4 Electrical supply (where applicable)

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

7.1.2.5 Convection fan (where applicable)

Tests are carried out with the fan in operation, except where otherwise stated in the clause concerned.

7.1.3 Practical application of test gases

7.1.3.1 Choice of test gases

Gases required for the tests described in clauses:

7.2.2 Soundness of the combustion circuit and evacuation of the combustion products

7.3 Heat input,

7.5 Ignition; cross-lighting; flame stability,

7.6 Pressure regulators,

7.7 Combustion,

shall be as given in 7.1.1 and made up in accordance with 7.1.2.

For the tests described in other clauses, it is acceptable, 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 5, and in accordance with 7.1.2.1, are used. The selected gases for each appliance category are listed in Table 5.

7.1.3.2 Conditions of supply and adjustment of the burners

7.1.3.2.1 Initial adjustment of appliance

The appliance shall be fitted with the appropriate equipment (injector(s), fixed primary aeration restrictor(s), etc.) corresponding to the gas family or gas group to which the specified test gas belongs (see Table 6). Any gas rate adjusters are set in accordance with the manufacturer's instructions using the appropriate reference gas(es) 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 is not altered.

7.1.3.2.3 Corrected pressures

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

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

7.1.3.2.4 Adjustment of heat inputs

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

The specified heat input shall be determined in accordance with 7.3.1 and with the appliance supplied with the appropriate reference gas(es).

7.1.4 Test pressures

The values of the test pressures, i.e. the pressure to be applied at the gas inlet connection to the appliance whilst in operation, are given in Table 5 and Table 6.

Table 5 — Test pressures where no pressure couple exists[a]

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

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

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

Table 6 — Test pressures where a pressure couple exists

Pressures in millibar				
Appliance categories carrying as index	**Test gas**	p_n	p_{min}	p_{max}
2nd family: 2E+	G 20, G 21 G 222	20	17 [b]	25
	G231	(25) [a]	17 [b]	30
3rd family: 3+ (28-30/37 couple)	G 30	29 [c]	20	35
	G 31, G 32	37	25	45
3rd family: 3+ (50/67 couple)	G 30	50	42,5	57,5
	G 31, G 32	67	50	80

[a] This pressure corresponds to the use of low Wobbe index gas, but in principle no test is carried out at this pressure.

[b] See A.6.

[c] Appliances of this category may be used without adjustment at the specified supply pressures of 28 mbar to 30 mbar.

7.2 Soundness

7.2.1 Soundness of the gas circuit

The appliance gas inlet is connected to an air supply capable of being constantly maintained at the appropriate pressure.

For appliances using 1st and/or 2nd family gases only, the tests are carried out with an air pressure of 50 mbar; the inlet valve is tested with an air pressure of 150 mbar. For appliances using 3rd family gases, all the tests are carried out with an air pressure of 150 mbar.

With the appliance at ambient temperature, compliance with 6.2.1 is checked under each of the following conditions:

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

b) With all valves open, including the flame supervision device, and the final unmixed gas outlets to the ignition burner and main burner sealed.

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

The method used to measure leakage is to be capable of measurement to an accuracy of at least 0,01 dm^3/h.

The tests are carried out when the appliance is delivered, and again on completion of all the appliance tests given in this standard. Any assembly in the gas circuit that has a gas-tight joint whose removal is provided for in the manufacturer's instructions is to be removed and replaced 5 times.

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

7.2.2.1 General

a) Test No. 1

The appliance shall be installed in accordance with 7.1.2.3, with the following flue lengths:

For type B_{11} appliances:

— without an outlet restrictor fitted, 1 m;

— with an outlet restrictor fitted (if applicable), 3 m;

— if the appliance has an integral flue provided by the manufacturer, the minimum length specified in the instructions.

For type B_{14} appliances, the maximum length specified in the instructions, or maximum equivalent resistance.

Any bricks, radiants and imitation fuel not positively located with respect to the burner and to each other shall be arranged at the limit of their movement.

Due note shall be taken of the manufacturer's instructions, and the ease with which refractories can be positioned.

The test is carried out after the appliance has been heated for 10 min at the nominal heat input using the reference gas or any other gas of suitable quality, any thermostat remaining fully open.

The method for measuring the amount of leakage involves collecting, in a hood placed over the appliance, the convected air output from the appliance together with any escaping products. Figure 4(a) gives details of a hood suitable for the majority of appliances. Where this hood is unsuitable a special hood is used for this purpose.

This arrangement of the hood for testing purposes is illustrated by Figure 4(b). The back panel may be adapted to fit around the fireplace opening and should be sealed to the face of the test box. The front lower edge of the hood is positioned above the likely source of leakage such that:

1) the hood is positioned as low as possible without affecting the performance of the appliance under test;

2) there is no loss of products from the bottom of the hood.

Instrumentation is required capable of measuring values of CO_2 concentration of gas of 0,002 %.

It is an advantage in this test method to minimise the flow through the collecting hood, thus increasing the CO_2 fraction of the sample. This is done by adjusting the hood damper. Care shall be taken to ensure that the hood does not spill. This is checked by sampling along the front bottom edge of the hood and comparing the CO_2 concentration with that of ambient air in the same plane as the horizontal edge of the hood (see Figure 4 a)). When the adjustment of the hood damper is completed, a period of not less than 30 min shall be allowed for the hood to stabilise to its new condition before starting the test.

Take samples of the laboratory air passing into the appliance under all sampling conditions, i.e. when CO_2 is being injected into the hood and when CO_2 is not being injected into the hood.

During the test ensure that the CO_2 concentration of the laboratory air passing into the appliance does not exceed 0,1 % and does not vary by more than $\pm$ 0,02 % during any one test.

NOTE 1 Rates of injection of CO_2 of 0,02 m^3/h and 0,04 m^3/h have been found suitable for the majority of appliances.

NOTE 2 It has been found that the laboratory air can fluctuate quite rapidly and therefore a fast response analyser or alternatively simultaneous sampling into bags is recommended.

Calculation of results:

$$V = \frac{r[b - a_1]}{([c - a_2] - [b - a_1])\,Q} \times \frac{100}{V_{CO_2,N}} \quad (1)$$

where

V is the leakage of dry undiluted products of combustion, in cubic metres per hour (m^3/h) per kilowatt (kW) of heat input;

a_1 is the CO_2 concentration in laboratory air when CO_2 is not injected into the hood, in percent, (%);

a_2 is the CO_2 concentration in laboratory air when CO_2 is injected into the hood, in percent, (%);

b is the CO_2 concentration in the hood when CO_2 is not injected into the hood, in percent, (%);

c is the CO_2 concentration in the hood when CO_2 is injected into the hood, in percent, (%);

r is the injection rate, in cubic meters per hour, (m^3/h);

Q is the appliance heat input, in kilowatts, (kW);

$V_{CO2,N}$ is the percentage of CO_2 concentration calculated for dry, air-free products of combustion of the gas involved (neutral combustion).

The values of $V_{CO2,\,N}$ (neutral combustion) for the test gases are given in Table 7.

Two pairs of results are used to calculate two values for the rate of leakage. Check that the two values are within ± 0,004 m^3/h per kW of heat input.

b) Test No.2

The appliance shall be installed in accordance with 7.1.2.3, with the following flue lengths:

For type B_{11} appliances:

— without a flue restrictor fitted, 1 m;

— with a flue restrictor fitted (if applicable), 3 m;

— the minimum length specified in the instructions.

For type B_{14} appliances, the maximum length specified in the instructions, or maximum equivalent resistance.

Any bricks, radiants and imitation fuel not positively located with respect to the burner and to each other shall be arranged at the limit of their movement.

Due note shall be taken of the manufacturer's instructions, and the ease with which refractories can be positioned. If it is obvious that any particular arrangement is not in accordance with the manufacturers instructions for assembly of the fuel bed, this arrangement shall not be used for testing purposes.

Test are carried out after the appliance has been heated for 1 h at the nominal heat input using reference gas or any other gas of suitable quality.

A suitable form of spillage detector is a 6 mm outside diameter sampling tube with holes drilled at 50 mm centres. The number of sampling holes shall be such that they are only situated over the appliance opening or the edge of the draught diverter. The sampling tube is positioned 5 mm above the top edge of the appliance opening and draught diverter, as applicable.

For other points of leakage, a single holed probe may be used. However, the sampling is to be such that it does not influence the leakage rate.

Sample across the appliance opening, around the edge of the draught diverter (if applicable) and any other possible points of leakage, and record the CO_2 concentration. Measure the ambient CO_2 concentration and calculate the difference between the two values.

Instrumentation is required capable of measuring the values of CO_2 concentration of gas of 0,002 % CO_2.

In doubtful cases, Test No.1 should be used.

7.2.2.2 Supplementary tests

7.2.2.2.1 For appliances with a door

Open the door and then close it in accordance with the manufacturer's instructions. The test described in 7.2.2.1 a) or 7.2.2.1 b) is repeated, as appropriate.

7.2.2.2.2 For appliances with a panel

Panels which have to be removed for the use, maintenance, or servicing of the appliance, are removed and replaced in accordance with the manufacturer's instructions. The test described in 7.2.2.1 a) or 7.2.2.1 b) is repeated, as appropriate.

7.2.3 Escape of unburnt gas

The test is carried out with reference gas at nominal heat input.

A suitable means is used to detect the escape of unburnt gas from the burner.

If necessary, components other than those of the burner may be removed, provided that this does not affect the test.

7.3 Heat inputs

7.3.1 Nominal heat input

The nominal gas rate is the volumetric rate V_N or mass rate M_N of the gas corresponding to the nominal heat input obtained with reference gas under reference test conditions (dry gas, 15 °C, 1 013,25 mbar).

The nominal heat input Q_N in kW is given by one of the following formulae:

$$Q_N = 0{,}278 M_N \times H_i \text{ (or } H_s) \quad (2)$$

$$Q_N = 0{,}278 V_N \times H_i \text{ (or } H_s) \quad (3)$$

where

M_N is the nominal mass rate in kilograms per hour (kg/h) obtained under reference conditions (dry gas, 15 °C, 1 013,25 mbar);

V_N is the nominal volumetric rate in cubic metres per hour (m^3/h) obtained under reference conditions (dry g as, 15 °C, 1 013,25 mbar);

H_i is the net calorific value of the reference gas in megajoules per kilogram (MJ/kg) (1st formula) or in megajoules per cubic metre (MJ/m^3) (dry gas, 15 °C, 1 013,25 mbar) (2^{nd} formula);

H_s is the gross calorific value of the reference gas in megajoules per kilogram (MJ/kg), (1^{st} formula), or in megajoules per cubic metre (MJ/m^3) (dry gas, 15 °C, 1 013,25 mbar), (2^{nd} formula).

The mass and volume rates correspond to a measurement and to a flow of reference gas under reference conditions, i.e. assuming the gas to be dry, at 15 °C and under 1 013,25 mbar pressure. In practice the values of mass and volumetric rates obtained during the tests do not correspond with these reference conditions, and have therefore to be corrected to bring them to the values that would have been obtained had the reference conditions existed during the tests, at the outlet of the injector.[2)]

When the determination is made by mass, (3rd family gas), the corrected mass rate is calculated from the formula:

$$M_o = M \sqrt{\frac{1013,25 + p}{p_a + p} \times \frac{273,15 + t_g}{288,15} \times \frac{d_r}{d}} \quad (4)$$

When the determination is made from the volumetric rate the following correction formula is used:

$$V_o = V \sqrt{\frac{1013,25 + p}{1013,25} \times \frac{p_a + p}{1013,25} \times \frac{288,15}{273,15 + t_g} \times \frac{d}{d_r}} \quad (5)$$

The corrected mass rate is calculated from the formula:

M_o=1,226 V_o·d

where

M_o is the mass rate in reference conditions;

M is the mass rate obtained in test conditions;

V_o is the volumetric rate under reference conditions at the appliance inlet;

V is the volumetric rate obtained under test conditions (measured at, or corrected to pressure p and temperature t_g);

p_a is the atmospheric pressure in millibar;

p is the gas supply pressure in millibar;

t_g is the temperature of the gas at the appliance inlet in degrees Celsius;

d is the density of dry test gas relative to that of dry air;

d_r is the density of reference gas relative to that of dry air.

These are the formulae that are used to calculate from the mass (M) or volumetric (V) rates, measured under test conditions, the corresponding M_o or V_o rates that would have been obtained under reference conditions, and it is these values , M_o and V_o, that are compared with the values M_N and V_N, calculated from the nominal heat input, using the formulae given earlier in this clause.

These formulae are applicable if the test gas used is dry.

If a wet (water filled) meter is used or if the gas is saturated, the value of d (density of dry gas in relation to dry air) is replaced by the density of the wet gas d_h given by the following formula:

2) Special precautions should be taken when the measurement of volumes of dry gases is made with a wet (water filled) meter. For 3rd family gases, if the rate is measured by volume, it is essential to use a dry meter.

$$d_h = \frac{d(p_a + p - p_w) + 0{,}622 \times p_w}{p_a + p} \quad (6)$$

where

p_w is the saturation vapour pressure of the test gas expressed in millibar at the temperature t_g.

For all the tests described in 7.3, the measurements are taken after the appliance has been operating for 1 h.

7.3.2 Calibrated injector rate of appliances without gas adjusters or where these adjusters are put out of action

To check the rate of the injectors each reference gas for the appliance category is used successively.

The appliance is fitted successively with each of the prescribed injectors and the rate is measured for each reference gas by supplying the appliance at the appropriate normal test pressure in accordance with 7.1.4.

7.3.3 Performance of gas rate adjusters for unregulated appliances

The tests are carried out with each reference gas pertaining to the appliance category but not with those for which the adjuster is put out of action.

Test No. 1

With the adjuster fully open, the supply pressure is brought to the minimum value given in 7.1.4 corresponding to the particular reference gas.

Test No. 2

With the adjuster fully closed, the supply pressure is brought to the maximum value given in 7.1.4 corresponding to the particular reference gas.

7.3.4 Start-gas heat input

The heat-input is measured as described in 7.3.1, by supplying the appliance with the appropriate reference gas(es) at normal test pressure (see 7.1.4). If an ignition burner has an adjuster, the heat input is measured at minimum test pressure (see 7.1.4) with the adjuster fully open.

7.3.5 Reduced rate

The reduced rate is measured as described in 7.3.1, by supplying the burner successively with each reference gas pertaining to the appliance category, after adjusting the burner to its nominal heat input and then turning the tap to the reduced rate position.

7.4 Temperature of various parts of the appliance

7.4.1 General

The test is carried out with reference gas at the nominal heat input.

For appliances fitted with a convection fan, if the appliance is designed such that failure of the convection fan (i.e. stoppage) does not result in closure of the gas valve(s), then the tests given below are repeated with the convection fan inoperative.

7.4.2 Temperature of external parts of the appliance

The appliance is installed as described in 7.4.4.

Initially, establish the zone that has the highest temperature. Temperature measurements are carried out when the difference between the surface temperature and the ambient temperature is constant for this zone, i.e. within ± 2 K.

The temperatures of external surfaces of the appliance are measured using a method which is accurate to within ± 2 °C.

Check the location of the working surface declared by the manufacturer.

7.4.3 Temperature of components

The temperature of components is measured during the tests for external temperature (see 7.4.2).

7.4.4 Temperature of floor, shelf and walls

7.4.4.1 General

The appliance is installed on a test rig (see Figure 5). The test rig consists of hardwood panels of thickness (25 ± 1) mm with their surfaces coated with matt black paint. Thermocouples are incorporated into each panel at the centre of squares of side 100 mm; these thermocouples penetrate the panels from the outside so that the junctions are situated 3 mm from the surface of the test panels facing the appliance.

For an appliance where the manufacturer specifies installation underneath a shelf, the manufacturer's user instructions should state any limitations on the height of the shelf above the appliance and shelf depth. An appropriate shelf of maximum recommended depth is placed at the minimum height above the appliance with the appropriate insulating material, if necessary, which should be supplied by the manufacturer.

For an appliance which is intended to be installed on a combustible surface, the manufacturer should indicate in the installation instructions the nature of the effective protection to be applied between the appliance and the floor, shelf or walls. This protection should be supplied to the test laboratory.

If the manufacturer states in the instructions that it is necessary to use effective protection to limit the temperature, the test is carried out with the appliance fitted with the protection.

The appliance is installed and tested as described in 7.4.4.2 or 7.4.4.3 with the burner adjusted to its nominal heat input using reference gas.

7.4.4.2 Built-in appliances

The appliance is installed in a test box, which is to be supplied by the manufacturer if requested by the test house. The test box comprises three walls, a floor and a ceiling, the internal dimensions being those of the minimum space specified in the installation instructions.

The test box should:

a) be made either in wood or in temperature-resistant materials for appliances intended exclusively for installation in a space made entirely of refractory materials;

b) have sufficient mechanical resistance;

c) have sufficient tightness between its walls;

d) allow the appliance to be installed according to the manufacturer's instructions;

e) accommodate any recess ventilation specified in the installation instructions.

Initially, on the external face of each wall of the test box, establish the zone that has the highest temperature. When the difference in the surface temperature and the ambient temperature for each zone is constant, i.e. within ± 2 K, thermocouples are placed from the outside of the walls in recessed holes in such a way that their hot junctions are in contact with the wood at 3 mm from the inner faces of the test box. Measure the difference between the surface temperature of the inner face and the ambient temperature for each zone.

7.4.4.3 All other appliances

The appliance is installed in a test corner (see Figure 5). The distance between the back and side surfaces and test panels are the minimum distances specified by the manufacturer or, where appropriate, that distance created by fixing to the wall. The side panel is placed at the side of the appliance where the temperatures are the highest.

Initially, for each surface of the test rig, establish the zone that has the highest temperature. All measurements are taken when the difference between the surface temperature and the ambient temperature for each zone is constant, i.e. within ± 2 K.

It is recommended that for this test the appliance should be placed in a room where the ambient temperature is approximately 20 °C. This is measured at a height of 1,50 m and at least 3 m from the appliance using a thermometer which is protected from the influence of stray heat.

7.5 Ignition, cross-lighting and flame stability

7.5.1 Ignition and cross-lighting

7.5.1.1 General

The following tests are carried out with the appliance at ambient temperature and thermal equilibrium.

Test No. 1

For this test, the burner and ignition burner are adjusted in accordance with 7.1.3.2.1 and the appliance is supplied with the appropriate reference and limit gases, according to appliance category (see Table 5), at the normal pressure (see 7.1.4).

Turn the appliance off and allow to cool to ambient temperature. Ignite the appliance according to the manufacturer's instructions.

The test is repeated either at the minimum rate given by the thermostat, where this exists, or at the rate obtained when the tap is in the reduced rate position if ignition is possible under these conditions in normal use according to the manufacturer's recommended procedure.

For piezo ignition devices, short out the electrodes after each ignition attempt.

Test No. 2

For this test, the initial adjustments of the burner and of the ignition burner are not altered and the appliance is supplied with reference gas under the following conditions.

a) If the appliance has no pressure regulator, the pressure at the appliance inlet is reduced to 70 % of the normal pressure (see 7.1.4) or a pressure to give 80 % of the ignition rate, whichever is the lowest, for 1st and 2nd family gases and to the minimum pressure for 3rd family gases (see 7.1.4).

b) If the appliance has a pressure regulator, the pressure is also lowered to a value equal to 70 % of the normal pressure, but the pressure downstream of the pressure regulator is lowered, if necessary, to obtain a heat input equal to 90 % of the nominal heat input for 1st family gases or 92,5 % of the nominal heat input for 2nd family gases, or 95 % of the nominal heat input for third family gases.

Under these supply conditions ignite the burner by the ignition burner.

The test is repeated either at the minimum rate given by the thermostat, where this exists, or at the rate obtained when the tap is in the reduced rate position if ignition is possible under these conditions in normal use according to the manufacturer's recommended procedure.

Test No. 3

a) For this test, the initial burner or ignition burner adjustment are not altered and the appliance is supplied with reference gas. The pressure is reduced at the appliance inlet to the minimum pressure (see 7.1.4). For an appliance with a pressure regulator, the pressure downstream of the pressure regulator is reduced, if necessary, to obtain a heat input equal to 90 % of the nominal heat input for 1st family gases or 92,5 % of the nominal heat input for 2nd family gases, or 95 % of the nominal heat input for third family gases (for the reference gases).

b) The ignition burner gas rate is reduced to the minimum required to keep the gasway to the burner open.

   The necessary reduction in the ignition burner gas rate may be achieved either:

   — by the adjustment of the ignition burner rate adjuster, if this exists;

   or, if this is not possible,

   — by means of adjustment of an adjuster inserted into the ignition burner gas supply system for this purpose.

c) The correct ignition of the burner by the ignition burner is then checked.

The test is repeated either at the minimum rate given by the thermostat, where this exists, or at the rate obtained when the tap is in the reduced rate position, if ignition is possible under these conditions in normal use according to the manufacturer's recommended procedure.

Test No. 4

The appliance is initially adjusted as described in 7.1.3.2.1 and supplied with the appropriate reference gas(es) (see Table 5) at nominal heat input.

Ignition of the main burner is checked. The test is repeated progressively delaying the ignition up to the end of the safety time declared by the manufacturer or 60 s for manual ignition.

In order to delay the ignition it generally will be necessary to provide independent control of the main gas or start gas automatic shut-off valves and the operation of the ignition device. A suitable arrangement is to provide a voltage supply, independent of the automatic burner control system, to the relevant gas valve(s) and to the ignition device. The ignition delay should be increased in stages.

7.5.1.2 Effect of down draughts (for type B_{11} appliances)

The appliance is supplied with an appropriate reference gas (see Table 5) at the corresponding normal pressure (see 7.1.4). It is connected to a flue of the same nominal diameter as the flue connection and straight for a length of not less than 10 times the diameter immediately above the draught diverter. A down-draught giving a pressure of 5,4 Pa at the base of the flue is applied through the flue using a suitable down-draught apparatus (see Figure 6).

7.5.2 Flame stability

7.5.2.1 General

The following tests are carried out with the appliance at ambient temperature and thermal equilibrium.

Test No. 1

For this test, the burner and ignition burner are adjusted in accordance with 7.1.3.2.1 and the appliance is supplied with the appropriate light-back limit gas (see Table 5) at the minimum pressure (see 7.1.4).

For an appliance with a pressure regulator, the pressure downstream of the pressure regulator is reduced, if necessary, to obtain a heat input equal to 90 % of the nominal heat input for 1st family gases or 92,5 % of the nominal heat input for 2nd family gases or 95 % for 3rd family gases.

Under these supply conditions check that the flames are stable.

The test is repeated either at the minimum rate given by the thermostat, where this exists, or at the rate obtained when the tap is in the reduced rate position.

Test No. 2

For all appliances without a pressure regulator, the initial burner and ignition burner adjustments are retained and the appliance is supplied, at the maximum pressure (see 7.1.4) with the flame-lift limit gas. The absence of flame-lift in normal use is checked.

For an appliance with a pressure regulator, the test is carried out by increasing the burner rate to a value corresponding to 107,5 % of the nominal heat input for 1st family gases or 105 % of the nominal heat input for 2nd family gases and 3rd family gases, flame lift gas is then substituted for the reference gas.

7.5.2.2 Special conditions

7.5.2.2.1 Effects of room draughts

The appliance is supplied with the reference gas at normal pressure and is subjected at burner level to a wind stream of 2 m/s. The wind stream covers at least the width of the burner.

The axis of the wind stream is in a horizontal plane and is moved one or more (at the discretion of the laboratory) angles of incidence within a semi-circle in front of the appliance, the centre of the semi-circle being at intersection of the plane of symmetry of the appliance and the plane of the test. A shield is placed between the fan and the appliance and, immediately after lighting the appliance, the shield is removed for periods of 3 s to produce gusts. This is repeated at each angle of incidence, applying 3 gusts in each position of 3 s intervals.

The test is carried out with the appliance at ambient temperature and in the hot condition with the main burner and any ignition burner alight together and, if appropriate, with only the ignition burner alight. Any lighting door remains closed during the test.

The test is repeated at the minimum input given by the controls, if such operation is intended by the manufacturer.

During the test, take precautions to screen the draught diverter from the effects of the wind.

7.5.2.2.2 Effect of down draughts (for type B_{11} appliances)

The appliance is supplied with an appropriate reference gas (see Table 5) at the corresponding normal pressure (see 7.1.4). It is connected to a flue of the same nominal diameter as the flue connection and straight for a length of not less than 10 diameters immediately above the draught diverter. A down-draught giving a pressure of 5,4 Pa at the base of the flue is applied through the flue using a suitable down-draught apparatus (see Figure 6).

7.5.2.2.3 Type B_{14} appliances

The test is carried out with each reference gas at nominal heat input.

After the appliance has been operated for 1 h, the flue outlet is progressively restricted until the main burner is shut off by the action of the flue gas monitoring device according to 5.4 (see 7.7.3.2).

7.6 Pressure regulators

7.6.1 Operational pressure regulator

If the appliance has a pressure regulator an adjustment is made, if necessary, to give the nominal volumetric rate with reference gas at normal pressure given in 7.1.4 and appropriate to the gas. Keeping this initial adjustment, the supply pressure is varied between the corresponding minimum and maximum values (see 7.1.4).

The test is carried out for all reference gases for which the pressure regulator is not put out of service.

7.6.2 Pressure regulator out of service

The appliance is supplied with the reference gas at the minimum and then at the maximum pressure given in 7.1.4 and the flow rate is measured under the same conditions of temperature and pressure. It is then verified that:

$$\frac{V_{\min}}{\sqrt{p_{\min}}} \times \frac{\sqrt{p_{\max}}}{V_{\max}} = 1 \pm 0{,}05 \quad (7)$$

where

$V_{\min}$ is the volumetric flow rate at minimum pressure $p_{\min}$ (m^3/h);

$V_{\max}$ is the volumetric flow rate at maximum pressure $p_{\max}$ (m^3/h);

$p_{\min}$ is the appropriate minimum pressure for the gas family or gas group to which the reference gas belongs (see 7.1.4) (mbar);

$p_{\max}$ is the appropriate maximum pressure for the gas family or gas group to which the reference gas belongs (mbar).

The test is carried out for all reference gases for which the pressure regulator is put out of service.

7.7 Combustion

7.7.1 General

7.7.1.1 All appliances

The appliance is supplied with the appropriate reference gas and, if necessary, adjusted as specified in 7.1.3.2 to give the nominal heat input.

The appliance is placed in a well ventilated room, installed and adjusted in accordance with 7.1.2.

For high-low or modulating appliances, the tests are carried out at the nominal and minimum heat input given by the control.

Unless otherwise specified, a sample of the products of combustion is taken when the appliance has reached thermal equilibrium.

The CO concentration of the dry, air-free products of combustion (neutral combustion) is given by the formula:

$$V_{\mathrm{CO,N}} = V_{\mathrm{CO_2,N}} \times \frac{V_{\mathrm{CO,M}}}{V_{\mathrm{CO_2,M}}} \quad (8)$$

where

$V_{\mathrm{CO,N}}$ is the percentage of CO concentration of the dry, air-free products of combustion;

$V_{\mathrm{CO_2,N}}$ is the calculated percentage of CO_2 in the dry, air-free products of combustion of the gas involved;

$V_{\mathrm{CO,M}}$ and $V_{\mathrm{CO_2,M}}$ are the carbon monoxide and carbon dioxide concentrations respectively measured in the sample during the combustion test, both expressed in percentage by volume.

The values of $V_{\mathrm{CO_2,N}}$ (neutral combustion) for the test gases are given in Table 7.

Table 7 — Values

Designation of gas	G 110	G 20	G 21	G 23	G 25 G 231	G 26	G 30	G 31	G 120	G 130	G 150	G 271
$V_{CO_2,N}$	7,6	11,7	12,2	11,6	11,5	11,8	14,0	13,7	8,35	13,7	11,8	11,2

The CO concentration of the dry, air-free products of combustion may also be calculated from the formula:

$$V_{CO,N} = \frac{21}{21 - V_{O_2,M}} \times V_{CO,M} \quad (9)$$

where

$V_{O_2,M}$ and $V_{CO,M}$ are the oxygen and carbon monoxide concentrations respectively measured in the sample, both expressed as a percentage.

The use of this formula is recommended where CO_2 concentration is less than 2 %.

7.7.1.2 Type B_{11} appliances

The appliance is installed with the back of the appliance as near as possible to a wall, according to the manufacturer's instructions.

The products of combustion are sampled by means of the probe shown in Figure 7 placed 200 mm from the top of the test flue.

If the appliance is fitted with a fan to assist in the distribution of convection air, the combustion tests are carried out both with the fan ON and OFF.

7.7.1.3 Type B_{14} appliances

The appliance is installed as specified in 7.1.2.3.

The products of combustion are sampled by means of the probe shown in Figure 7 to ensure a representative sample.

If the appliance is fitted with a fan to assist in the distribution of convection air, the combustion tests are carried out both with the fan ON and OFF.

7.7.2 Tests under limit conditions

7.7.2.1 Reference gas(es)

The following tests are carried out under still air conditions using the appropriate reference gas(es) (see Table 5).

a) For appliances without a gas rate adjuster or regulator, or for appliances fitted with these devices but where their function has been annulled, the test is carried out as follows: for live fuel effect appliances, the appliance is supplied at the normal pressure given in 7.1.4. and the combustion measured after 1 h; for all other appliances, the appliance is supplied at the maximum pressure given in 7.1.4 and the combustion measured.

b) For an appliance with a gas rate adjuster but without a pressure regulator, the test is carried out by adjusting the burner to a rate equal to 1,10 times the nominal heat input and the combustion measured. For live fuel effect appliances, the combustion is measured after 1 h.

c) For an appliance with a regulator that has not been put out of action, the test is made by bringing the burner rate to 1,07 times the nominal heat input, when it is supplied with gas G 110, or 1,05 times the nominal heat input, when it is supplied with gases G 20 or G 25. For live fuel effect appliances, the combustion is measured after 1 h.

An appliance with a gas rate adjuster or pressure regulator which is immobilised for one or more gas families is tested successively under the various relevant supply conditions.

7.7.2.2 Incomplete combustion gas

7.7.2.2.1 Live fuel effect appliances

After carrying out the test in 7.7.2.1, without turning the appliance off and with the appliance supplied with the appropriate reference gas(es) (see Table 5) at the normal pressure (see 7.1.4), adjust the appliance to give the fixed reduced rate position.

After 15 min without turning the appliance off, adjust the inlet pressure to the minimum pressure (see 7.1.4). The appliance is tested with the incomplete combustion limit gas (see Table 5).

This test is done by immediately replacing the reference gas by the corresponding incomplete combustion limit gas without changing the adjustment of the appliance or the gas supply pressure, without turning the appliance off. The combustion is to be measured after 5 min.

With the appliance control tap set at the maximum rate position and supplied with the appropriate reference gas (see Table 5), adjust the inlet pressure to give the maximum pressure (see 7.1.4). The appliance is then tested with the incomplete combustion limit gas (see Table 5).

This test is done by running the appliance for 1 h on the reference gas and then, without changing either the adjustment of the appliance or the gas supply pressure and without turning the appliance off, replacing the reference gas by the corresponding incomplete combustion limit gas. The combustion is measured after 10 min.

7.7.2.2.2 Other appliances

After the test with the reference gas(es) in 7.7.2.1, the appliance is tested with the incomplete combustion limit gas for the appliance category (see Table 5).

For this test, in three cases above (i.e. 7.7.2.1 a), b) and c)), using the reference gas, the heat input of the appliance is adjusted to 1,05 times the nominal heat input if a regulator is fitted or 1,075 times the nominal heat input if the appliance does not incorporate a pressure regulator. If the appliance is intended to be installed solely on a gas installation with a meter with regulator, the factor of 1,05 may be applied.

Without changing the adjustment of the appliance or supply pressure, the reference gas is replaced by the corresponding incomplete combustion gas.

7.7.3 Supplementary tests under special conditions

7.7.3.1 Normal and abnormal voltage fluctuation

With the mains electrical supply reduced to 85 % of the minimum voltage for which the appliance is designed, using the appropriate reference gas(es) and at the normal gas supply pressure, ignite the appliance. With the appliance at its maximum setting (tap or thermostat) and at thermal equilibrium, or after 1 h for live fuel effect appliances, measure the CO concentration of the air-free dry products of combustion. Repeat the test with the mains electrical supply increased to 110 % of the maximum voltage for which the appliance is designed.

7.7.3.2 Effects of down draught and blocked flue

The tests are carried out with each reference gas at the nominal heat input.

A first test is carried out with the flue blocked.

A second test for the effect of down draught is carried out as described in 7.5.2.2.2.

For type B_{11BS} and B_{14BS}, the spillage monitoring system is overridden.

The CO concentration of the combustion products shall meet the requirements of 6.7.1.

The combustion products issuing from the draught diverter or appliance opening should be collected in such a manner as to ensure a representative sample.

The appliance is connected to a flue as described in 7.1.2.3. The test is carried out with each of the reference gases as appropriate to the appliance category supplied at the normal pressure (see 7.1.4).

After the appliance has been operated for 1 h, the flue outlet is progressively restricted until the main burner is shut off by the action of the flue gas monitoring device according to 5.4. The products of combustion are sampled during the period that the flue outlet is being restricted.

The CO concentration of the combustion products shall meet the requirements of 6.7.1.

The combustion products issuing from the draught diverter or appliance opening should be collected in such a manner as to ensure a representative sample.

7.7.4 Measurement of oxides of nitrogen (all appliances)

The test is carried out under the test conditions described in 7.1.2 using the reference gas(es) only at normal pressure.

The method of test shall be in accordance with CR 1404.

According to the function and use of the appliance, the measured NO_x values are weighted before checking under which level (given in Table 2) the appliance comes.

The weightings applied are as follows:

a) For modulating appliances (maximum - modulation - minimum rate)

NO_x value measured at nominal heat input x 0,1 = $NO_{x(max)}$

NO_x value measured at 60 % of nominal heat input x 0,45 = $NO_{x(mod)}$

NO_x value measured at minimum heat input specified by the manufacturer x 0,45 = $NO_{x(min)}$

$NO_{x(max)}$ + $NO_{x(mod)}$ + $NO_{x(min)}$ = Weighted NO_x value in mg/kWh

b) For appliances with one rating only (maximum - off)

NO_x value measured at nominal heat input = Weighted NO_x value in mg/kWh

c) For appliances with two ratings (maximum - minimum)

NO_x value measured at nominal heat input x 0,3 = $NO_{x(max)}$

NO_x value measured at minimum heat input specified by the manufacturer x 0,7 = $NO_{x(min)}$

$NO_{x(max)}$ + $NO_{x(min)}$ = Weighted NO_x value in mg/kWh

d) For appliances with more than two fixed ratings

NO_x value measured at nominal heat input x 0,1 = $NO_{x(max)}$

NO_x value measured at other (*n*) fixed ratings specified by the manufacturer x 0,9 = $NO_{x(n)}$

$$NO_{x(max)} + \Sigma \frac{NO_{x(n)}}{n} = \text{Weighted } NO_x \text{ value in mg/ kWh} \quad (10)$$

where

n is the number of other fixed ratings.

Conversion of emission values to parts per million (ppm) is given in Annex H.

7.8 Sooting

7.8.1 General

The apparatus is described in Annex E.

7.8.2 Determination of the smoke number

Unscrew the paper fixing device, insert the filter in the slot provided on the pump and screw up the device.

Introduce the sampling tube horizontally into the middle of the flow of the combustion gases. Gas-tightness between the sampling tube and the wall of the measuring sleeve, where the sample is taken, should be ensured.

The sampling may be either by a hand pump or an electro-mechanical pump.

When a hand pump is used, ten suctions are to be carried out; each suction is to be regular and last 2 s to 3 s. The end of the suction is reached, when the operator no longer feels the reactions of the piston.

Withdraw the tube from the flue, unscrew the fixing device, withdraw the filter paper with care.

Compare the test spot visually with the grey scale by holding the band of filter paper against the back of the standard scale. Examine the spot through the central window of the scale. Note the grade number whose shade is closest to that of the test spot. For the range of the grey scale between 0 and 4, the intermediate grades are to be distinguished particularly carefully.

An equivalent opto-electronic method of determining the smoke number may be used.

7.8.3 Test conditions

7.8.3.1 General

If an appliance is fitted with a fan to assist in the distribution of convection air, the sooting tests are carried out with the fan both ON and OFF.

7.8.3.2 Test No. 1

The appliance is installed and ignited according to the manufacturer's instructions using the appropriate reference gas and adjusted to give the nominal heat input. Substitute the reference gas with the appropriate sooting limit gas (see Table 5). Turn the appliance off and allow to cool to ambient temperature.

Light the appliance from the cold condition in accordance with the manufacturer's instructions and immediately, using the apparatus described in 7.8.1 sample the flue gases as described in 7.8.2 applying only one suction then turn the appliance off. Repeat this operation a further nine times. At the end of the tenth cycle verify compliance with 6.8.1.

7.8.3.3 Test No. 2

At the end of the tenth suction in test 7.8.3.2, leave the appliance running for 1 h on the sooting limit gas. At the end of this period determine the smoke number of the flue gases and verify compliance with 6.8.2.

7.8.3.4 Test No. 3 (only if soot is found on the burner/fuel bed)

With the appliance at room temperature, the appliance is cleaned in accordance with the manufacturer's instructions.

The following tests are then carried out with the appliance using reference gas and adjusted to give the nominal heat input.

a) Cycle the appliance 16 h on and 8 h off for five cycles with the fuel bed, if any, arranged in accordance with the manufacturer's instructions.

b) Measure the dry air-free CO concentration of the products of combustion after 1 h of the first cycle.

c) At the end of the final cycle, measure the dry air-free CO concentration of the products of combustion and compare the result with that obtained in b) above (see 6.8.3).

7.9 Spillage monitoring system

7.9.1 General

If the appliance is fitted with a fan to assist the distribution of convection air and the user is able to turn the fan ON and OFF under normal operating conditions, the fan is to be rendered inoperative for the following test(s).

7.9.2 Atmosphere sensing device (type B_{11AS} and B_{14AS} appliances only)

7.9.2.1 General

The appliance is installed on the narrowest wall of a sealed room and adjusted to the nominal heat input using the appropriate reference gas(es).

7.9.2.2 Sealed room (see Figure 8)

The room dimensions are as follows:

Length 3,5 m ± 0,1 m

Width 2,0 m ± 0,1 m

Height 2,5 m ± 0,1 m

Volume 17,5 m^3 ± 1 m^3

Other dimensions may be used provided that the test results are unaffected.

The soundness of the room is to be such that after a homogeneous room concentration of (4 ± 0,2) % CO_2 has been established then it should not have decreased by more than 0,1 % at the end of a two hour period.

The room is to be designed such that:

— the operator may, at any time, observe the appliance in operation;

— sampling of the room atmosphere for carbon monoxide may be carried out from the geometric centre of the room;[3)]

— the atmosphere in the room is maintained as a homogenous mixture;

3) It is important that the sampling line from the probe to the analyzer is as short as possible.

— the temperature at the centre of the room is maintained between 20 °C and 40 °C.

7.9.2.3 Test method

The appliance is ignited at the normal setting pressure with the flue functioning normally.

At the end of the 1 h warm up period the flue is capped and sealed.

The CO concentration of the atmosphere of the test room is continuously monitored, and continued after the appliance has shut down until the CO concentration starts to decrease. The maximum CO concentration is recorded.

7.9.3 Combustion products discharge safety device (type B_{11BS} and B_{14BS} appliances)

7.9.3.1 General

The appliance is installed in accordance with the manufacturer's instructions and in accordance with the following conditions:

— the tests are carried out with a reference gas for the appliance category at nominal heat input;

— spillage is determined by means of a sampling probe connected to a rapid-response CO_2 analyser enabling concentrations of the order of 0,1 % to be detected;

— built-in appliances are installed in the test box described in 7.4.4.2.

7.9.3.2 Nuisance shutdown

The appliance is installed as described in 7.9.3.1.

The appliance is kept in operation for 30 min with any thermostat put out of action. It is checked that the device does not cause shutdown. The main burner is then shut off.

The rise in temperature after the burner shutdown should not result in a signal from the device to initiate shutdown.

7.9.3.3 Shutdown times

7.9.3.3.1 Tests with complete blockage

The appliance is installed in accordance with 7.9.3.1 with a 1 m high test flue and is operated at nominal heat input. When the appliance is at thermal equilibrium, the flue is completely blocked (see Figure 9). The reaction time between the flue being blocked and shutdown is measured. For appliances without lockout, the obstruction is maintained and the time between shutdown and ignition of the main burner is measured.

This test is repeated at the minimum rate, if any.

7.9.3.3.2 Tests with partial blockage

The appliance is installed in accordance with 7.9.3.1 and fitted with a telescopic flue (see Figure 7) brought to thermal equilibrium at the nominal heat input in accordance with 7.9.3.3.1.

The length of the telescopic flue is reduced until spillage just does not occur. Should this "spillage point" not be obtainable at the minimum height of the telescopic flue then a concentric annulus is fitted to the flue in order to reach this point.

If the device is actuated before this length is obtained then shutdown is deemed to comply with 6.9.2.2.

If not, the test flue is covered with a blocking plate having a concentric circular orifice of which the diameter is equal to 0,6 times the diameter *D* (see Table 3) of the test flue at its upper extremity (see Figure 9).

If spillage is not achieved with the telescopic test flue, it is covered with a plate incorporating a circular hole of diameter *D*' (see Table 3) which allows the limit of spillage to be obtained.

This plate is then replaced by another blocking plate incorporating a circular hole of diameter *d* which is equal to 0,6 times *D*'.

The time between the blocking plate being put into position and shutdown is measured.

Check that the shutdown times comply with 6.9.2.2.

NOTE If the manufacturer specifies a minimum flue height, the test is carried out using a flue of that height.

7.10 Flame supervision device

7.10.1 Thermoelectric device

7.10.1.1 Cold condition

The tests are carried out with the appropriate reference gas(es) with the appliance adjusted to its nominal heat input.

After this adjustment has been made, the appliance is allowed to cool to ambient temperature. The gas is turned on again and lit at the ignition burner, if any, or main burner as appropriate. The opening time is that between the moment of lighting the ignition burner, or main burner, as appropriate, to that when the safety device is actuated.

7.10.1.2 Hot condition

The appliance is left to operate at its nominal heat input for 1 h.

The time measured is the interval between the moment when the ignition burner and main burner are intentionally extinguished by cutting off the gas supply and the moment when, after turning on again, the gas supply is shut off through the action of the flame supervision device. A gas meter or any other appropriate device may be used to detect the closure of the valve of the flame supervision device.

7.10.2 Automatic burner control systems

7.10.2.1 General

The appliance is installed as described in 7.1.2.3 and supplied with an appropriate reference gas (see Table 5) at the nominal heat input in accordance with 7.3.1. The start device is manually operated 10 times, i.e. once every 5 s.

7.10.2.2 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 time.

7.10.2.3 Extinction delay 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 of valve closure is given.

7.11 Flue gas monitoring device (for Type B_{14} appliances only)

7.11.1 General

The appliance is installed in accordance with 7.1.2 and supplied with an appropriate reference gas.

The appliance is fitted with the longest air inlet and combustion products outlet ducts permitted in the manufacturer's instructions. The tests may be carried out without the terminal or fitting piece in place.

The CO concentration is determined.

7.11.2 Voltage reduction

The appliance is adjusted to the nominal heat input. Measurements are taken at thermal equilibrium. The voltage at the fan terminals is progressively reduced. The CO concentration is continuously monitored.

7.11.3 Restricted flue

The test is carried out when the appliance is at thermal equilibrium, at the nominal heat input, or for modulating appliances at the maximum and minimum heat input and at the heat input corresponding to the arithmetic mean of these two inputs. When several rates are provided, supplementary tests are carried out at each of the rates.

The combustion products evacuation duct is progressively restricted ensuring that there is no recirculation of products. The CO concentration is continuously monitored.

7.12 Efficiency

7.12.1 Installation and supply to appliances

7.12.1.1 For Type B_{11} appliances

The appliance is installed in accordance with the manufacturer's instructions, but with a test flue of sufficient length to give an overall installation height of 3 m. This height is measured from the floor to the top of the flue (for floor standing appliances), or, from the base of the appliance to the top of the flue (for wall mounted appliances).

For appliances whereby the manufacturer specifies the fitting of a spigot restrictor, this restrictor is fitted to the appliance. The appliance is then tested for compliance with 6.2.2.1 prior to the efficiency test.

The appliance is initially adjusted with reference gas to obtain the nominal heat input given in 7.1.3.2 and the efficiency is determined when thermal equilibrium has been reached. The temperature of the room shall be approximately 20 °C. This temperature is measured at a height of 1,5 m at least 3 m from the appliance and with a thermometer which is shielded from direct radiation from the appliance.

The products of combustion are sampled and the temperature is measured 200 mm from the upper end of the flue. The products are sampled with the probe described in 7.7.1 and shown in Figure 7.

7.12.1.2 For Type B_{14} appliances

The appliance is installed with the maximum length of flue according to the manufacturer’s instructions.

The appliance is initially adjusted with reference gas to obtain the nominal heat input given in 7.1.3.2 and the efficiency is determined when thermal equilibrium has been reached. The temperature of the room shall be approximately 20 °C. This temperature is measured at a height of 1,5 m at least 3 m from the appliance and with a thermometer which is shielded from direct radiation from the appliance.

The products of combustion are sampled and their temperature measured in the connecting duct at a point at least 200 mm before the flue outlet but upstream of any dilution air entrainment. The sampling point should be selected so as to give representative CO_2 and temperature readings.

7.12.2 Determination of efficiency

The efficiency η referred to the net calorific value, H_i, is given by the formula:

$$\eta = 100 - (q_1 + q_2) \quad (11)$$

where

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

and

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

q_1 is given by the formula:

$$q_1 = C_1 \cdot V_p \frac{t_2 - t_1}{H_i} \cdot 100 \quad (12)$$

where

C_1 is the mean specific heat of the dry products of combustion in megajoules per cubic metre (MJ/(m^3·K)) (see Figure 10);

t_2 is the average temperature of the products of combustion (°C);

t_1 is the average combustion air temperature (°C);

H_i is the net CV of the gas at 1 013, 25 mbar and 15 °C, dry in megajoules per cubic metre (MJ/m^3);

V_p is the volume of dry products of combustion per unit volume of gas at 1 013, 25 mbar and 15 °C (m^3);

V_p is given by the formula:

$$V_p = \frac{V_{CO_2}}{V_{CO_2,M}} \cdot 100 \quad (13)$$

where

V_{co2} is the volume of CO_2 produced by the combustion of 1 m^3 of gas (m^3);

$V_{CO2, M}$ is the CO_2 concentration of the products of combustion in percent (%);

q_2 is given by the formula:

$$q_2 = 0,077 \cdot \frac{H_s - H_i}{H_i} \cdot (t_2 - t_1) \quad (14)$$

where

H_s is the gross calorific value of the gas at 1 013,25 mbar and 15 °C, dry in megajoules per cubic metre (MJ/m^3).

The measurement is made with a tolerance of ± 1 % (absolute value) on the CO_2 concentration (%) which is measured to an accuracy of ± 5 %.

The efficiency is calculated when thermal equilibrium has been achieved.

8 Marking and instructions

8.1 General

The technical instructions of the appliance and warning notices shall be in the official language(s) of the country(ies) of destination.

8.2 Marking

8.2.1 Marking of the appliance

The appliance shall carry one or more data plates and/or labels firmly and durably attached to the appliance such that the information is visible to, and can be read by, the installer, possibly after removing the outer case. The data plate(s) and/or label(s) shall give the following information in indelible characters:

a) the manufacturer's[4)] name and/or identification symbol;

b) the commercial identification of the appliance;

c) the serial number;

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

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

f) the direct country or countries of destination of the appliances (see 8.2.6.4);

g) the appliance category or categories: if more than one appliance category is specified, each of these categories shall be identified in relation with the appropriate country or countries of destination;

h) the class of efficiency, for appliances with an efficiency equal to or greater than 80/82 % (see Table 4), Class 1 Heater, and for those with an efficiency less than 80/82 % (see Table 4), Class 2 Appliance;

i) 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;

j) the setting pressure for appliances with regulator;

k) the method of evacuating the products of combustion, e.g. B_{11BS}.

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.

No other information shall be included on the appliance if this could lead to confusion with regard to the current state of adjustment of the appliances and the corresponding appliance category (or categories) and the direct country (or countries) of destination.

The indelibility of the marking shall be checked by a test carried out in accordance with 7.14 of EN 60335-1:1994.

4) "Manufacturer" means the organisation or company which assumes responsibility for the product.

8.2.2 Spillage test label

A notice stating that the installer shall check that all the products of combustion are entering the flue after 10 min when lit from cold by traversing the perimeter of the open front and draught diverter, if applicable, using a smoke generator, e.g. a smoke match, shall be securely fitted to the appliance in a position readily accessible to the installer and/or service engineer. This may be incorporated as part of the data plate.

8.2.3 Other marking

The appliance 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."

8.2.4 Warning labels

Appliances fitted with a guard shall have a label reading as follows:

> "No part of the guard shall be permanently removed.
>
> **IT DOES NOT GIVE FULL PROTECTION FOR YOUNG CHILDREN, THE ELDERLY OR THE INFIRM."**

Where a permanent guard is not fitted, appliances shall have affixed to them a tie-on label headed 'To be removed only by the user' and bearing in capital letters not less than 8 mm high the words:

> **"WARNING: THIS APPLIANCE HAS A NAKED FLAME, A SUITABLE GUARD SHOULD BE USED FOR THE PROTECTION OF YOUNG CHILDREN, THE ELDERLY AND THE INFIRM."**

8.2.5 Marking of the packaging

The packaging shall carry at least the following information:

— the type of gas in relation to the pressure and/or the pressure couple, for which the appliance has been adjusted; any pressure indication shall be identified in relation to the corresponding category index; if an intervention is necessary on the appliance in order to change from one pressure to the other within a pressure couple of the third family, only the pressure corresponding to the current adjustment of the appliance shall be indicated;

— the direct country or countries of destination of the appliance;

— the class of efficiency of the appliance (see 8.2.1 h));

— the appliance category or categories: if more than one appliance category is specified, each of these categories shall be identified in relation with the appropriate country or countries of destination.

For appliances which can only be installed on a gas installation with a meter with regulator, the packaging shall be marked with the following text:

> "This appliance is intended for use on a gas installation with a meter with regulator".

The packaging 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 and the corresponding appliance category (or categories) and the direct country (or countries) of destination.

8.2.6 Utilisation of symbols on the appliance and packaging

8.2.6.1 Electrical supply

The marking concerning electrical values shall comply with EN 60335-1.

8.2.6.2 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 8.

NOTE In order to satisfy the needs expressed by CEN members their countries declared means of identification can be included in addition to the symbol. These additional means are given in Annex D.

Table 8 — Corresponding category index

Symbol of the type of gas[a]	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+
G 25	2L, 2LL
Third family:	
G 30	3B/P, 3+ [b,d]
G 31	3+[c,d], 3P

[a] If, in its current state of adjustment, the appliance may use gases from different groups, all the reference gases corresponding to these groups shall be indicated.

[b] 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.

[c] Only applies to appliances which need an adjustment between G 30 and G 31, and which are adjusted for G 31.

[d] For the appliances which need an adjustment between G 30 and G 31, the label concerning the adjustment to the other gas and the other pressure of the pressure couple shall be supplied with the technical instructions.

8.2.6.3 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.

8.2.6.4 Country of destination

In accordance with EN ISO 3166-1, the names of countries shall be represented by the following codes:

Austria	AT	Hungary	HU
Belgium	BE	Ireland	IE
Bulgaria	BG	Iceland	IS

Switzerland	CH	Italy	IT
Cyprus	CY	Lithuania	LT
Czech Republic	CZ	Luxembourg	LU
Germany	DE	Latvia	LV
Denmark	DK	Malta	MT
Estonia	EE	Netherlands	NL
Spain	ES	Norway	NO
Finland	FI	Poland	PL
France	FR	Portugal	PT
United Kingdom	GB	Romania	RO
Greece	GR	Sweden	SE
Croatia	HR	Slovenia	SI
		Slovakia	SK

8.2.6.5 Category

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

8.2.6.6 Other information

The symbol for nominal heat input of a burner, represented by Q_n is not obligatory, but is recommended under the title "preferential", and to the exclusion of any other symbol, to avoid the use of many and different markings.

8.3 Instructions

8.3.1 General

Instructions 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 country or 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 using the symbols given in 8.2.6.4.

Instructions for countries other than those stated on the appliance may be supplied with the appliance, on condition that each set of instructions has the following initial statement: "These instructions are only valid if the following country code is on the appliance .... If this code is not present on the appliance, it is necessary to refer to the technical instructions which will provide the necessary information concerning the modification of the appliance to the conditions of use for the country".

8.3.2 Technical instructions for installation and adjustment

8.3.2.1 All appliances

The following statement shall be included:

> "Before installation, ensure that the local distribution conditions (identification of the type of gas and pressure) and the adjustment of the appliance are compatible".

In addition to the information specified in 8.2.1, 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[5)]. If such information is given, the instructions shall include a warning that modification of the appliance and its method

5) Indirect countries of destination.

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. 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 available with the appliance and shall cover the following:

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

— the fixing of the appliance;

— the gas rate in m^3/h in relation to the gas used;

— for an appliance with an adjustable pressure regulator, the setting pressure as measured upstream of the burner but downstream of any adjuster, in relation to the gas family or group used;

— the adjusters.

The instructions shall include the following:

— a recommendation that the chimney should be swept before the appliance is installed and a flue test in accordance with National Regulations is carried out;

— where the distribution medium is of a granular material, a precise description of the method of filling the burner tray, e.g. the method of levelling the medium and precautions to be taken with regard to compressing the medium;

— a declaration by the manufacturer of area(s) to be considered as a working surface;

— minimum distances between the appliance and any walls and/or shelves, if applicable;

— any necessary precautions to be taken to avoid over-heating of the floor, shelf, walls, or else a statement to use non-combustible materials for the floor, shelf or wall close to the appliance;

— where the dress guard is not supplied with the appliance, the installer shall inform the user of the local rules in force and advise the fitting of the manufacturer's dress guard. He shall also warn the user of the hazard caused to clothing by open flames if the dress guard is not fitted, and make reference to the user's instructions.

The instructions shall provide the following:

— all information on the operations and adjustments to be carried out when converting from one gas to another, and the injector markings for each gas that may be used;

— necessary instructions for inspecting the flue;

— description of the performance and installation characteristics particular to the appliance, and information necessary for commissioning and maintenance.

For appliances which can only be installed on a gas installation with a meter with regulator, the instructions shall state the following:

"This appliance is intended for use on a gas installation with a meter with regulator".

The instructions for the spillage monitoring system shall:

a) warn that the system shall not be adjusted by the installer;

b) warn that the spillage monitoring system shall not be put out of operation;

c) warn that, when the spillage monitoring system or any of its parts is exchanged, only original manufacturer's parts shall be used.

For appliances which are to be marketed for installation such that no part of the flame or incandescent material project more than 50 mm into the room or living space, the following statement shall be included:

> "This appliance shall be installed with a hearth that projects at least 300 mm in front of the naked flame/incandescent fuel bed, extends at least 150 mm at either side, and around its periphery is a height of at least 50 mm above finished floor level."

8.3.2.2 Built-in appliances

In addition to the requirements given in 8.3.2.1 the instructions shall include:

a) the nature of the materials and the minimum dimensions of the enclosure in which the appliance is to be recessed;

b) ventilation requirements for the recess;

c) performance and installation characteristics particular to the appliance, including, where applicable, minimum clearances around the appliance;

d) where a draught diverter has to be assembled, full details for the assembly.

8.3.3 Instructions for use and maintenance

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

The instructions, which are intended for the user, shall provide all the necessary information for the safe and sensible use and maintenance of the appliance in clear and simple terms. They shall be separate or easily separable from the installation instructions, or, constitute a separate section in the same booklet/document containing the installation instructions. Wherever necessary, diagrams and/or photographs shall augment the text.

The instructions shall also stress that a qualified installer is required to install the appliance, and, where applicable, to convert it for use with other gases. The instructions shall deal briefly with the installation regulations (connection, ventilation) in the country where the appliance is to be installed.

Where the radiants or parts of the fuel bed are intended to be removed by the user, there shall be explicit diagrams or photographs and instructions for their correct replacement. The instructions shall warn against changing the fuel bed layout or the quantity of material contained in the fuel bed.

The instructions shall include the following statement:

> "It is advisable to fit the dress guard available from the manufacturer. Failure to fit this dress guard will result in a potential hazard to clothing when approaching the appliance."

The instructions shall state the recommended frequency of periodic servicing and draw particular attention to the need for periodic sweeping of the flue according to the regulations in the country where the appliance is to be installed.

The instructions shall include:

— the manufacturer's or distributor's name and address;

— the type name or number (commercial designation);

— the operations of ignition, cleaning and maintenance of the appliance;

— a declaration by the manufacturer of area(s) to be considered as a working surface;

— a recommendation for any additional guard that may be required to take account of the special hazards that exist in nurseries and other places where there are young children or aged or infirm persons;

— a warning that curtains should not be positioned above the appliance at a distance less than the minimum specified for shelves in accordance with 6.4.3;

— a minimum distance between the appliance and shelf, if applicable;

— where appropriate, a statement indicating that the gas controls require manual resetting following interruption and subsequent restoration of the electricity supply;

— any specific instructions that are necessary in respect of the operation of any tap(s) fitted;

— lighting instructions which state clearly that if any flame supervision device actuating flame is extinguished either intentionally or unintentionally, no attempt should be made to relight the gas until at least 3 min have elapsed;

— explict instructions, if applicable, for the correct replacement of artificial solid fuel components or any parts of the fuel bed intended to be removed by the user, and a warning against changing the fuel bed layout or the quantity of material contained therein;

— a statement on the need for regular servicing of the appliance;

— a statement that the chimney should be swept before the appliance is installed;

— a statement that the chimney should be checked regularly to ensure that all the products of combustion are entering the flue or canopy, as applicable, and that there is no excessive build up of soot;

— a statement that any purpose-provided ventilation should be checked regularly to ensure that it is free from obstruction;

— a statement that debris from any source, or any soot formed shall require removal;

— where appropriate, a statement warning the user not to use the appliance if the glass front door or panel has been broken, removed or is open;

— where appropriate, information regarding the safe use of removable handles or of any special tool supplied by the manufacturer;

— a statement that any special removable tool is to be removed after use;

— point out the spillage monitoring system operates if evacuation of the combustion products is interrupted;

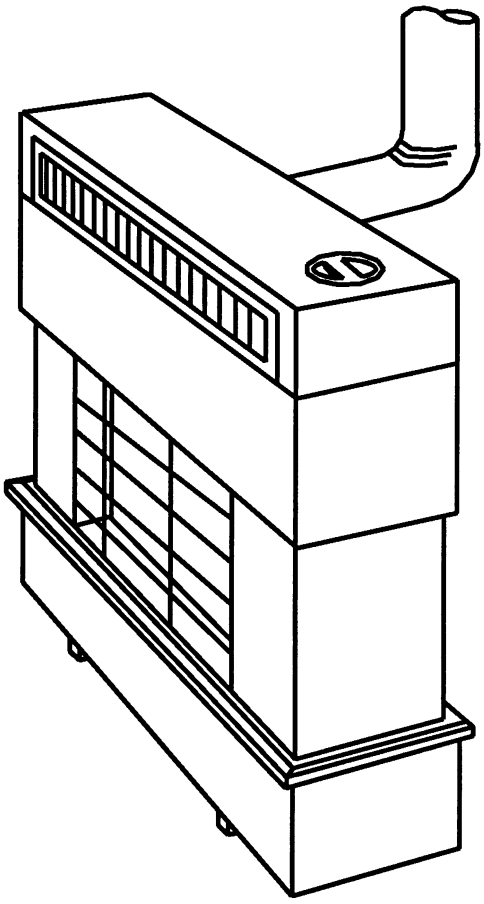
— describe the restart procedures;

— point out that, on repeated operation of the spillage monitoring system, a specialist should be informed.

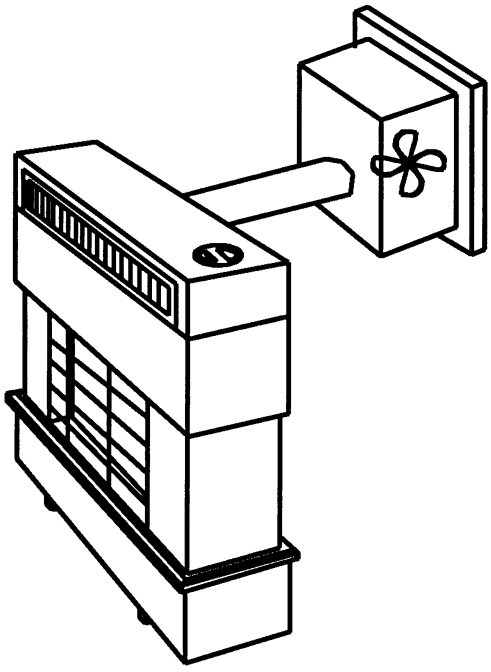
8.3.4 Additional information

The manufacturer shall specify the NO_x level of the appliance (see 6.7.2).

If the appliance is designed for use on more than one gas and the NO_x levels are different when changing from one gas to the other, the manufacturer shall specify the lowest level (i.e. the level that gives the highest NO_x limit).

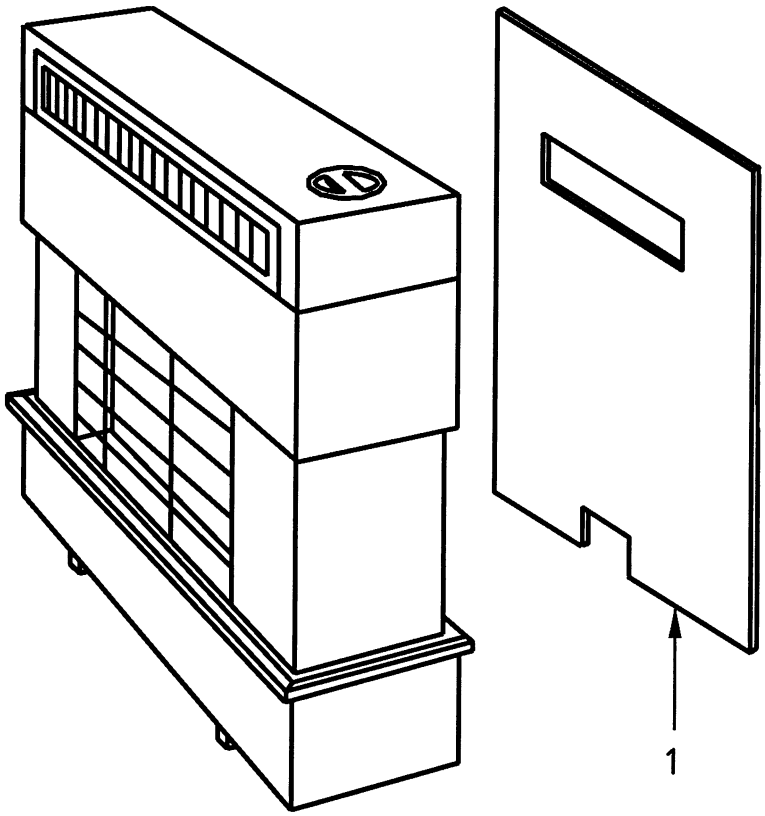


a)



b)

Figure 1 — Example of open-flued appliances

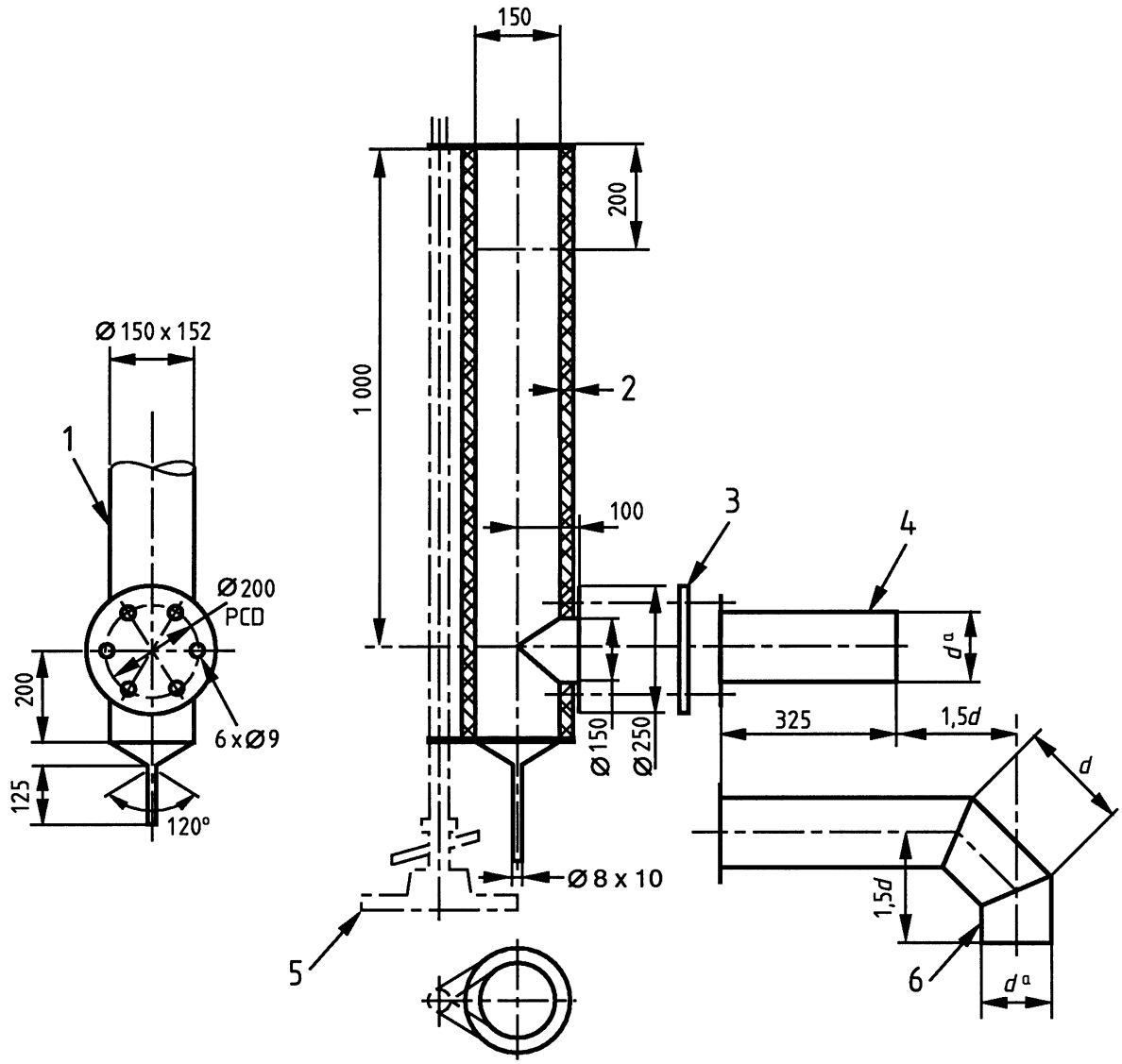


Key

1 closure plate

Figure 2 — An appliance with a closure plate

Dimensions in millimetres



Key

d [a] : external diameter of the flue spigot = internal diameter of the socket

1 stainless steel flue duct

2 insulation
(glass wool – density 64 kg/m^3)

3 gasket

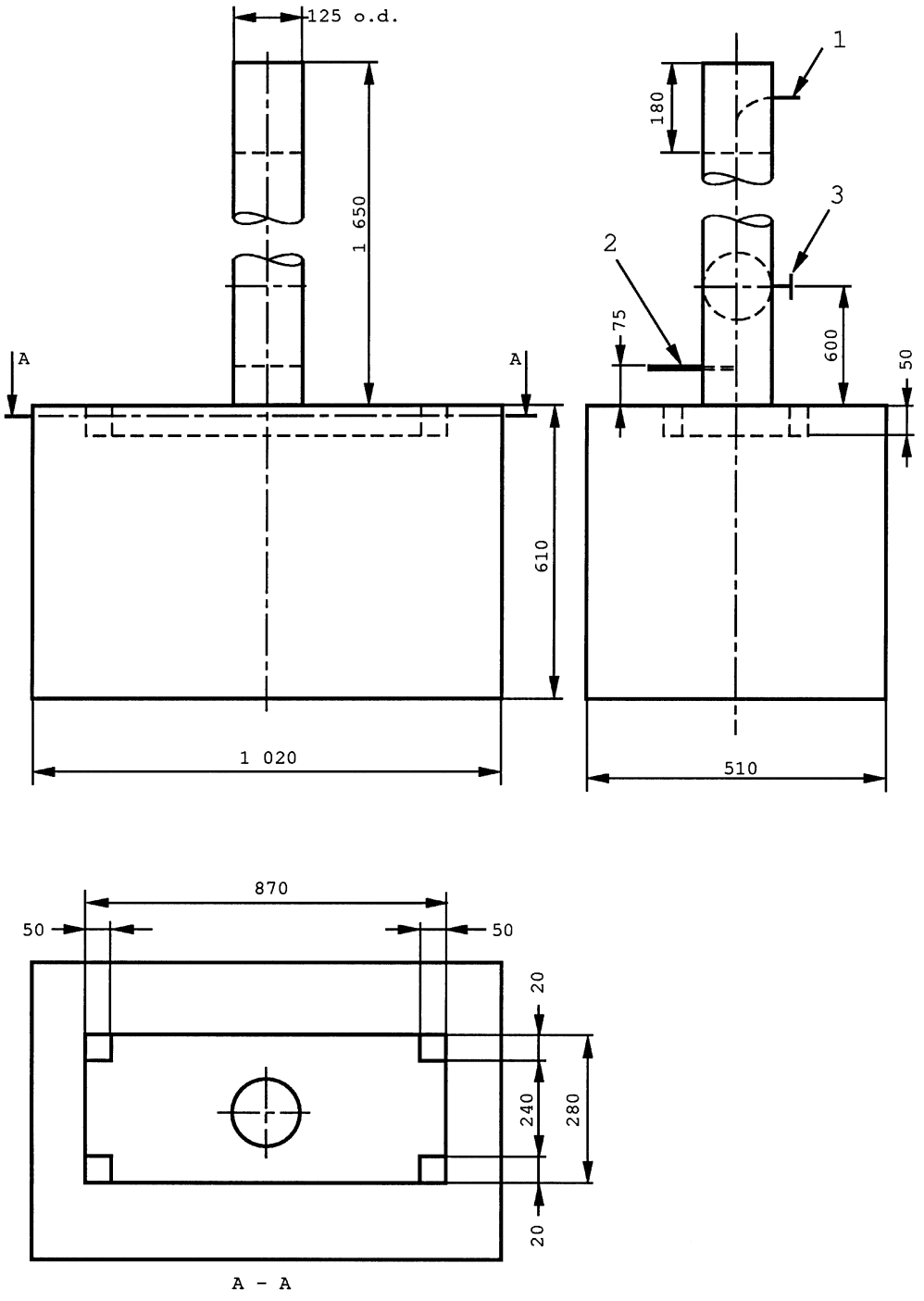
4 stainless steel connecting pipe
(horizontal spigot)

5 support
(height adjustable)

6 stainless steel connecting pipe
(Vertical spigot)

Figure 3 — Test flue

Dimensions in millimetres



a)

Key

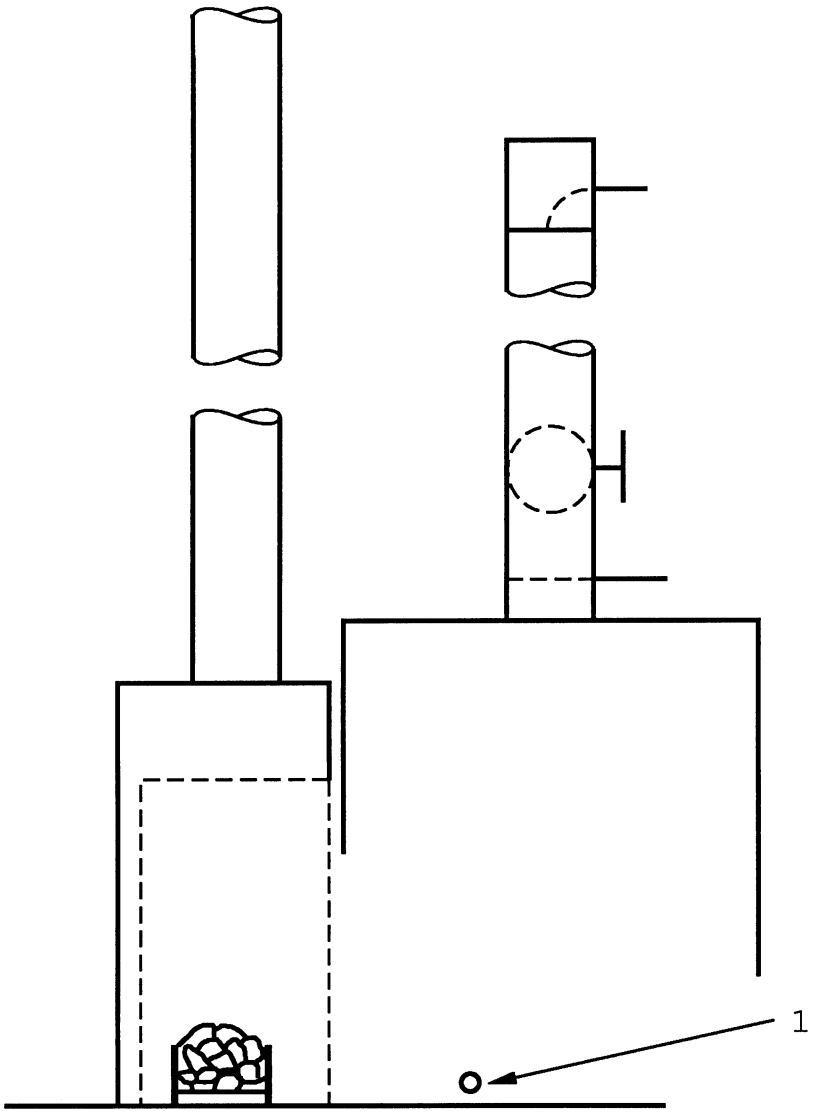
1 sampling probe

(Ø copper tube)

2 CO_2 injection probe

3 flow restrictor

a) Hood



b)

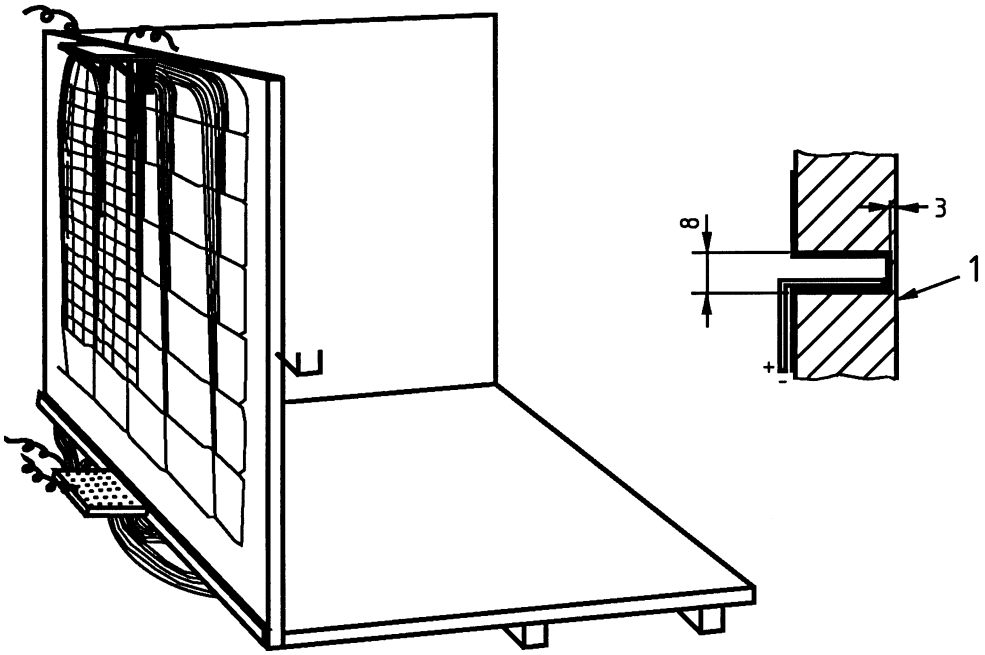
Key

1 sampling tube for laboratory air

b) Positioning

Figure 4 — Collecting hood

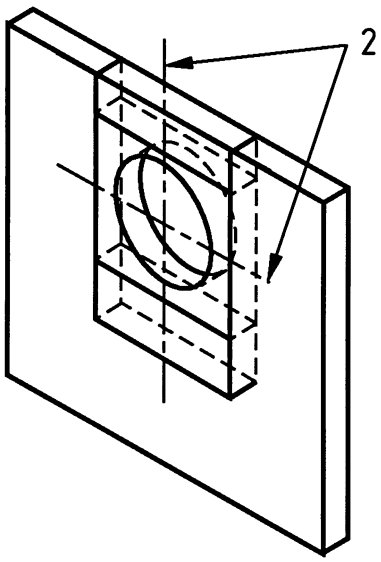
Dimensions in millimetres



Key

1 face of wall

a) thermocouple arrangement



b) filling piece assembly

Key

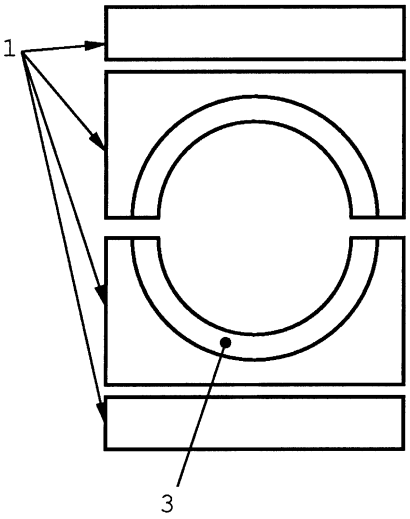
1 25 mm thick hardwood (or a material with similar thermal conductivity) with thermocouples inserted from outside to within 3 mm of surface facing the appliance.

The thermocouples are spaced at the centre of squares of side 100 mm.

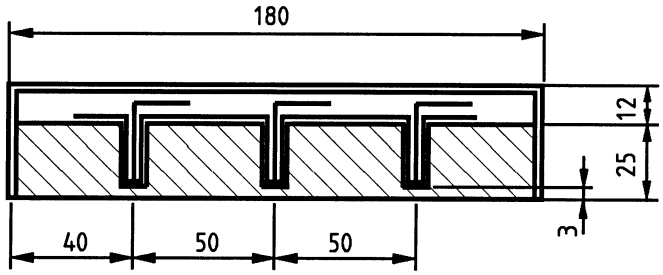
For filling pieces, 2 and 3 additional thermocouples are located so as to measure the highest temperatures in the vicinity of the flue outlet duct.

2 centrelines of flue outlet

3 insulation in accordance with manufacturers installation instructions



c) filling pieces

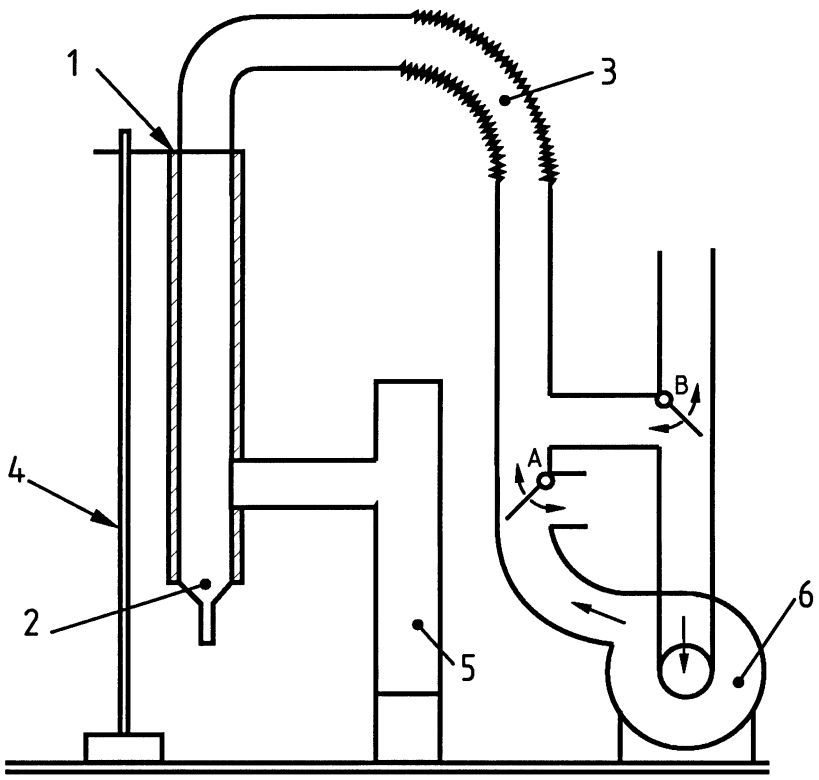


d) spacing of thermocouples

Figure 5 — Test corner for measuring floor, wall and shelf temperatures

Material for test shelf: hardwood. Oak is preferred, but any other wood or board having a thermal conductivity of approximately 0,16 W/(m·K) is acceptable.

Backing sheet: 0,9 mm aluminium.

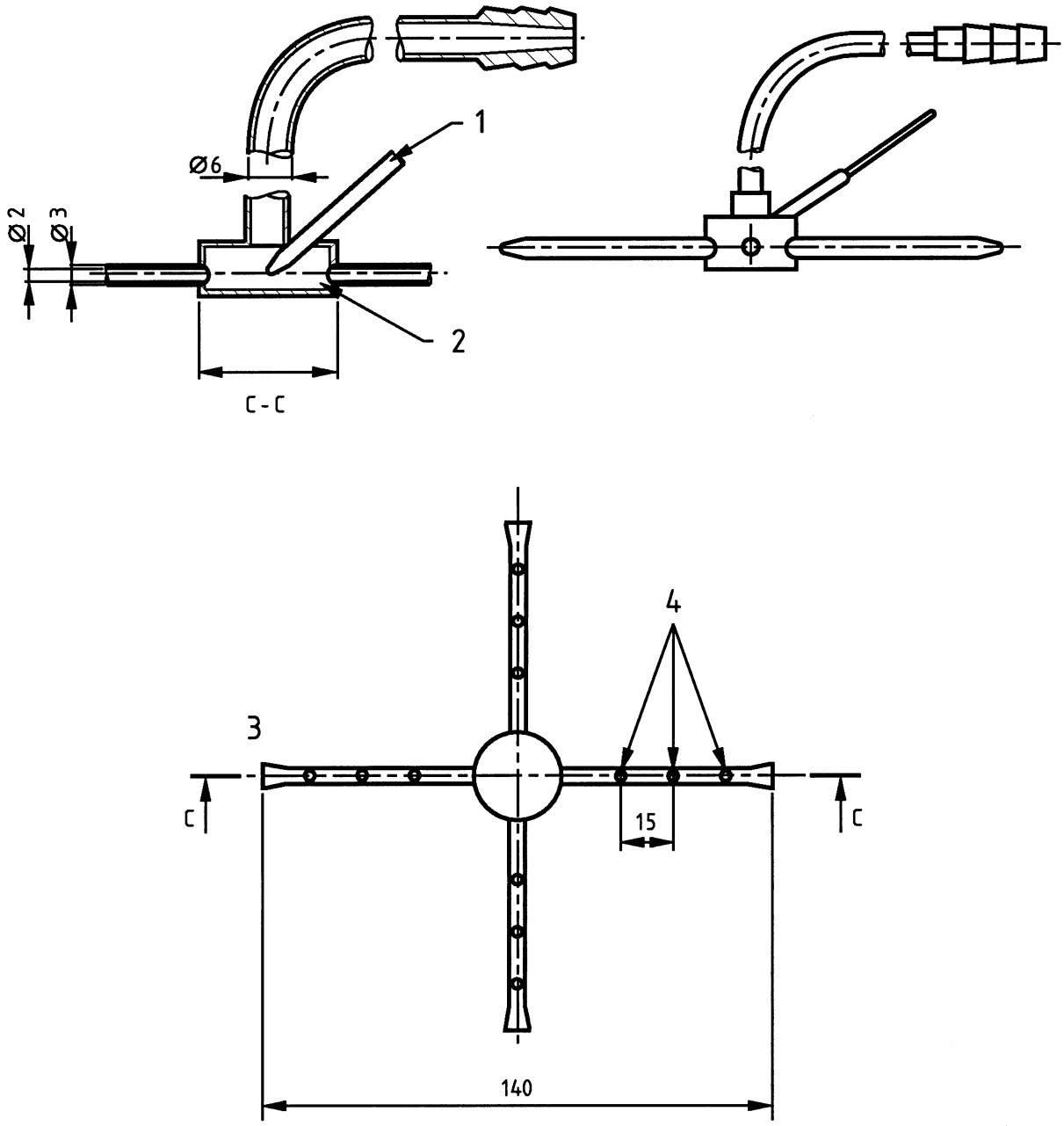


Key

1	test flue (see Figure 3)	5	appliance under test
2	pressure measuring point	6	fan
3	flexible ducting	A	flap valve for obtaining down draught
4	support	B	flap valve for obtaining down draught

Figure 6 — Abnormal draught conditions - Type B appliances

Dimensions in millimetres



Key

1 steatite tube with two holes into which thermocouple wires are sealed

2 measuring point

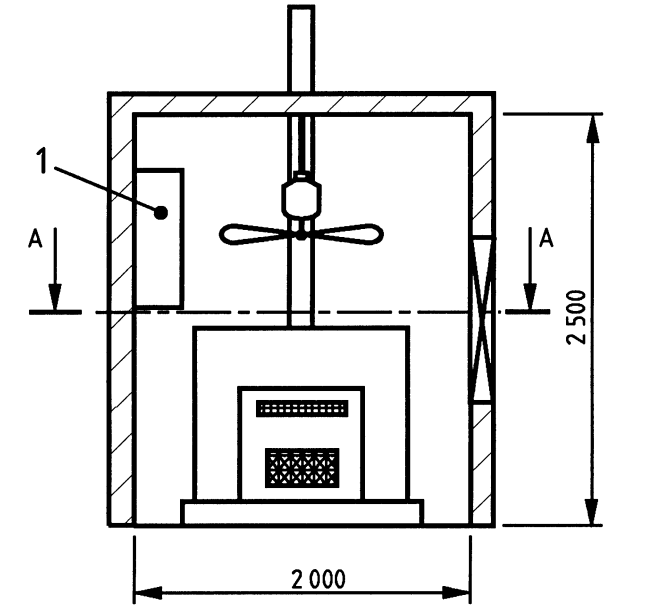
3 pipe ends closed

4 3 holes Ø 1 per branch

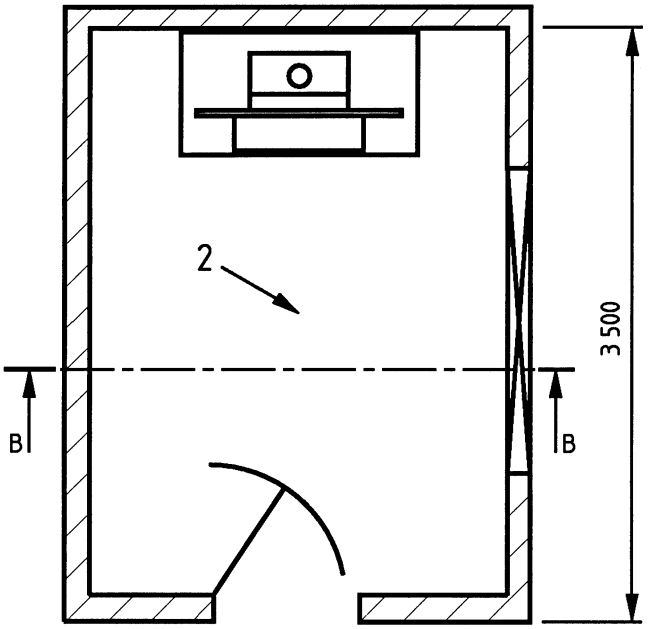
material - stainless steel

Figure 7 — Sampling probe

Dimensions in millimetres



B-B



A-A

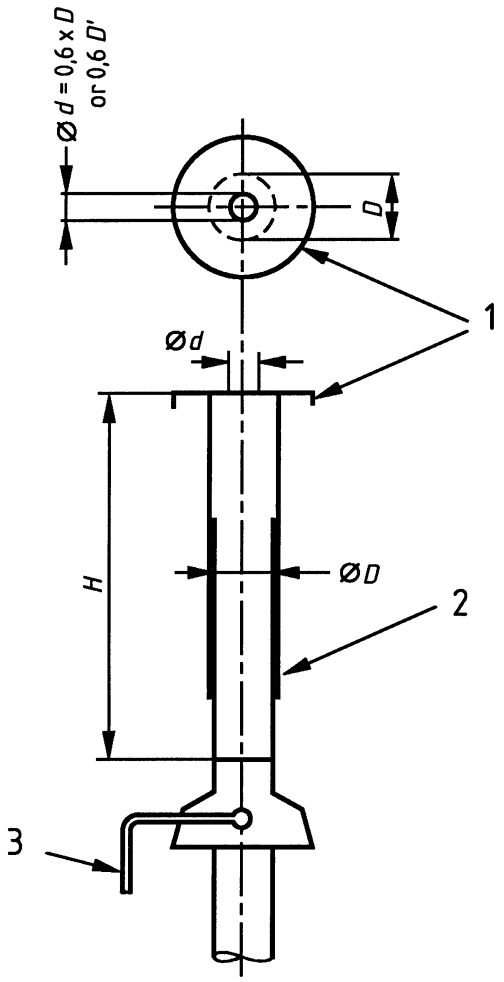
Key

1 chiller

2 sampling point at geometric centre of room

Figure 8 — Oxygen depletion test room

Dimensions in millimetres



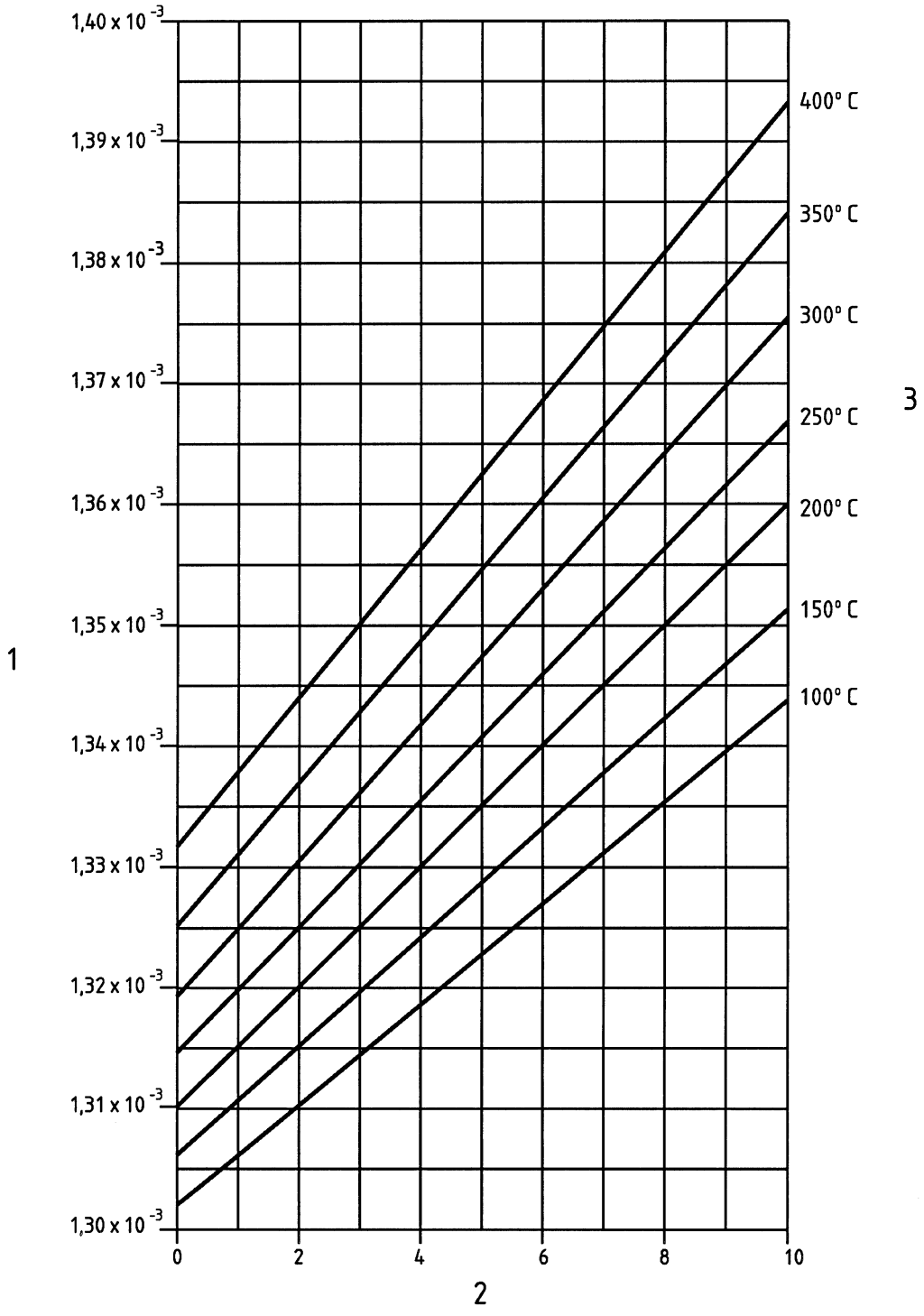
Key

1 plate

2 telescopic test flue

3 detector

Figure 9 — Combustion products safety device - Test apparatus (see 7.9.3.3.2)



Key

1 mean specific heat of dry combustion products (MJ/(m^3·K))

2 % CO_2 in combustion products

3 temperature of the combustion products (ºC)

Figure 10 — Nomogram - Mean specific heat of dry products

Annex A
(informative)

National situations

A.1 General

In each country in which this European Standard applies, appliances can be marketed only if they comply with the particular national supply conditions of that country.

In order to assist, the correct choice to be made from all the situations covered, both at the time of testing the appliance and at the time of its sale, the various national situations are summarised in Tables A.1, A.2, A.3, A.4, A.5 and A.6.

A.2 Categories listed in the body of the standard marketed in the different countries

Table A.1.1 and Table A.1.2 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 tables indicates only that these categories may be sold throughout the whole of the country concerned and A.4 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 — Single categories marketed

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

Table A.1.2 — Double categories marketed

Country	II_{1a2H}	$II_{2H3B/P}$	II_{2H3+}	II_{2H3P}	$II_{2L3B/P}$	II_{2L3P}	$II_{2E3B/P}$	II_{2E+3+}	II_{2E+3P}
AT		X							
BE								X	
BG									
CH	X	X	X	X					
CY									
CZ									
DE							X		
DK	X	X							
EE									
ES	X		X	X					
FI		X							
FR								X	X
GB			X	X					
GR		X	X	X					
HR									
HU									
IE			X	X					
IS									
IT	X		X						
LT									
LU									
LV									
MT									
NL					X	X			
NO									
PL									
PT			X	X					
RO									
SE	X	X							
SI									
SK									

A.3 Appliance supply pressures

Table A.2 gives the conditions in the various countries concerning the supply pressures to appliances in the categories given in A.2.

Table A.2 — 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
BG												
CH	X	X							X		X	
CY												
CZ												
DE		X	X				X			X		
DK	X	X				X		X				
EE												
ES	X	X				X			X		X	
FI		X				X		X				
FR					X	X			X		X	
GB		X				X			X		X	
GR		X				X			X	X		
HR												
HU												
IE		X				X			X		X	
IS												
IT	X	X							X		X	
LT												
LU		X										
LV												
MT												
NL				X		X		X		X		
NO						X		X				
PL												
PT		X				X			X		X	
RO												
SE	X	X				X		X				
SI												
SK												

A.4 Special categories marketed nationally or locally

A.4.1 The national or local conditions of gas distributions (gas composition and supply pressures) lead to the definition of special categories, that are marketed nationally or locally in certain countries, according to Table A.3.

Table A.3 — Categories marketed nationally or locally

Category	Reference gas	Incomplete combustion limit gas	Light back limit gas	Lift limit gas	Sooting limit gas	Country
I_{2ELL}	G 20, G 25	G 21	G 222	G 231, G 271	G 21	DE
II_{1c2E+}	G 130, G 20	G 21	G 132, G 222	G 231,	G 21	FR
$II_{2ELL3B/P}$	G 20, G 25, G 30	G 21, G 30	G 222, G 32	G 231, G 271	G 30	DE
$III_{1a2H3B/P}$	G 110, G 20, G 30	G 21	G 112, G 222, G 32	G 23, G 31	G 30	DK
$III_{1c2E+3+}$	G 130, G 20, G 30	G 21	G 132, G 222, G 32	G 231, G 31	G 30	FR
$III_{1ab2H3B/P}$	G 110, G 120, G 20, G 30	G21	G 112, G 222, G 32	G 23, G 31	G 30	SE
$III_{1ce2H3+}$	G 130, G 150, G 20, G 30	G 21	G 132, G 152, G 222, G 32	G 23, G 31	G 30	ES
$III_{1ace2H3+}$	G 110, G 130, G 150, G 20, G 30	G 21	G 112, G 222, G 32	G 23, G 31	G 30	ES

A.4.2 The definition of the categories in Table A.3 are derived in the same way as those categories listed in 4.1.2. The characteristics of the gases distributed regionally are given in Table A.4.

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).

Category I_{1e}: Appliances using only gases of group e linked to the first family (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_{2LL}: Appliances using only gases of group LL linked to the second family, at a fixed supply pressure. On condition that the gross 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}.

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_{1c2E+}: Appliances capable of using gases of group c linked to the first family and gases of group E 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_{2E+}.

A.4.2.2.2 Appliances designed to use gases of the second family or that are linked to it and gases of the third family

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 $I_{3B/P}$.

A.4.2.3 Category III

Category $III_{1a2H3B/P}$: Appliances capable of using gases of group a of the first family, gases of group H of the second family and gases of the third family. The first family gases are used under the same conditions as for category I_{1a}. The second family gases are used under the same conditions as for category I_{2H}. The third family gases are used under the same conditions as for category $I_{3B/P}$.

Category $III_{1c2E+3+}$: Appliances capable of using gases of group c of 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 $III_{1ab2H3B/P}$: 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 $I_{3B/P}$.

Category $III_{1ce2H3+}$: Appliances capable of using gases of groups c and e linked to the first family, gases of group H of the second family and gases of the third family. The gases linked to the first family gases are used under the same conditions as for categories I_{1c} and I_{1e}. 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 $III_{1ace2H3+}$: Appliances capable of using gases of group a of the first family, gases of groups c and e 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 that are linked to it are used under the same conditions as for categories I_{1a}, I_{1c} and I_{1e}. 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+}.

A.5 Test gases for the special gases distributed nationally or locally

The characteristics of the gases distributed nationally or locally and the corresponding test gases are given in Table A.4 as at 15 °C and 1 013,25 mbar.

Table A.4 — Test gases corresponding to local situations

Gas family and group		Nature of gas	Designation	Composition by volume %	W_i MJ/m^3	H_i MJ/m^3	W_s MJ/m^3	H_s MJ/m^3	d	Test pressure mbar	Country
Gases linked to the first family	Group b	Reference		H_2 = 47						p_n = 8 p_{min} = 6 p_{max} = 15	
		Incomplete Combustion Sooting	G 120	CH_4 = 32 N_2 = 21	24,40	15,68	27,64	17,77	0,413		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[a] = 73,1	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		ES
Gas linked to first family	Group e	Reference (methane-air)	G 150	CH_4 = 53 Air[a] = 47	20,65	18,03	22,93	20,02	0,762	p_n = 8	
		Light back	G 152	CH_4 = 40 Air[a] = 54 C_3H_8 = 6	20,09	18,49	22,09	22,33	0,847	p_{min} = 6 p_{max} = 15	ES

Table A.4 *(continued)*

Gas family and group		Nature of gas	Designation	Composition by volume %	W_i MJ/m^3	H_i MJ/m^3	W_s MJ/m^3	H_s MJ/m^3	d	Test pressure mbar	Country
Gases linked to the second family	Group LL	Reference	G 25[b]	CH_4 = 86 N_2 = 14	37,38	29,25	41,52	32,49	0,612	p_n = 20	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	p_{min} = 18 p_{max} = 25	

[a] Composition of the air (%): O_2 = 20,95; N_2 = 79,05.

[b] For the characteristics of the reference gases G 20 and G 25, see Table 6.

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 can only be used without supplementary tests in appliances in multiple categories including group a of the first family.

A.6 Gas connections in the various countries

Table A.5 lists the situations concerning types of connection specified in 5.1.4.

Table A.5 — Types of connection used in different countries

Countries	Categories I3B/P, I3+, I3P				Other categories		
	Without thread	With thread		Position connector	Thread		Position Connector
		ISO 7-1	EN ISO 228-1		ISO 7-1	EN ISO 228-1	
AT	yes	yes[b]	yes	no	yes	yes	no
BE	yes	yes	yes	yes	yes[b]	no	no
BG							
CH	no	yes	yes	yes	yes	yes	no
CY							
CZ							
DE	yes	yes[b]	no	no	yes[b]	no	no
DK	yes	yes	no	no	yes	no	no
EE							
ES	no	yes[a,b]	yes	yes	yes[a,b]	yes	yes
FI	no	yes	yes	yes	yes	yes	no
FR	no	no	yes	yes	no	yes	yes
GB	yes	yes[a,b]	no	no	yes[a,b]	no	no
GR	yes	yes[b]	no	no	yes[b]	no	on
HR							
HU							
IE	yes	yes[a,b]	no	no	yes[a,b]	no	no
IS							
IT	yes	yes	no	yes	yes[b]	no	yes
LT							
LU							
LV							
MT							
NL	no	yes[b]	no	yes	yes[b]	no	no
NO	yes	yes		no			no
PL							
PT	yes	yes	yes	no	yes	yes	no
RO							
SE	no	yes	yes	yes	yes	yes	no
SI							
SK							

[a] Taper - taper threads.

[b] Taper - parallel threads.

A.7 Flue connections (see 5.1.7)

Table A.6 shows the diameters of flue pipes used in various countries.

Table A.6 — Flue connection practices

Country	Commercial 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 90 100 110 120 130 140 150 160 180
CY	
CZ	
DE (Int)	60 70 80 90 110 120 130 150 160 200
DK	Diameters not standardised
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 -1 tolerance)
	84 109 137 162 fibre cement pipes (all ± 3 tolerances)
GR (Int)	60 70 80 90 110 120 130 150 160 200
HR	
HU	
IE	As GB
IS	
IT	60 80 100 110 120 150
LT	
LU	
LV	
NL	60 70 80 90 100 110 130 150 180 200
NO	Diameters not standardised
PL	
PT	60 85 90 95 105 110 115 120 125 130 135 145 155 205 255 305 355
RO	
SE	
SI	
SK	

Annex B
(normative)

Equivalence rules

B.1 Conversion to categories within a restricted Wobbe Index range

Any appliance belonging to one category may be categorised as an appliance belonging to another category covering a more restricted range of Wobbe Index provided that the requirements of 5.1.1, 5.2.2 and 5.2.5 are satisfied, that its state of conversion corresponds to that of the country (or countries) of destination and that the information provided on the appliance corresponds to its adjustment.

In principle, this equivalence is recognised 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[6)], even though sealed, has been tested under the conditions of the original category with test gases different from those of the country where it is to be sold; or

c) when the requirements for regulators (see 5.2.5) with respect to the existing category differ from those of the new category.

In all cases these supplementary tests are at most those stated in 7.1.3.1.

Examples:

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 7.1.3.1 shall be carried out, after changing the injectors, if necessary.

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 7.1.3.1 after changing the injectors, if necessary, and after adjusting the regulator in accordance with 5.2.5.

B.2 Conversion to categories within an identical Wobbe Index range

Any appliance belonging to one category may be categorised as an appliance belonging to another category covering a more restricted range of Wobbe Index provided that the requirements of 5.1.1, 5.2.2 and 5.2.5 are satisfied, that its state of conversion corresponds to that of the country (or

6) Throughout Annex B the word "adjuster" refers to gas rate adjusters and to fixed primary aeration adjusters as appropriate.

countries) of destination and that the information provided on the appliance corresponds to its adjustment.

In principle, this equivalence is recognised 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[7)], even though sealed, has been tested under the conditions of the original category with test gases different from those of the country where it is to be sold; or

c) when the requirements for regulators (see 5.2.5) with respect to the existing category differ from those of the new category.

In all cases these supplementary tests are at most those stated in 7.1.3.1.

Examples:

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 7.1.3.1 for the test pressures and the test gases relating to category I_{2Esi} or I_{2Er}[8)] and with the corresponding injectors and adjustments. These adjustments shall take into account the requirements of 5.2.5.

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 test specified in 7.1.3.1 for the test pressures corresponding to category I_{2E+}[9)]. In addition, any adjusters shall be locked and sealed in the appropriate positions, taking account of the requirements of 5.2.5.

B.3 Conversion of categories within a wider Wobbe Index range

An appliance belonging to one category may be categorised as an appliance in another category covering a wider range of Wobbe Index if it complies with all the constructional requirements of the proposed new category.

In addition, the appliance shall be submitted to the tests specified in 7.1.3.1 using the test gases and test pressures for the proposed new category. Where appropriate, account shall be taken of the Special Condition given in Annex G.

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7) Throughout Annex B, the word "adjuster" refers to gas rate adjusters and to fixed primary aeration adjusters as appropriate.

8) Where the intended country of destination is Belgium, account should be taken of the Special Conditions given in Annex G.

9) Where the intended country of destination is Belgium, account should be taken of the Special Conditions given in Annex G.

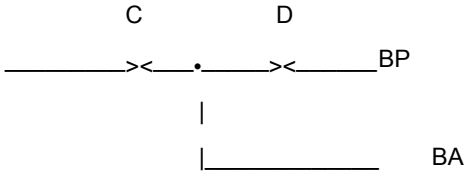
Annex C
(informative)

Gas valve arrangements

Legend: BA = ignition burner

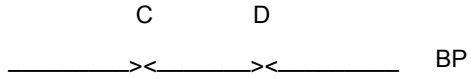
BP = main burner

a) Appliances with permanent ignition burner



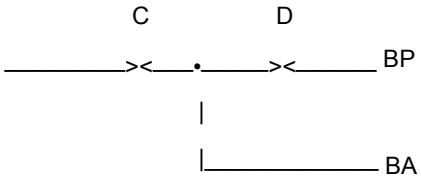
b) Appliances with automatic ignition

1) Direct ignition of the main burner

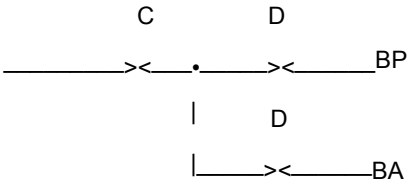


2) Appliances with an intermittent ignition burner

i)



ii)



Annex D
(informative)

Means of identification of the types of gas in force in the various countries

Table D.1 — Means of identification of the types of gas in use in the various countries

Gas type	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			Propan-Luft Butan-Luft		Erdgas H		Butan	Propan
CY								
CZ								
DE		Gruppe b			Erdgas E Ws.n = 15,0 kWh/m^3	Erdgas LL Ws.n = 12, 4kWh/m^3	Flüssiggas B	Flüssiggas P
DK	By gas				Naturgas		F-Gas	F-Gas
EE								
ES	Gas manufacutrado		Aire propando	Aire Metando	Gas natural		Butano	Propano
FI					Maakaasu naturgas		Butaani butan	Propaani Propan
FR			Air propané/ Air butanè		Gaz naturel Lacq	Gaz naturel Groningue	Butane	Propane
GB					Natural gas		Butane	Propane
GR								
HR								
HU								
IE					Natural gas		Butane	Propane
IS								

Table D.2 *(continued)*

Gas type	G 110	G 120	G 130	G 150	G 20	G 25	G 30	G 31
IT	Gas di Città				Gas naturale/ Gas metano		GPL	
LT								
LU								
MT								
NL						Aardgas	Butaan	Propaan
NO							Butan	Propan
PL								
PT	Gás de cidade				Gás naturel		Butano	Propano
RO								
SE								
SI								
SK								

Annex E
(normative)

Apparatus for the determination of the smoke number

E.1 Pump

A (hand) pump, by means of which (160 ± 8) cm^3 may be sucked in a single operation through an effective filtering surface 6 mm in diameter (i.e. approximately (570 ± 27,5) cm^3 per cm^2 of effective filtering surface); the piston stroke of the pump should be approximately 200 mm.

The tensioning of the paper fixing device, which is set in the specified position before the paper is inserted, is to ensure satisfactory air-tightness for the re-heating operation which is intended to eliminate condensation.

The distance travelled by the gases from the sampling point to the filtering surface is not to exceed 40 cm, except in special chimney conditions.

E.2 Sampling tube

A tube with an external diameter of 6 mm, suitable for use with the pump described in E.1.

E.3 Filter paper

Use a filter paper with a reflection factor of (85 ± 2,5) % determined photometrically. For this measurement, place the filter paper on a white surface having a reflection factor of 75 % or more.

The passage of clean air through the new filter paper, at a flow rate of 3 dm^3 per min per cm^2 of effective filtering surface, to give a pressure drop of between 20 mbar and 100 mbar.

E.4 Grey scale

The grey scale consists of ten numbered grades from 0 to 9, scaled in equal intervals from white to dark grey. These grades comprise samples printed, or made by other means on a support made of paper or plastic with a reflection factor of (85 ± 2,5) % determined photometrically.

The identification number of each grade is equal to one tenth of the reduction rate. This is expressed as a percentage of the incident light reflected on the corresponding sample. The number 0 corresponds to the support paper and the number 6, for example, to a reduction rate of 60 %.

The tolerance of the deviations of the reflection factor for each of the points on the scale, should not exceed 3 % of its value.

If the scale is protected by a transparent plastic cover, it should be made in such a way that the test spot and the standard grades are observed through the same thickness of protection material. The grades of the scale range have a diameter of about 20 mm and a central circular window 6 mm in diameter.

Annex F
(informative)

Symbols and abbreviations

Calorific value - Net Caloric value - Gross	H_i H_s	MJ/m^3 or MJ/kg
Heat input Nominal heat input	Q Q_n	kW kW
Relative density - Dry test gas Relative density - Dry reference gas Relative density - Wet gas	d d_r d_h	
Wobbe index - Net Wobbe index - Gross	W_i W_s	MJ/m^3 or MJ/kg
Pressure - Normal Pressure - Maximum Pressure - Minimum Pressure - Atmospheric Pressure - Saturation vapour	p_n p_{max} p_{min} p_{at} p_w	mbar mbar mbar mbar mbar
Mass flow rate	M	kg/h
Volumetric flow rate Volumetric flow rate - Reference conditions	V V_o	m^3/h
Carbon monoxide concentration Carbon monoxide measured	$V_{CO,N}$ $V_{CO,M}$	% by volume % by volume
Carbon dioxide concentration Carbon dioxide measured	$V_{CO2,N}$ $V_{CO2,M}$	% by volume % by volume

Annex G
(normative)

Special national conditions

Special national condition: National characteristic or practice that cannot be changed even over a long period, e.g. climatic conditions, electrical earthing conditions.

NOTE If it affects harmonisation, it forms part of the European Standard or Harmonisation Document.

For the countries in which the relevant special national conditions apply these provisions are normative, for other countries they are informative.

G.1 Belgium

Appliances of category I_{2E+} 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.

Appliances in category I_{2Er} may also be marketed in Belgium, in which case the governor is required to be sealed. In addition, the sealing of the governor shall be identified by the symbol(s).

Annex H
(normative)

Calculation of conversions of NOx

Table H.1 — Conversion of the emission value of NOx for first family gases

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

Table H.2 — Conversion of the emission value of NOx for second family gases

1 ppm = 2,054 mg/m^3 (1 ppm = 1 cm^3/m^3)		G 20		G 25	
		mg/kWh	mg/MJ	mg/kWh	mg/MJ
O_2 = 0 %	1 ppm =	1,764	0,490	1,797	0,499
	1 mg/m^3 =	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

Table H.3 — Conversion of the emission value of NOx for third family gases

1 ppm = 2,054 mg/m^3 (1 ppm = 1 cm^3/m^3)		G 30		G 31	
		mg/kWh	mg/MJ	mg/kWh	mg/MJ
O_2 = 0 %	1 ppm =	1,792	0,498	1,778	0,494
	1 mg/m^3 =	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

Annex I
(normative)

Dress guards

I.1 Scope

This annex contains requirements and tests for integral dress guards described in 5.1.10.

I.2 Requirements

I.2.1 Access

When tested with the test probe shown in Figure I.1 in accordance with I.3.1 it shall not be possible to touch the heated radiants, radiant material, or any flame, with any part of the test probe cone.

No opening in the guard or between the guard and the aperture to be protected shall have a major dimension exceeding 150 mm, a minor dimension exceeding 35 mm and a diagonal measurement exceeding 154 mm. The above dimensions do not apply to any opening:

— between the guard and the aperture to be protected if it is not possible to pass the 12 mm diameter probe, according to Figure I.1, through that opening;

— where the gap between any vertical rods does not exceed 5 mm.

I.2.2 Strength

I.2.2.1 Metallic designs

The guard, when subjected to the test load described in I.3.2.1 shall not have been removed, permanently distorted or permanently displaced.

Any hinged guard opened by the test probe described in I.3.2.1 shall return to its original position on release of the pull but any fastening clip need not necessarily re-engage.

I.2.2.2 Guard designs which include glass or similar material

When subjected to the test described in I.3.2.2 the glass shall not break.

I.3 Tests

I.3.1 Access

With the cone (b) illustrated in Figure I.1 assembled to the handle (a), under normal conditions of burning, insert the probe through or around the guard with a pressure exerted on the probe not exceeding 5 N. Take the weight of the probe into account in the force applied.

With the probe (c) illustrated in Figure I.1 assembled to the handle (a), under normal conditions of burning, insert the probe through any opening between the guard and the aperture to be protected with a pressure exerted on the probe not exceeding 5 N. Take the weight of the probe into account in the force applied.

I.3.2 Strength

I.3.2.1 Metallic designs

Place the appliance used at room temperature, so that the plane of the central section of the guard is horizontal, then;

a) place a load consisting of a flat disc 100 mm in diameter and 5 kg in mass on the guard midway between the fixing points and retain it there for 1 min. At the end of that period remove the load, then;

b) apply a pull of 20 N in any direction to the guard when it is in its normal position of use.

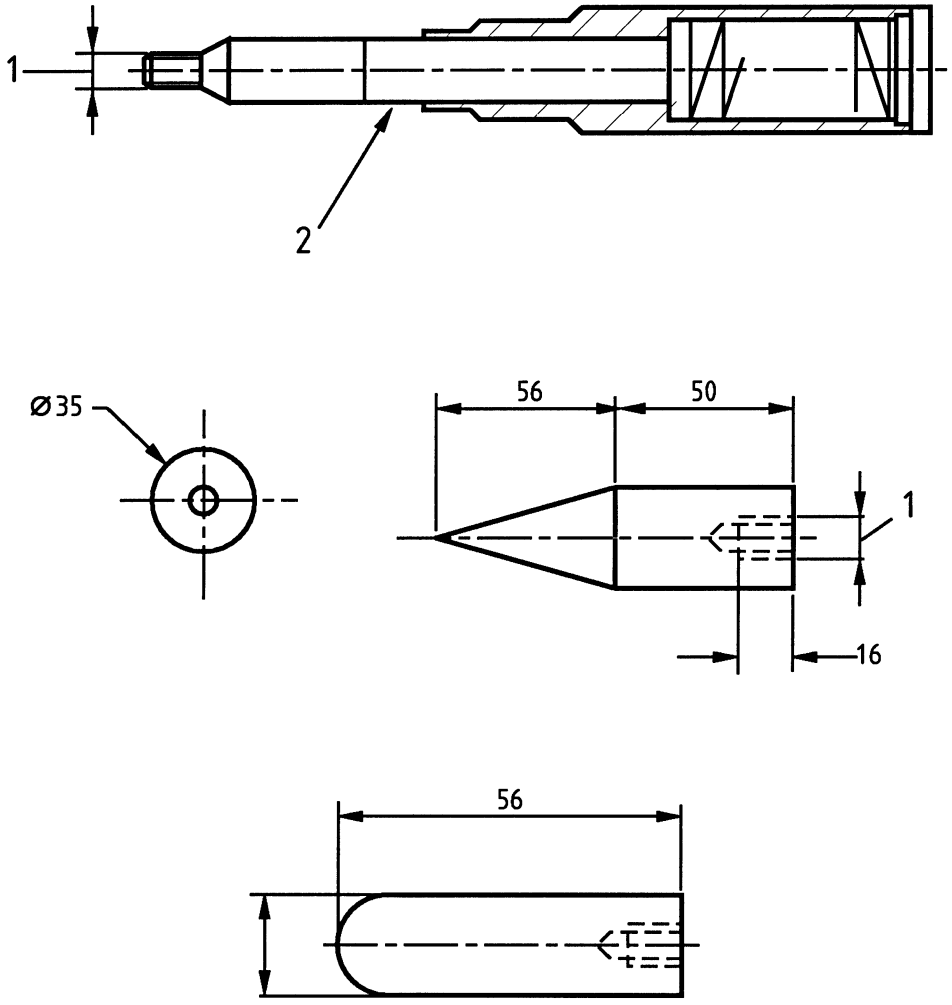
I.3.2.2 Guard designs which include glass or similar material

With the appliance at room temperature, apply a direct blow at the weakest point of the guard equivalent to an impact energy of 0,5 N·m.

When a guard consists of bars of glass or similar material packed along side each other so as to touch, reduce the impact energy to 0,25 N·m.

Apply the blow by means of the spring-operated impact-test apparatus in accordance with EN 60068-2-75.

Dimensions in millimetres



Key

1 6 mm thread medium fit

2 5 N force for the horizontal and vertical planes are marked on either side

Figure I.1 — Test probe

Annex J
(informative)

A-deviations

A-deviations: National deviation due to regulations, the alterations of which is for the time being outside the competence of the CEN/CENELEC member.

This European Standard falls under Directive 2009/142/EC for gas appliances.

NOTE (from CEN-CENELEC IR Part 2:2011, 2.17) Where standards fall under EU Directives, it is the view of the Commission of the European Communities (OJ No C 59; 1982-03-09) that the effect of the decision of the Court of Justice in case 815/79 Cremonini/Vrankovich (European Court Reports 1980, p. 3583) is that compliance with A-deviations is no longer mandatory and that the free movement of products complying with such a standard should not be restricted except under the safeguard procedure provided for in the relevant Directive.

A-deviations in an EFTA country are valid instead of the relevant provisions of the European Standard in that country until they have been removed.

J.1 A-deviations

For Switzerland, additional requirements to the following clauses are necessary:

6.7 Combustion

6.8 Sooting

Additional to the requirements given in this standard the limit of values for emissions of CO and sooting as laid down in the Swiss Clean-Air-Regulations[10)] (CAR) dated 1985-12-16 (state 1992-01-01) are authoritative.

10) LRV/OPair/CAR 81444.318.142.1
Bezugsquelle/Vente/Available from:

EMDZ
PO Box
CH-3000 Berne
Switzerland

Annex K
(informative)

Main technical changes compared to the edition of 2003

Page No.	Clause	Change
102	Annex ZA	The A-deviation for Switzerland is a normal annex since Annex Z are dedicated to European Directives.
7	1	Last line of the section 'This standard is only applicable to appliances which are intended to be type tested.' is deleted as it does not just apply to type tested appliances.
8	2	EN 437:2003 has been changed to EN 437.
8	2	EN 437:2003 has been changed to EN 437.
14	3.4.1	The device is just an adjuster. Therefore text has been amended to 'immobilization of an adjuster (by some means such as e.g. a screw).
14	3.4.2	Both Notes in this section have been deleted as they are covered elsewhere.
15	3.5.1.4	'declared by the manufacturer' has been replaced with ''as stated in the instructions'. Reference to the standard EN 437:2003 has been removed.
17	4.1.2.1	Wording added 'these are referenced in EN 437' at the end of the first sentence. Removed the 2nd and 3rd paragraph and all of 4.1.2.2, 4.1.2.3 and 4.1.2.4.
18	5.1.1.1	'Manufacturer's instructions' has been changed to 'Technical instructions of the appliance'.
19	5.1.2	In the second paragraph, there is now a full stop after manufacturer's instructions and 'manufacturer's instructions has been changed to be changed to 'technical instructions of the appliance'.
19	5.1.2	In the third paragraph, the Special Tool must be detailed in the technical instructions or supplied with the appliance.
20	5.1.3	There is now a full stop after maintenance in the 4th paragraph. The text 'installation instructions' has been replaced with 'technical installation instructions of the appliance'.
22	5.1.8	In the third paragraph 'manufacturer specifies the nature' to be changed to 'technical instructions'.
23	5.2.2	'Governor' has been replaced with 'regulator'
27	5.5	'Manufacturer' to be changed to 'technical instructions'.
32	6.6	In the second paragraph the text 'annulled' has been changed to 'immobilised' for consistency.
34	6.12	On the first line 'manufacturer' has been changed to 'technical instructions'.
35	7.1.1	The first paragraph has been changed to remove everything up to Table 9 and refer to EN437 as this section is a direct copy of that standard.
36	7.1.5.3	In the first paragraph, the note has been removed as it superfluous.
39	7.2.2.1	Under b) – Test No. 2, the text 'if the appliance has an integral flue' has been removed.
43	7.3.3	Governors has been replaced with regulators.
47	7.6	'Governor' has been replaced with 'regulator'

58	8.	The text ‘Instructions’ has been changed to ‘Technical instructions of the appliance’.
59	8.2.5	‘Governor’ has been replaced with ‘regulator’
77	Annex A	In the first paragraph ‘can be marketed only’ has been replaced with ‘may only be put into service if’.
91	Annex D	Note a) has been removed from Table D-1 and put in the title as it refers to all countries.
95	Annex G.1	‘marketed’ has been replaced by ‘put into service’.
102	Annex ZA/ZB	See above for Annex ZA.

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 2009/142/EC

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 2009/142/EC.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Directive 2009/142/EC

Essential requirement	Subject		Relevant clauses in EN 13278
1.1	Safe design and construction		Whole standard
1.2	Instructions	- installer	8.3.2.1
		- user	8.3.3
	Warning notice	- appliance	8.2.1
		- packaging	8.2.5
	Official language		8 and 8.3.1
1.2.1	Type of gas used		8.3.2.1
	Gas supply pressure		8.3.2.1
	Fresh air	- for combustion	8.3.2.1
	Forced draught burners	- products dispersal	8.3.2.1
			Not applicable
1.2.2	Instructions for use and servicing		8.3.1
			8.3.3
1.2.3	Warning notices on appliance and packaging		8.2.1
			8.2.5
1.3	Fittings - manual valves		5.2.3
	- regulators		5.2.5
	- flame supervision device		5.2.4
	- automatic valves		5.2.3
	- automatic burner control systems		5.2.6
	- thermostats		5.2.7
	Instructions		Not applicable
2.1	Appropriate materials		5.1.2
			5.1.3
2.2	Properties		1
3.1.1	Durability		5.1.2 and 5.1.3
3.1.2	Condensation		5.1.2
3.1.3	Explosion risk		5
3.1.4	Air/water penetration		Not applicable

Table ZA.1 *(continued)*

Essential requirement	Subject	Relevant clauses in EN 13278
3.1.5	Normal fluctuation of auxiliary energy	5.1.9, 6.5.3 and 6.7.1b)
3.1.6	Abnormal fluctuation of auxiliary energy	5.1.9 6.7.1b)
3.1.7	Electrical hazards	5.1.8
3.1.8	Deformation	Not applicable
3.1.9	Safety/control device failure - gas circuit - automatic burner control system - flame supervision device - automatic shut off valves - regulators - thermostats - air proving device	 5.2 5.2.6 5.2.4 and 5.5 5.2.3 5.2.5 5.2.7 5.4
3.1.10	Overruling of safety devices	5.2.1
3.1.11	Pre-set adjuster protection	5.2.1 5.2.2
3.1.12	Marking of levers and setting devices	5.2.3
3.2.1	Gas leakage	5.1.5, 6.2.1
3.2.2	Gas release during ignition, re-ignition and extinction	5.5 6.10
3.2.3	Unburned gas accumulation	5.2.4 , 5.5
3.3	Ignition - ignition, re-ignition and cross-lighting	6.5.1
3.4.1	Flame stability Harmful substance	6.5.2 6.7
3.4.2	Combustion products release	6.2.2
3.4.3	Combustion products release	6.9
3.4.4	Flueless domestic appliances	Not applicable
3.5	Rational use of energy	6.12
3.6.1	Floor etc. temperatures	6.4.3
3.6.2	Temperature of knobs/levers	6.4.1, 6.4.2
3.6.3	External parts	6.4.1
3.7	Foodstuffs and water	Not applicable
Annex II	Certification	1

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

Bibliography

[1] EN 509, *Decorative fuel-effect appliances*

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