

BS EN 12309-2:2015

Incorporating corrigendum December 2015



BSI Standards Publication

Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW

Part 2: Safety

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National foreword

This British Standard is the UK implementation of EN 12309-2:2015, incorporating corrigendum December 2015. Together with BS EN 12309-1:2014 it supersedes BS EN 12309-1:2000, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GSE/37, Gas fired sorption and laundering appliances.

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

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English Version

Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW - Part 2: Safety

Appareils à sorption fonctionnant au gaz pour le chauffage et/ou le refroidissement de débit calorifique sur PCI inférieur à 70 kW - Partie 2 : Sécurité

Gasbefeuerte Sorptions-Geräte für Heizung und/oder Kühlung mit einer Nennwärmebelastung nicht über 70 kW - Teil 2: Sicherheit

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Foreword

This document (EN 12309-2:2015) has been prepared by Technical Committee CEN/TC 299 “Gas-fired sorption appliances, indirect fired sorption appliances, gas-fired endothermic engine heat pumps and domestic gas-fired washing and drying appliances”, the secretariat of which is held by UNI.

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of an identical text or by endorsement, at the latest by November 2015, and conflicting national standards shall be withdrawn at the latest by November 2015.

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 12309-1:1999.

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, Annex ZB and Annex ZC, which are integral parts of this document.

EN 12309 comprises the following parts under the general title, *Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW*:

- Part 1: Terms and definitions;
- Part 2: Safety;
- Part 3: Test conditions;
- Part 4: Test methods;
- Part 5: Requirements;
- Part 6: Calculation of seasonal performances;
- Part 7: Specific provisions for hybrid heating appliances;
- Part 8: Environmental aspects.

EN 12309-1 and EN 12309-2 supersede EN 12309-1:1999, whereas EN 12309-1 and EN 12309-3, EN 12309-4, EN 12309-5, EN 12309-6 and EN 12309-7 supersede EN 12309-2:2000. EN 12309-1, EN 12309-2, EN 12309-3, EN 12309-4, EN 12309-5, EN 12309-6 and EN 12309-7 have been prepared to address the essential requirements of the European Directive 2009/142/EC relating to appliances burning gaseous fuels (see EN 12309-2:2015, Annex ZA, for safety aspects and EN 12309-5:2014, Annex ZA, for rational use of energy aspects).

These documents are linked to the following European Directives:

- Energy Related Products Directive (2009/125/EC) in terms of tests conditions, tests methods and seasonal performances calculation methods under Mandate M/495 (see EN 12309-5:2014, Annex ZB);

For the relationship with EU Directive(s), see EN 12309-2:2015, Annex ZA, and EN 12309-5:2014, Annex ZA, Annex ZB and Annex ZC. These documents will be reviewed whenever new mandates could apply.

EN 12309-8, Environmental aspects, deals with the incorporation of the Resolution BT 27/2008 regarding CEN approach on addressing environmental issues in product and service standards.

This document deals particularly with the operational safety of the appliance.

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

1.1 Scope of EN 12309 series

Appliances covered by this European Standard include one or a combination of the following:

- gas fired sorption chiller;
- gas fired sorption chiller/heater;
- gas fired sorption heat pump.

This European Standard applies to appliances only when used for space heating and cooling with or without heat recovery.

This European Standard applies to appliances having flue gas systems of type B and C (according to CEN/TR 1749) and to appliances designed for outdoor installations. EN 12309 does not apply to air conditioners, it only applies to appliances having:

- integral burners under the control of fully automatic burner control systems;
- closed system refrigerant circuits in which the refrigerant does not come into direct contact with the water or air to be cooled or heated;
- mechanical means to assist transportation of the combustion air and/or the flue gas.

The above appliances can have one or more primary or secondary functions (i.e. heat recovery - see definitions in EN 12309-1:2014). In the case of packaged units (consisting of several parts), the standard applies only to those designed and supplied as a complete package.

The appliances having their condenser cooled by air and by the evaporation of external additional water are not covered by this European Standard.

Installations used for heating and/or cooling of industrial processes are not within the scope of these standards.

NOTE All the symbols given in this text are used regardless of the language used.

1.2 Scope of this Part 2 to EN 12309

This part of EN 12309 deals with the safety of gas-driven sorption heat pumps as defined in EN 12309-1. Only types B12 for outdoor installations, B13 for outdoor installations, B22 for outdoor installations, B23 for outdoor installations, C12 and C13, C32 and C33 are covered in this European Standard.

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 88-1:2011, *Pressure regulators and associated safety devices for gas appliances - Part 1: Pressure regulators for inlet pressures up to and including 50 kPa*

EN 88-2:2007, *Pressure regulators and associated safety devices for gas appliances - Part 2: Pressure regulators for inlet pressures above 500 mbar up to and including 5 bar*

- EN 126:2012, *Multifunctional controls for gas burning appliances*
- EN 161:2011+A3:2013, *Automatic shut-off valves for gas burners and gas appliances*
- EN 257:2010, *Mechanical thermostats for gas-burning appliances*
- EN 298:2012, *Automatic burner control systems for burners and appliances burning gaseous or liquid fuels*
- EN 378-2:2008+A2:2012, *Refrigerating systems and heat pumps - Safety and environmental requirements - Part 2: Design, construction, testing, marking and documentation*
- EN 378-3:2008+A1:2012, *Refrigerating systems and heat pumps - Safety and environmental requirements - Part 3: Installation site and personal protection*
- 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*
- EN 1092-1:2007+A1:2013, *Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN designated - Part 1: Steel flanges*
- EN 1092-2:1997, *Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN designated - Part 2: Cast iron flanges*
- EN 1092-3:2003, *Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN designated - Part 3: Copper alloy flanges*
- EN 1254-2:1998, *Copper and copper alloys - Plumbing fittings - Part 2: Fittings with compression ends for use with copper tubes*
- 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 12067-2:2004, *Gas/air ratio controls for gas burners and gas burning appliances - Part 2: Electronic types*
- EN 12309-1:2014, *Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW - Part 1: Terms and definitions*
- EN 12309-3:2014, *Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW - Part 3: Test conditions*
- EN 12309-4:2014, *Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW - Part 4: Test methods*
- EN 12309-5:2014, *Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW - Part 5: Requirements*
- EN 14459:2007, *Control functions in electronic systems for gas burners and gas burning appliances - Methods for classification and assessment*
- EN 60335-1:2012, *Household and similar electrical appliances - Safety - Part 1: General requirements (IEC 60335-1:2010, modified)*

EN 60335-2-102:2006, *Household and similar electrical appliances - Safety - Part 2-102: Particular requirements for gas, oil and solid-fuel burning appliances having electrical connections (IEC 60335-2-102:2004, modified)*

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

EN 60730-2-9:2010, *Automatic electrical controls for household and similar use - Part 2-9: Particular requirements for temperature sensing controls (IEC 60730-2-9:2008, modified)*

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

EN ISO 3166-1:2014, *Codes for the representation of names of countries and their subdivisions - Part 1: Country codes (ISO 3166-1:2013)*

ISO 7-1:1994, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 1182:2010, *Reaction to fire tests for products — Non-combustibility test*

ISO 3864-2:2004, *Graphical symbols — Safety colours and safety signs — Part 2: Design principles for product safety labels*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12309-1:2014 and the following apply.

3.1 automatic recycling
automatic process by which, after loss of flame during operation, the gas supply is interrupted and the full start procedure is re-initiated automatically

4 Classification

Appliances can be classified according to:

- the gases they use;
- the mode of air supply and evacuation of combustion products;
- the temperatures of their heat transfer media;
- their denomination.

4.1 Classification of appliances

4.1.1 Classification of gases

Gases are classified into three families, divided into groups according to the value of the Wobbe index. Families and groups of gas used in this standard are in accordance with those of the EN 437:2003+A1:2009.

4.1.2 Classification according to the mode of air supply and evacuation of the combustion products

The types of appliances as defined in CEN/TR 1749 are applicable.

4.1.3 Classification according to the temperatures of the heat transfer media

4.1.3.1 General

The classification according to the temperatures of the heat transfer media is formed in such a way that the heat transfer media are indicated together with their temperatures (in °C). A short classification is formed in such a way that a characteristic letter is used for the heat transfer medium: A for air, W for water and B for brine.

For the purposes of this standard, all references to the term “absorber” shall be taken to mean “adsorber” where the function of the appliance is based on adsorption.

4.1.3.2 Cooling mode

When the appliance is operating in the cooling mode, the temperatures indicated in the first place refer to the indoor heat exchanger and the temperatures in the second place to the outdoor heat exchanger.

Air and water/brine temperatures for the indoor heat exchanger indoor heat exchanger are inlet temperatures. Water/brine temperatures for the outdoor heat exchanger are outlet temperatures.

EXAMPLE A27/W7 means an inlet temperature of air for the indoor heat exchanger indoor heat exchanger of 27 °C and an outlet temperature of water for the outdoor heat exchanger of 7 °C.

4.1.3.3 Heating mode

When the appliance is operating in the heating mode, the values indicated in the first place refer to the outdoor heat exchanger and the values in the second place to the indoor heat exchanger.

Air and water/brine temperatures for the outdoor heat exchanger are inlet temperatures. Water/brine temperatures for the indoor heat exchanger are outlet temperatures.

EXAMPLE B0/W50 means an inlet temperature of brine for the outdoor heat exchanger of 0 °C and an outlet temperature of water for the condenser/absorber of 50 °C.

4.1.4 Classification according to denomination

4.1.4.1 Cooling mode

Appliances designed to operate in the cooling mode are denominated in such a way that the heat transfer medium for the indoor heat exchanger is indicated first, followed by the heat transfer medium for the outdoor heat exchanger. Examples of such appliances are given in Table 1.

Table 1 — Examples of appliances designed to provide cooling

Heat transfer medium		Denomination
Indoor heat exchanger	Outdoor heat exchanger	
Air	Water ^a	Air Cooled Liquid Chiller Air Cooled Liquid Chiller Heater
Water ^a	Water ^a	Water Cooled Liquid Chiller Water Cooled Liquid Chiller Heater
Brine	Water ^a	Brine Cooled Liquid Chiller Brine Cooled Liquid Chiller Heater
^a This description also applies where the water contains additives to prevent corrosion as specified in the appliance's instructions.		

4.1.4.2 Heating mode

For the purposes of this standard, appliances designed to operate in the heating mode are denominated in such a way that the heat transfer medium for the outdoor heat exchanger is indicated first, followed by the heat transfer medium for the indoor heat exchanger. Examples of such appliances are given in Table 2.

Table 2 — Examples of appliances designed to provide heating

Heat transfer medium		Denomination
Outdoor heat exchanger	Indoor heat exchanger	
Air	Water ^a	Air/water Heat pump
Water ^a	Water ^a	Water/water Heat Pump
Brine	Water ^a	Brine/Water Heat Pump
^a This description also applies where the water contains additives to prevent corrosion as specified in the appliance's instructions.		

5 Construction and design requirements

5.1 General

5.1.1 Conversion to different gases

The following operations are allowed in order to convert from a gas of one family or group to a gas of another family or group:

- a) adjustment of the gas rate of the main burner and ignition burner;
- b) change of injectors or restrictor;
- c) change of the ignition burner or its components;
- d) change of the gas rate modulation system;

- e) putting out of service and sealing a gas rate adjuster and/or a regulator;
- f) changes of configuration parameters by data exchange (for requirement see EN 14459).

For each of the operations mentioned above the appliance shall be tested with each of the gases. These operations shall be possible without having to interfere with the connections of the appliance to its pipe-work (gas, water, duct system).

5.1.2 Materials and method of construction

When the appliance is installed in accordance with the appliance's instructions, all components, including the heat exchangers and the refrigerant circuit, shall withstand the mechanical, chemical and thermal conditions to which they may be subjected in the course of normal use.

In addition, the appliance shall be designed in such a way that if condensation takes place, this shall not:

- affect the operational safety;
- drop outside the appliance.

This requirement does not apply to the flow of condensate which is produced at the outlet of the combustion products evacuation duct or from a purpose made condensate discharge system.

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

Asbestos or materials containing asbestos shall not be used.

Solder with a melting point below 450 °C after application shall not be used for gas carrying parts. Hard solder containing cadmium in its formulation shall not be used in the construction of the appliance.

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

5.1.3 Accessibility for maintenance and use

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

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

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

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

5.1.4 Thermal insulation

Any thermal insulation shall retain its insulating properties under the influences of temperature and ageing. The insulation shall withstand the normally expected thermal and mechanical stresses. The insulation of parts associated with the combustion products circuit shall be non combustible. All insulation shall be securely located and protected against mechanical damage, condensate and vermin.

5.1.5 Gas connection

The appliance gas inlet connection shall be accessible.

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

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

A compression fitting suitable for copper tube shall comply with EN 1254-2 and EN 1057.

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

If flanges are used, they shall comply with EN 1092-1, EN 1092-2 or EN 1092-3 as appropriate and the counterflanges and sealing gaskets shall be provided.

5.1.6 Soundness

5.1.6.1 Soundness of the gas circuit

The gas circuit shall consist of metallic parts.

Holes for screws, studs, etc., intended for the assembly of parts shall not open into gasways. The wall thickness between drillings and gasways shall be at least 1 mm. This does not apply to orifices for measurement purposes.

The soundness of parts and assemblies making up the gas circuit and likely to be dismantled for routine maintenance *in situ* shall be achieved by means of mechanical joints, e.g. metal-to-metal joints, packing, or O-ring joints, i.e. excluding the use of all sealing materials such as tape, paste or liquid. However, the sealing materials mentioned above may be used for permanent assemblies. These sealing materials shall remain effective under all conditions of appliance use. It shall not be possible for water to penetrate into the gas circuit.

5.1.6.2 Soundness of the combustion circuit

The combustion circuit shall be constructed so as to prevent any leakage of combustion products.

Any means used to achieve soundness of the combustion circuit shall be such that it remains effective under normal conditions of use and servicing.

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

Where the appliance case forms part of the combustion circuit and it can be removed without the use of tools, either the appliance shall not operate, or there shall be no leakage of combustion products into the room where the appliance is installed when the case is replaced incorrectly.

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

The ducts, bends, if any, and the terminal or fitting piece shall fit together correctly and form a stable assembly.

Parts intended to be dismantled for periodic servicing shall be designed and arranged so that soundness is ensured after reassembly.

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

5.1.7 Air proving

Appliances with fans shall be fitted with a system for air proving.

Except for appliances with gas/air ratio controls, before each fan starts it shall be checked that there is no simulation of air flow in the absence of air flow.

The system for supervision of the combustion air rate or combustion products rate shall be activated directly by the flow of combustion air or combustion products. This is also valid for appliances with more than one fan speed in which the flows associated with each fan speed are monitored.

The supply of combustion air shall be checked by one of the following methods:

- a) gas /air ratio controls;
- b) continuous supervision of the combustion air rate or combustion products rate;
- c) start up supervision of the combustion air rate or combustion products rate provided that for indoor installations:
 - the combustion products circuit is completely surrounded by the air supply circuit;
 - there is a shutdown at least every 24 h¹⁾;
 - there is an indirect system for air proving (e.g. fan speed supervision) during operation.

5.1.8 Air proving device

5.1.8.1 General

Depending on the principle of air proving, the applicable requirements are described in the clauses below.

The appliance is installed as stated in 7.1.6.4. The appliance is supplied with one of the reference gases for the category to which it belongs.

The appliance is fitted with the longest combustion air supply and combustion products evacuation ducts stated in the installation instructions. The tests may be carried out without the terminal or fitting piece.

The CO concentration is determined as stated in 7.3.5.

5.1.8.2 Supervision of the combustion air rate or the combustion products rate

Under the test conditions 7.3.14.1 the following requirement shall be met.

At a reduced flow rate the CO concentration (dry, air-free) may not exceed a specific value.

The following methods of flow reduction are to be examined:

1) Some appliances can be used in a way that it is very likely they can shutdown at least once per 24 h without having a specific function to ensure this.

- a) progressive blockage of the air inlet;
- b) progressive blockage of the combustion products evacuation ducts;
- c) progressive reduction of the fan speed, for example by reduction of the fan voltage.

There are two alternative supervision strategies for the air proving; a start up supervision or a continuous supervision. Based on the supervision strategy the appliance shall at a reduced flow rate meet one of the following two requirements:

- d) continuous supervision: Shutdown before the CO concentration exceeds 0,2 %, or
- e) start up supervision: Not start if the CO concentration exceeds 0,1 %.

5.1.9 Gas/air ratio controls

5.1.9.1 Fixed or adjustable gas/air ratio settings

If the installation instructions state (see 8.2.1) that the gas/air ratio control settings are not intended to be adjusted during installation, appliance service or when the gas valve is replaced then the appliance shall incorporate additional provisions to discourage unauthorized interference with the gas/air ratio control settings.

The following examples are considered to be suitable additional provisions:

- a) physical removal of the adjustment screws (or other method of rendering these inoperative);
- b) physically preventing access to the adjustment screws (e.g. filling access holes);
- c) addition of a suitably worded warning label affixed to the gas valve and/or in close proximity to the adjuster screws. This label shall be clearly visible to whilst gaining access to the adjuster screws.

NOTE 1 Gas/air ratio controls typically have two adjustments ("throttle" and "offset") and the requirements of this clause apply to both.

If the appliance installation instructions indicate that the valve can be adjusted using appropriate instruments a provision shall be provided to indicate that the valve setting has been changed.

NOTE 2 An example of a suitable provision is to use a paint spot on the adjusting device.

If at the time of installation or service there is an indication that the gas/air ratio control settings have been altered then the appliance instructions shall include how the settings should be checked. The appliance installation instructions shall indicate the action to be taken if the settings are found to be incorrect.

If the appliance installation instructions allow the gas/air ratio controls to be adjusted then the method for adjustment shall be described.

5.1.9.2 Leakage of control tubes

Under the test conditions in 7.3.15, the following requirement shall be met.

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

5.1.9.3 Supervision of the combustion air rate or the combustion products rate

Under the test conditions in 7.3.14.2 the following requirement shall be met.

At a reduced flow rate the CO concentration may not exceed a specific value. The following methods of flow reduction are to be examined:

- a) progressive blockage of the air inlet;
- b) progressive blockage of the combustion products evacuation ducts;
- c) if internal recirculation can occur then an additional test shall be carried out by progressive reduction of the fan speed, for example by reduction of the fan voltage.

There are two alternative supervision strategies for the air proving; a start up supervision or a continuous supervision. Based on the supervision strategy the appliance shall at a reduced flow rate meet one of the following two requirements:

- a) start up supervision:
not start if the CO concentration (dry, air free) exceeds 0,1 %.
- b) continuous supervision:
shutdown before the CO concentration (dry, air free) exceeds:
 - 1) 0,20 % over the range of modulation specified in the installation instructions), or
 - 2) $C_{Omes} \times Q / Q_{KB} \leq 0,20$ % below the minimum rate of the modulation range.

where

- Q is the instantaneous heat input, in kW;
- Q_{KB} is the heat input at the minimum rate, in kW;
- C_{Omes} is the measured CO concentration (dry, air free)

5.1.9.4 Adjustment of the gas/air ratio

Under the test conditions in 7.3.16, the following requirement shall be met.

The installation instructions (see 8.2) shall declare maximum and minimum CO₂ levels between which no adjustment action is required.

If the gas/air ratio is adjustable for CO₂ the test of 5.1.9.3 shall be repeated at the test conditions from 7.3.16.

5.1.10 Supply of combustion air and evacuation of combustion products

5.1.10.1 General

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

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

5.1.10.2 Appliance combustion air inlet

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

5.1.10.3 Appliance flue gas outlet

5.1.10.3.1 General

The cross section of the appliance flue gas outlet shall not be adjustable after installation i.e. flue dampers are not permitted.

5.1.10.3.2 Type B₁₂ and B₁₃ appliances

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

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

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

It shall be possible to insert a flue pipe of nominal external diameter ($D-2$) mm to a depth of at least $D/4$ but not so far that the evacuation of the combustion products is impaired. However, for a vertical connection, the depth of insertion can be reduced to 15 mm.

NOTE D is the outside diameter of the duct.

5.1.10.3.3 Type B₂₂ and B₂₃ appliances

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

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

It shall be possible to insert a flue pipe of nominal external diameter ($D-2$) mm to a depth of at least $D/4$ but not so far that the evacuation of the combustion products is impaired. However, for a vertical connection, the depth of insertion can be reduced to 15 mm.

NOTE D is the outside diameter of the duct.

Minimum and maximum equivalent resistance shall be stated. The appliance's instructions shall give details for calculating the equivalent resistance, for example the allowance to be made for bends etc.

Where the appliance is intended to be fitted to a flue having a wall termination, a flue terminal shall be supplied or the type of termination shall be specified. The design of this shall be such that it is 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.

5.1.10.3.4 Type C appliances

The terminal and any necessary flue/air ducts shall be supplied or specified.

Minimum and maximum length of ducts that can be used shall be stated.

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

Any condensate formed in the combustion circuit when operating the appliance from cold shall either be retained and subsequently re-evaporated or discharged clear of the wall. For specific requirements related to condensing appliances see 5.15.

5.1.10.3.5 Appliances designed for outdoor installation

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

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

5.1.10.4 Terminal guard

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

5.1.11 Checking the state of operation

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

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

However, when the main burner is fitted with its own flame detector, an indirect means of indication (e.g. an indicator light) is allowed. The means of indicating presence of flame shall not be used to indicate any other fault, except for a fault in the operation of the means of checking the flame itself, which shall result in an indication that there is no flame.

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

5.1.12 Electrical equipment

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

This includes the requirements for the electromagnetic compatibility (EMC).

If the nature of the electrical protection of the appliance is specified on the data plate, this specification shall comply with EN 60529.

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

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

Interruption and subsequent restoration of the electricity supply at any time during start up or operation of the appliance shall result in safety shut down or continued safe operation.

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

5.1.14 Rotating parts (e.g. motors and fans)

The direction of rotation of fans shall be clearly marked.

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

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

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

Lubrication points, if provided, shall be readily accessible.

5.1.15 Pressurized parts of the appliance

All pressurized parts of the appliance shall meet the requirements of EN 378-2.

The maximum working pressure of any vessel of the appliance containing refrigerant which has a part of its external surface at atmospheric pressure and which is capable of being subjected to internal pressures in excess of 0,5 bar above atmospheric pressure shall be specified. This requirement applies to vessels that are subjected to these internal pressures:

- during the normal operation of the appliance, or
- when a safety device has been activated, e.g. where a high pressure vessel is designed to relieve excess pressure to a lower pressure vessel.

NOTE These maximum working pressures are verified by the requirements given in 6.8.

In addition, the minimum yield strength of any vessel capable of being subjected to such internal pressures shall be stated. The yield strength values shall be expressed as internal pressures (in bar) relative to the atmospheric pressure, and shall be valid for the normal operating temperature range of the materials concerned.

Factory-sealed sorption appliances can be installed in occupied spaces according to EN 378-1.

The specified yield strength of each vessel shall be at least 1,5 times its maximum working pressure.

5.2 Requirements for adjusting, control and safety devices

5.2.1 General

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

All controls and safety devices shall be appropriate for use over the range of ambient temperatures declared in the appliance's instruction.

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

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

5.2.2 Gas rate adjusters and range-rating device

5.2.2.1 Common requirements

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

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

5.2.2.2 Gas rate adjusters

Appliances in categories I_{2H} , I_{2L} , I_{2E} , I_{2E+} , $I_{3B/P}$, I_{3P} , I_{3+} , $II_{2H3B/P}$, 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, governed appliances in all of these categories, except category II_{2E+3+} , may have a gas rate adjuster consisting of an adjusting screw on the gas pressure regulator.

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

For appliances in categories II_{2H3+} and II_{2E+3+} having a gas rate adjuster, it shall be possible to put these devices out of service when these appliances are supplied with a 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 adjustable only with a tool.

5.2.2.3 Range-rating devices

A range-rating device on an appliance is optional.

For appliances in category II_{1a2H} , the gas rate adjuster and the range-rating device may be one and the same. However, if the gas rate adjuster has to be sealed, either completely or partially, when the appliance is supplied with a 2nd family gas, the gas rate adjuster or its sealed part shall no longer be used as a range-rating device.

5.2.3 Aeration adjusters

Aeration adjusters are not allowed for the appliances in the scope of this standard.

5.2.4 Automatic gas/air ratio controls

Gas/air ratio controls shall be designed and constructed so that reasonably foreseeable damage does not give rise to a change capable of affecting safety.

Pneumatic gas/air ratio controls shall comply with the relevant requirements of EN 88-1.

Electronic gas/air ratio controls shall comply with the relevant requirements of EN 12067-2.

5.2.5 Gas pressure regulators

Gas pressure regulators shall comply with the requirements of EN 88-1 and EN 88-2.

All appliances shall be fitted with a gas pressure regulator, except appliances in categories I_{2L}, II_{2L3P} and II_{2L3B/P} where this is optional.

For appliances in categories I_{2E+}, II_{2E+3P} and II_{2E+3+} the gas pressure regulator shall not be operational in the range of the two normal pressures of the second family pressure couple, i.e. 20 mbar -25 mbar.

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

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

For appliances in categories I₃₊, II_{2H3+} and II_{2E+3+}, it shall be possible to put the gas pressure regulator partially out of service when they are supplied with third family gases such that the gas pressure regulator is not operational in the range of the two normal pressures e.g. 28 mbar -30 mbar /37 mbar.

The design and accessibility of the gas 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 unauthorized interference with the adjustment difficult.

5.2.6 Multifunctional controls

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

5.2.7 Automatic shut-off valves

5.2.7.1 General requirements

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

5.2.7.2 gives the minimum valve requirements.

5.2.7.2 Application

Each main gas supply shall be under the control of at least two automatic shut-off valves in series. Minimum gas valve requirements are for appliances:

- with pre-purge: C + J;
- without pre-purge but with a valve proving system or permanent or alternating ignition flame: C + J;
- without pre-purge: B + J or C + C.

Instead of J-class valves also C-class valves are possible, instead of C-class valves also B-class valves.

For individual gas lines > 0,250 kW, safety devices which require non-volatile lockout to occur shall give rise to simultaneous signal to close the two valves.

In response to a control device, if the delay between the signals to close the two valves is not greater than 5 s, the signals are considered to be simultaneous.

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

The flame supervision system and the overheat cut off device shall effect closure of all shut off valves in the systems specified.

5.2.8 Automatic burner control systems

5.2.8.1 General

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

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

5.2.8.2 Manually operated devices

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

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

5.2.9 Gas strainers

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

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

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

5.3 Ignition devices

5.3.1 General

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

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

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

5.3.2 Ignition device for the main burner

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

5.3.3 Ignition burners

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

5.4 Transportation of combustion air and/or flue gases

5.4.1 Combustion air

Appliances shall be fitted with a suitable device for proving adequate combustion air flow during the pre-purge, ignition and operation of the burner (see 6.5). Combustion air flow failure at any time during the pre-purge, ignition or operation of the main burner shall cause safety shut-down. The air proving device shall be proved in the 'no air flow' position prior to start-up. Failure to prove 'no air flow' shall prevent start-up or cause lock-out.

5.4.2 Pre-purge and post-purge

For fan-assisted appliances, pre-purge is mandatory before each ignition of the main burner (a single ignition attempt or several consecutive automatic ignition attempts) unless one of the following conditions is fulfilled:

- a) appliances with a permanent or alternating ignition burner;
- b) appliances in which the main burner gas line is fitted with a leakage control device;
- c) appliances fitted with two Class C valves or a Class B and a Class J valve, which close simultaneously.

Pre-purge is always necessary after a safety shutdown or a lock out situation unless, when tested in accordance with the test sequence as described below, no hazard or damage occurs.

The volume or the duration of the pre-purge shall be:

- 1) for appliance where the pre-purge air is induced over the whole cross section of the combustion vessel inlet: at least the volume of the combustion vessel or at least 5 s at the air rate corresponding to nominal heat input,
- 2) for other appliances: at least three times the volume of the combustion vessel or at least 15 s at the air rate at the nominal heat input (Q_n).

Post-purge is optional.

5.5 Flame supervision system

The burner shall be fitted with a flame supervision device.

The flame supervision device shall incorporate a suitable means to provide safety shut down or lock out if the flame detector signals flame presence at any time during the pre-purge. This is the safe start check.

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

Upon flame failure the flame supervision device shall either:

- cause non-volatile lock-out or volatile lock-out; or
- permit an immediate reignition attempt by spark restoration, or permit automatic recycling.

Where reignition by spark restoration is used, the immediate reignition attempt shall commence within 1 s and finish by the end of the first safety time. If this reignition attempt is not successful, at least volatile lock-out shall result.

If, in the case of automatic recycling, ignition is not achieved by the end of the first safety time, at least volatile lock-out shall result.

The time for the flame supervision device to de-energize the automatic shut-off valves upon flame failure shall not be more than 3 s. This shall be verified under the conditions of 7.2.2.

5.6 Flame ignition and safety time T_{SA}

Under the test conditions of 7.3.17 the following requirement shall be met.

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

Where the ignition gas supply is taken from between the two main gas valves, either:

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

NOTE A valve proving system or a proof of closure switch is deemed to satisfy this requirement.

or,

- b) the requirement of 6.4.1.2 shall be met.

The safety time T_{SA} shall be declared.

The safety time shall be verified under the test conditions of 7.2.3 and 7.3.4.1.3. There shall be no deterioration of the appliance, no hazard to the user. The test is repeated with the delay starting at one second and increased by one second each time up to a maximum of T_{SA} .

If the heat input of the ignition burner does not exceed 0,250 kW, there is no requirement in respect of the T_{SA} .

Where the heat input of the ignition burner is between 0,250 kW and 1 kW, there is no requirement in respect of T_{SA} if suitable evidence is given that no dangerous situation for the user or damage to the appliance occurs.

In all other cases, the T_{SA} is chosen in accordance with the test in the section. There shall be no deterioration of the appliance, no hazard to the user. The test as stated below is repeated with the delay starting at one second and increased by one second each time up to a maximum of T_{SA} .

However, a delayed ignition test is not necessary if the T_{SA} , determined under the test conditions below, complies with the following requirement:

$$T_{SA} \leq 5 \cdot \frac{Q_n}{Q_{ign}} \text{ seconds but without exceeding 10 s;}$$

where

Q_n is the nominal input in kW;

Q_{ign} is the ignition rate in kW.

Where several automatic ignition attempts are made without being followed by a purge, the sum of the duration of the ignition attempts shall comply with the above requirement for T_{SA} .

Where several automatic ignition attempts are made followed by a purge, the ignition safety time shall be less than T_{SA} for each attempt.

5.7 Main flame establishment

5.7.1 Establishment by means of an ignition flame

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

The main flame shall ignite reliably and smoothly from the ignition flame.

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

5.7.2 Direct establishment of the main flame

Direct ignition of the main flame is permitted e.g. spark ignition, hot surface igniter.

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

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

- a) non-volatile lock-out; or
- b) safety shut-down followed by an automatic recycle, with a maximum number of 4 automatic recycling attempts. If these ignition attempts are not successful, non-volatile lock-out shall result.

The safety time shall not exceed the maximum declared safety time.

This safety time shall be verified under the test conditions of 7.2.3 and 7.3.4.1.1.

5.8 Main burner

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

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

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

5.9 Facility for remote control

Where the appliance is capable of being controlled remotely by means of thermostats or a time control, electrical connections of these controls shall be possible without disturbing any internal connections in the appliance other than a purpose designed link.

5.10 Thermostats and control of air temperature

5.10.1 General requirements

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

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

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

5.10.2 Overheat cut-off device

An overheat cut-off device(s) shall be fitted to the appliance to prevent overheating of parts of the appliance heated by the burner e.g. the generator. Such device(s) shall be so designed and arranged that they cause shut-down and non-volatile lock-out in the event of an overheating condition occurring.

The operating temperature of the device(s) shall be set and sealed. In addition, the maximum operating temperature of the device(s) shall be specified.

The device(s) shall not be wired in series with either the flame sensor or the line supply from a programming unit to any automatic shut-off valve.

The device(s) shall not operate during the normal operation of the appliance.

5.10.3 Sensors

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

5.11 Gas pressure test points

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

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

5.12 Pressure relief devices

The means for pressure relief in case of over-pressurization shall meet the requirements of EN 378-2.

The appliance shall be fitted with one or more pressure relief devices to prevent the over-pressurization of refrigerant containing parts of the appliance in the event, for example, of a fire of external origin.

In the case of refrigerant containing parts that are pressurized, the means of relieving pressure shall be pressure activated.

In the case of refrigerant containing parts that are not pressurized, the means of relieving pressure shall be:

- either pressure activated; or
- temperature activated, providing that the means of pressure relief reacts consistently to over-pressurization in all circumstances.

If temperature activated devices are used the maximum relief temperature shall be declared.

NOTE Operational requirements are given in 6.9.

These devices shall not be adjustable.

5.13 Additional requirements for appliances designed for outdoor installation

5.13.1 General

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

5.13.2 Combustion air inlets

Air inlets shall be designed such that proper air supply is provided (e.g. in the event of heavy snow or rain). The entrainment of soil shall be prevented. One recommendation to achieve this is to place the combustion air inlet as high as possible above the base of the appliance.

5.13.3 Access panels and doors

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

5.13.4 Dimensions of openings

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

5.13.5 Fixing screws

The fixing of external panels intended to be removed for maintenance and servicing shall be so designed and arranged as to be suitable for outdoor conditions.

5.13.6 Frost protection

If the minimum ambient temperature declared is less than 0 °C, a sorption heat appliance shall be protected from freezing by a frost protection system.

In the installation instruction it shall be described how accumulation of ice is avoided for the condensate drainage and the outdoor heat exchanger defrosting disposal, if any.

NOTE This requirement is to be applied for indoor installations if the ambient temperature declared in the instruction manual is below 0 °C.

5.14 Materials in contact with condensate

All parts of the heat exchanger(s) and other parts of the appliances likely to come into contact with condensate shall be constructed of sufficiently corrosion resistant materials or materials protected by a suitable coating in order to ensure a reasonable life for an appliance that is installed, used and maintained in accordance with the appliance's instructions.

5.15 Condensate

5.15.1 Discharge of condensate

Under the test conditions 7.3.18 the following requirement shall be met.

Condensing appliances shall be fitted with a condensate discharge system of corrosion-resistant material or covered by a durable protection against corrosion.

Where disposal of condensate from the appliance is by gravity the internal diameter of the condensate discharge connection shall be at least 13 mm. If the appliance incorporates some form of pump assisted condensate disposal the size of the discharge from the appliance and connection to any point of gravity discharge shall be specified by the appliance instructions. The disposal system, forming part of the appliance or supplied with the appliance, shall be such that it can be easily inspected and cleaned in accordance with the appliance's instructions;

Surfaces in contact with condensates (except purpose provided drains, water traps and siphons) shall be designed to prevent condensate retention.

It shall be possible to service and clean the system easily. There may be a common condensate drain for flue gas exhaust and the condensing appliance.

5.15.2 Control of the combustion products temperature

If the combustion products circuit contains materials that are likely to be affected by heat or is intended to be connected to a flue (including seals) that is likely to be affected by heat from the combustion products, the appliance shall incorporate a device to prevent the combustion products temperature exceeding the maximum allowable working temperature declared for the material.

This and the requirements of 6.14 shall be verified under the test conditions of 7.3.13.

The device for limiting the combustion products temperature shall be non-adjustable and shall not be accessible without tools.

5.15.3 Chemical composition of the condensate

If the chemical composition of the condensate is stated, the composition shall be verified at the end of the test.

5.15.4 Additional requirements for indoor installations

The disposal system, forming part of the appliance or supplied with the appliance, shall be such that it cannot transmit combustion products or let enter air into the room where the appliance is installed; this requirement is met if the disposal system incorporates a water trap.

The water trap shall meet 2 requirements:

- 1) the water trap shall have a seal of at least 25 mm water column;
- 2) the functional operating of the water trap shall be tested under the blockage tests from b) of 6.5.5 and 7.3.5.5. In that condition there shall be no leakage of combustion products into the room where the appliance is installed.

5.16 Electrical safety

The appliance shall comply with the relevant requirements of EN 60335-2-102.

If the appliance is fitted with electronic components or electronic systems providing a safety function, these shall comply with the relevant requirements in Clause 7.

If the nature of the electrical protection of the appliance is stated, on the data plate, this statement shall comply with EN 60529:1991.

For appliance intended to be installed in a partially protected place:

- the enclosure protection degree shall be at least IPX4D;
- the electrical and/or electronic equipment temperature range shall be suitable for the specified temperature range of the appliance.

6 Operational requirements

6.1 Soundness

6.1.1 Soundness of the gas circuit

The gas circuit shall be sound.

External soundness is ensured if, under the conditions specified in 7.3.1.1 the air leakage rate does not exceed 100 cm³/h however many valves are fitted in series or in parallel on the appliance.

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

6.1.2.1 Type B₁₂ and B₁₃, appliances

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

6.1.2.2 Type B₂₂ and B₂₃ appliances

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

6.1.2.3 Type C₁₂, C₁₃, C₃₂ and C₃₃ appliances (indoor installations)

Soundness with respect to the room where the appliance is installed is ensured if, under the specified test conditions of 7.3.1.2.3, the leakage rates do not exceed the values in Table 3.

Table 3 — Maximum admissible leakage rates

Test object	Surrounding of the combustion products circuit by the combustion air circuit	Maximum leakage rate m ³ /h
Appliance with its air supply and combustion products evacuation ducts and all their joints	Completely not completely	5 1
Appliance and the joints to the air supply and combustion products evacuation ducts	Completely not completely	3 0,6
Combustion products evacuation ducts, not completely surrounded by combustion air, with all its joints excluding the joints tested above		0,4
Air supply duct with all its joints excluding the joints tested above		2