

Gas-fired absorption and adsorption air-conditioning and/or heat pump appliances with a net heat input not exceeding 70 kW

Part 1: Safety

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British Standard

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Summary of pages

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Gas-fired absorption and adsorption air-conditioning and/or heat
pump appliances with a net heat input not exceeding 70 kW -
Part 1: Safety

Appareils de climatisation et/ou pompes à chaleur à ab- et
ad- sorption fonctionnant au gaz de débit calorifique sur
PCI inférieur ou égal à 70 kW - Partie 1: Sécurité

Gasbefeuerte Absorptions- und Adsorptions-Klimageräte
und/oder Wärmepumpengeräte mit einer
Nennwärmebelastung nicht über 70 kW - Teil 1: Sicherheit

This European Standard was approved by CEN on 27 November 1998.

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 299, Gas-fired sorption appliances and domestic gas-fired washing and drying appliances, the Secretariat of which is held by AENOR.

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of an identical text or by endorsement, at the latest by January 2000, and conflicting national standards shall be withdrawn at the latest by January 2000.

This European Standard 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 standard.

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

CEN/TC 299 intends to prepare an amendment to this European Standard for appliances that fall within the scope of EU Directive 97/23/EEC, in order to address its essential requirements.

Requirements and methods of test covering rational use of energy for gas-fired absorption and adsorption air-conditioning and/or heat pump appliances are in the course of preparation and will be published as EN 12309-2.

1 Scope

This European Standard specifies the requirements and test methods for the safety of gas-fired absorption and adsorption air-conditioning and/or heat pump appliances having a net heat input not exceeding 70 kW, hereafter referred to as “appliances”.

This standard applies to appliances having flue systems of Type B₁₂, B_{12BS}, B₁₃, B_{13BS}, B₁₄, B₂₂, B₂₃, C₁₂, C₁₃, C₃₂ and C₃₃, and to appliances designed for outdoor installations.

This standard 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 gases.

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

- Gas-Fired Absorption Air Conditioner;
- Gas-Fired Adsorption Air Conditioner;
- Gas-Fired Absorption Heat Pump;
- Gas-Fired Adsorption Heat Pump.

The above appliances may have one or more primary or secondary functions (see 3.1.5 and 3.1.6) and this standard applies to all such functions providing that the function concerned is dependent on circulation of fluid within the absorption, or adsorption, refrigerant circuit.

NOTE: Any appliance function that is not dependent on circulation of the fluid within the absorption, or adsorption, refrigerant circuit should be assessed separately.

This standard does not apply to appliances fitted with more than one flue outlet.

This standard is applicable to appliances that are intended to be type tested. Requirements for appliances that are not type tested would need to be subject to further consideration.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

EN 88:1991

Pressure governors for gas appliances for inlet pressures up to 200 mbar

EN 126:1995	Multifunctional controls for gas burning appliances
EN 161:1991	Automatic shut-off valves for gas burners and gas appliances
EN 257:1992+A1:1996	Mechanical thermostats for gas - burning appliances
EN 298:1993	Automatic gas burner control systems gas burners and gas burning appliances with or without fans
PrEN 378-3:1994	Refrigerating systems and heat pumps. Safety and environmental requirements - Part 3: classification of refrigerating systems, occupancies and refrigerants
EN 37:1993	Test gases - Test pressures - Appliance categories
EN 50165:1997	Electrical equipment of non-electric heating appliances for household and similar purposes – Safety requirements
EN 60335-1:1995	Safety of household and similar electrical appliances - Part 1: General requirements
EN 60529:1991	Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)
EN 60730-2-9:1995	Automatic electrical controls for household and similar use - Part 2-9: Particular requirements for temperature sensing controls (IEC 60730-2-9:1992, modified)
EN ISO 3166-1:1997	Codes for the representation of names of countries - Part 1: Country codes (ISO 3166-1:1997)
CR 1749:1995	European scheme for the classification of gas appliances according to the method of evacuation of the products of combustion (types)
ISO 7-1:1994	Pipe threads where pressure-tight joints are made on the threads - Part 1: Dimensions, tolerances and designation
ISO 228-1:1994	Pipe threads where pressure-tight joints are not made on the threads - Part 1: Dimensions, tolerances and designation
ISO 274:1975	Copper tubes of circular section - Dimensions.
ISO 1182:1990	Fire tests - Building materials - Non-combustibility test
ISO 3864:1984	Safety colours and safety signs.
ISO 6976:1995	Natural gas - Calculation of calorific values, density, relative density and Wobbe index from composition

ISO 7005-1:1992	Metallic flanges - Part 1: Steel flanges.
ISO 7005-2:1988	Metallic flanges - Part 2: Cast iron flanges.
ISO 7005-3:1988	Metallic flanges - Part 3: Copper alloy and composite flanges.

3 Definitions

For the purposes of this standard, the following definitions apply:

3.1 Appliance and its constituent parts

3.1.1 air-conditioning appliance: Appliance which is capable of providing full air conditioning (i.e. cooling, heating and humidity control); or which only provides the cooling and possibly the heating functions.

3.1.2 chiller: Air conditioning appliance utilizing an absorption or adsorption refrigerant cycle which is designed to provide cooling as a primary function and may provide heating as a secondary function.

3.1.3 chiller/heater: Air-conditioning appliance utilizing an absorption or adsorption refrigerant cycle which is designed to provide cooling and heating, both as primary functions.

3.1.4 heat pump appliance: Heating appliance utilizing a refrigerant to extract heat from one medium (e.g. air, water, etc.) and transfer it to a second medium (e.g. air, water, etc.) at a higher temperature in order to contribute to the heating function of the appliance.

3.1.5 primary function: Main purpose for which the air conditioning or heat pump appliance is designed. In the case of an air conditioning appliance this is normally the cooling function. In the case of a heat pump this is normally the heating function. (Both the heating and cooling functions of the appliance may be classed as primary functions if they satisfy the rational use of energy requirements¹ for those functions.)

3.1.6 secondary function: Optional function of the appliance, such as heating or cooling, which is not expected to satisfy the rational use of energy requirements of a primary function.

3.1.7 open system: System in which the fluid (e.g. water, ammonia, etc.) which provides heating or cooling comes into direct contact with the fluid (e.g. water, air, etc.) which is to be heated or cooled.

3.1.8 closed system: System in which the fluid within the refrigerant circuit (e.g. water, ammonia, etc.) which provides heating or cooling does so without coming into contact with the surrounding air and with the heat transfer medium (e.g. water, brine, air).

3.1.9 heat transfer medium: Any medium (e.g. air, water, brine, etc.) used for the transfer of heat to or from refrigerant-containing parts of the appliance; it may be:

- the cooling medium circulating in the evaporator;

¹ See prEN 12309-2 which is in the course of preparation.

- the cooling medium circulating in the condenser or absorber;
- the heat recovery medium circulating in the heat recovery heat exchanger.

3.1.10 brine: Liquid that has a freezing point depressed relative to water.

3.1.11 absorption: Process in which molecules of the refrigerant are dissolved into a liquid.

3.1.12 adsorption: Process in which molecules of the refrigerant are held at the surface of a solid (possibly porous) structure.

3.1.13 gas inlet connection: Part of the appliance intended to be connected to the gas supply.

3.1.14 mechanical joint (mechanical means of obtaining soundness): Means of assuring the soundness of an assembly of several (generally metallic) parts without the use of liquids, pastes, tapes, etc. There are, for example:

- metal to metal joints;
- conical joints;
- toroidal sealing rings ("O" rings);
- flat joints.

3.1.15 gas circuit: Part of the appliance that conveys or contains the gas between the appliance gas inlet connection and the burner(s).

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

3.1.17 gas rate adjuster: Component allowing an authorized person to set the gas rate of the burner to a predetermined value according to the supply conditions.

Adjustment may be progressive (screw adjuster) or in discrete steps (by changing restrictors).

The adjusting screw of an adjustable governor is regarded as a gas rate adjuster.

The action of adjusting this device is called "adjusting the gas rate".

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

3.1.18 setting an adjuster: Procedure by which an adjuster is immobilized in a position by some means such as a screw, etc.

3.1.19 sealing an adjuster: Procedure by which changing the setting of an adjuster breaks the sealing material and makes the interference with the adjuster apparent.

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

A governor is considered to be non-existent if it has been factory sealed in the fully opened position.

3.1.20 putting an adjuster or a control out of service: Procedure by which a control (temperature, pressure, etc.) is put out of action and sealed in this position. The appliance then functions as if this device had been removed.

3.1.21 injector: Component that admits the gas into a burner.

3.1.22 main burner: Burner that is intended to assure the thermal function of the appliance and is generally called the burner.

3.1.23 ignition device: Any means (flame, electrical ignition device or other device) used to ignite the gas at the ignition burner or at the main burner.

This device can operate intermittently or permanently.

3.1.24 ignition burner: Burner whose flame is intended to ignite another burner.

3.1.25 aeration adjuster: Device enabling the air to be set at the desired value according to the supply conditions.

The action of adjusting this device is called “adjusting the aeration”.

3.1.26 Combustion products circuit

3.1.26.1 combustion chamber: Enclosure inside which combustion of the air-gas mixture takes place.

3.1.26.2 flue outlet: Part of a type B appliance that connects with a flue to evacuate the products of combustion.

3.1.26.3 draught diverter: Device placed in the combustion products circuit to reduce the influence of flue-pull and to prevent that of down-draught on the burner performance and combustion.

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

3.1.26.5 flue terminal: Device fitted at the end of the duct system that enables the discharge of flue gases and may, at the same time, allow entry of combustion air.

3.2 Adjusting, control and safety devices

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

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

3.2.2 automatic burner control system: System comprising at least a programming unit and all the elements of a flame detector device. The various functions of an automatic burner control system may be in one or more housings.

3.2.3 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. The programming unit follows a predetermined sequence of actions and always operates in conjunction with a flame detector device.

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

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

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

3.2.6 flame signal: Signal given by the flame detector device, normally when the flame sensor senses a flame.

3.2.7 flame simulation: Condition that occurs when the flame signal indicates the presence of a flame when in reality no flame is present.

3.2.8 pressure governor²: Device that maintains the outlet pressure constant independent of the variations in inlet pressure and/or flow rate within defined limits.

3.2.9 adjustable pressure governor: Governor provided with means for changing the outlet pressure setting.

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

3.2.11 automatic shut-off valve: Device that automatically opens, closes or varies the gas rate on a signal from the control circuit and/or the safety circuit.

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

3.2.13 overheat cut-off device: Device that shuts off and locks out the gas supply before the appliance is damaged and/or before safety is put into question, and that requires manual intervention to restore the gas supply.

3.2.14 overheat control device: Automatic reset device that shuts off the gas supply to the burner in case the temperature of the delivered air exceeds a certain preset value during abnormal operation conditions.

² The term “governor” is used in this case and for a volume governor.

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

3.2.16 temperature sensing element (or sensor): Component that detects the temperature of the environment to be supervised or controlled.

3.2.17 modulating control: Automatic control by which the heat input of the appliance can be adjusted continuously between the nominal heat input and a minimum value.

3.2.18 high/low control: Automatic control that permits an appliance to operate either at the nominal heat input or at a fixed reduced heat input.

3.2.19 spillage monitoring system: System which contains a device that automatically shuts off the gas supply to the main burner, and perhaps the ignition burner, when there is a release of combustion products from the appliance.

3.3 Operation of the appliance

3.3.1 volumetric flow rate: Volume of gas consumed by the appliance in unit time during continuous operation.

Symbol: V

Units: cubic metre per hour (m^3/h), litre per minute (l/min), cubic decimetre per hour (dm^3/h), or cubic decimetre per second (dm^3/s).

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

Symbol: M

Units: kilogram per hour (kg/h), or gram per hour (g/h).

3.3.3 heat input: 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.

Symbol: Q

Units: kilowatt (kW)

3.3.4 nominal heat input: Value of heat input declared by the manufacturer.

Symbol: Q_n

3.3.5 flame stability: The characteristic of flames that remain on the burner ports or in the flame reception zone intended by the construction.

3.3.6 flame lift: Total or partial lifting of the base of the flame away from the burner port or the flame reception zone provided by the design. Flame lift may cause the flame to blow out, i.e. extinction of the air-gas mixture.

3.3.7 light-back: Entry of a flame into the body of the burner.

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

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

3.3.10 yellow tipping: Yellowing of the tip of the blue cone of an aerated flame.

3.3.11 first safety time³: Interval between the ignition burner gas valve, the start gas valve or main gas valve, as applicable, being energized and the ignition burner gas valve, start gas valve or main gas valve, as applicable, being de-energized if the flame detector signals the absence of a flame at the end of this interval.

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

3.3.13 start gas flame: Flame established at the start gas rate either at the main burner or at a separate ignition burner.

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

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

3.3.16 non-automatic burner system: Burner system with an ignition burner that is ignited under manual supervision.

3.3.17 controlled shut-down: Process by which the power to the gas shut-off valve(s) is removed immediately, e.g. as a result of the action of a controlling function.

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

3.3.19 Lock-out

3.3.19.1 non-volatile lock-out: Safety shut-down condition of the system, such that a restart can only be accomplished by a manual reset of the system and by no other means.

³ Where there is no second safety time, this is called the safety time.

3.3.19.2 volatile lock-out: Safety shut-down condition of the system, such that a restart can only be accomplished either by the manual reset of the system, or by an interruption of the electrical supply and its subsequent restoration.

3.3.20 spark restoration: Process by which, after disappearance of the flame signal in the running condition, the ignition device is energized again without the gas supply having been totally interrupted. This process ends with the restoration of the running condition or, if there is no flame signal at the end of the safety time, with volatile or non-volatile lock-out.

3.3.21 automatic recycling: Process by which, following loss of flame signal during the running condition or accidental interruption of the operation of the appliance, the gas supply is interrupted and the complete start sequence is automatically re-initiated. This process ends with the restoration of the running condition or, if there is no flame signal at the end of the safety time, or if the cause of the accidental interruption has not disappeared, with volatile lock-out or non-volatile lock-out.

3.3.22 ignition opening time: Time interval between ignition of the supervised flame and the moment when the valve is held open.

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

- to the main burner;
- and/or to the ignition burner.

3.3.24 ignition interlock: Part that prevents the operation of the igniter as long as the main gasway is open.

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

3.4 Gases

3.4.1 test gases: Gases intended for the verification of the operational characteristics of appliances using combustible gases. They comprise the reference and limit gases. (EN 437:1993).

3.4.2 reference gases: Test gases on which appliances operate under nominal conditions, when they are supplied at the corresponding normal pressure. (EN 437:1993).

3.4.3 limit gases: Test gases representative of the extreme variations in characteristics of the gases for which appliances have been designed. (EN 437:1993).

3.4.4 calorific value: Quantity of heat produced by 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 to the same conditions.

There are two types of calorific value:

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

Units:

- either megajoule per cubic metre of dry gas under reference conditions (MJ/m^3);
- or megajoule per kilogram of dry gas (MJ/kg).

(EN 437:1993).

3.4.5 relative density: Ratio of the masses of equal volumes of dry gas and dry air under the same conditions of temperature and pressure: 15°C and 1 013,25 mbar.

Notation: d

3.4.6 Wobbe index: Ratio of the calorific value of a gas per unit volume and the square root of its relative density under the same reference conditions. The Wobbe index is said to be gross or net depending on whether the calorific value is the gross or net calorific value.

Notation: gross Wobbe index: W_s , net Wobbe index: W_i .

Units:

- either megajoule per cubic metre of dry gas under reference conditions (MJ/m^3);
- or megajoule per kilogram of dry gas (MJ/kg).

(EN 437:1993).

3.4.7 gas pressure: Static pressure, relative to the atmospheric pressure, measured at right angles to the direction of flow of the gas.

Notation: p

Unit: millibar (mbar)

NOTE: 1 mbar = 10^2 Pa

3.4.8 test pressures: Gas pressures used to verify the operational characteristics of appliances using combustible gases. They consist of normal pressures and limit pressures.

Unit: millibar (mbar)

(EN 437:1993).

3.4.9 normal pressure: Pressure under which the appliances operate in normal conditions, when they are supplied with the corresponding reference gas.

Notation: p_n

(EN 437:1993).

3.4.10 limit pressures: Pressures representative of the extreme variations in the appliance supply conditions.

Notations: maximum pressure: $p_{\max}$; minimum pressure: $p_{\min}$.

(EN 437:1993).

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

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

(EN 437:1993).

3.5 Conditions of operation and measurement

3.5.1 Reference conditions

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

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

3.5.3 hot condition: Condition of the appliance required for some tests and obtained by heating to thermal equilibrium at the nominal heat input specified by the manufacturer.

3.5.4 equivalent resistance: Resistance to flow in millibar, measured at the outlet of the appliance, which is equivalent to that of the actual flue/duct.

3.6 Marking of the appliance and packaging

3.6.1 direct country of destination: Country for which the appliance has been certified and which is specified by the manufacturer as the intended country of destination. At the time of putting the appliance on the market and/or of installation, the appliance shall be capable of operating, without adjustment or modification, with one of the gases distributed in the country concerned, at the appropriate supply pressure.

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

4 Classification

4.1 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.

4.2 Classification of appliances

Appliances can be classified according to:

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

4.2.1 Classification according to the gases capable of being used

These appliance classifications are in accordance with those in EN 437:1993.

Table 1: Classification of gases

Gas families and Groups	Gross Wobbe Index at 15 °C and 1 013,25 mbar MJ/m ³	
	minimum	maximum
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

4.2.1.1 Category I

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

a) Appliances designed for use on first family gases only

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

b) Appliances designed for use on second family gases only

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

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

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

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

c) Appliances designed for use on 3rd family gases only

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

Category I₃₊: Appliances capable of using the third family (propane and butane) and operating with a pressure couple without adjustment of the appliance other than a possible adjustment of the primary air in order to change from butane to propane and vice versa. No operational pressure regulating device is permitted on the appliance.

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

4.2.1.2 Category II

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

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

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

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

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

Category II_{2H3+}: Appliances capable of using gases of group H of the second family and gases of the third family. The second family gases are used under the same conditions as for category I_{2H}. The third family gases are used under the same conditions as for category I₃₊.

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

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

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

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

Category II_{2E+3+}: Appliances capable of using gases of group E of the second family and gases of the third family. The second family gases are used under the same conditions as for category I_{2E+}. The third family gases are used under the same conditions as for category I₃₊.

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

4.2.1.3 Category III

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

This category is not in general use.

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

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

Appliances are classified into several types according to the method of evacuation of the combustion products and admission of the combustion air. Appliances for which the combustion air is introduced by mechanical means other than a fan shall be regarded for the purposes of classification as if the mechanical means is a fan.

These appliance classifications are based on those described in CR 1749:1995.

4.2.2.1 Type B

An appliance intended to be connected to a flue which evacuates the products of combustion to the outside of the room containing the appliance.

The combustion air is drawn directly from the room.

- **Type B₁**: A type B appliance incorporating a draught diverter.
- **Type B₂**: A type B appliance without a draught diverter.

For appliances in which the combustion air is supplied and/or in which the products of combustion are evacuated by mechanical means, seven types are identified (see annex B).

- **Type B₁₂**: A type B₁ appliance designed for a natural draught flue incorporating a fan downstream of the combustion chamber/heat exchanger and upstream of the draught diverter.
- **Type B_{12BS}**: A type B₁₂ appliance fitted with a spillage monitoring system to prevent the release of combustion products in a dangerous quantity into the room under abnormal draught conditions.
- **Type B₁₃**: A type B₁ appliance designed for a natural draught flue incorporating a fan upstream of the combustion chamber/heat exchanger.
- **Type B_{13BS}**: A type B₁₃ appliance fitted with a spillage monitoring system to prevent the release of combustion products in a dangerous quantity into the room under abnormal draught conditions.
- **Type B₁₄**: A type B₁ appliance having a fan downstream of both the combustion chamber/heat exchanger and the draught diverter.
- **Type B₂₂**: A type B₂ appliance incorporating a fan downstream of the combustion chamber/heat exchanger.
- **Type B₂₃**: A type B₂ appliance incorporating a fan upstream of the combustion chamber/heat exchanger.

4.2.2.2 Type C

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

- **Type C₁**: A type C appliance which is designed for connection via ducts to a horizontal terminal which at the same time admits fresh air to the burner and discharges the products of combustion to the outside through orifices which are either concentric or close enough to come under similar wind conditions.
- **Type C₃**: A type C appliance which is designed for connection via ducts to a vertical terminal which at the same time admits fresh air to the burner and discharges the products of combustion to the outside through orifices which are either concentric or close enough to come under similar wind conditions.

For appliances in which the combustion air is supplied and/or in which the products of combustion are evacuated by mechanical means, four types are identified (see annex B).

- **Type C₁₂:** A type C₁ appliance incorporating a fan downstream of the combustion chamber/heat exchanger.
- **Type C₁₃:** A type C₁ appliance incorporating a fan upstream of the combustion chamber/heat exchanger.
- **Type C₃₂:** A type C₃ appliance incorporating a fan downstream of the combustion chamber/heat exchanger.
- **Type C₃₃:** A type C₃ appliance incorporating a fan upstream of the combustion chamber/heat exchanger.

4.2.3 Classification according to the temperatures of the heat transfer media

4.2.3.1 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.

4.2.3.2 Cooling mode

When the appliance is operating in the cooling mode, the temperatures indicated in the first place refer to the condenser/absorber and the temperatures in the second place to the evaporator.

All air temperatures are inlet temperatures. Water and brine temperatures for the evaporator are outlet temperatures. Water temperatures for the condenser/absorber are inlet temperatures.

For example, A27/W7 means an inlet temperature of air for the condenser/absorber of 27 °C and an outlet temperature of water for the evaporator of 7 °C.

4.2.3.3 Heating mode

When the appliance is operating in the heating mode, the values indicated in the first place refer to the evaporator and the values in the second place to the condenser/absorber.

All air temperatures are inlet temperatures. Water temperatures for the condenser/absorber are outlet temperatures. Water and brine temperatures for the evaporator are inlet temperatures.

For example, B0/W50 means an inlet temperature of brine for the evaporator of 0 °C and an outlet temperature of water for the condenser/absorber of 50 °C.

4.2.4 Classification according to denomination

4.2.4.1 Cooling mode

For the purposes of this standard, appliances designed to operate in the cooling mode are denominated in such a way that the heat transfer medium for the condenser/absorber is indicated first, followed by the heat transfer medium for the evaporator. Examples of such appliances are given in Table 2.

Table 2: Examples of appliances designed to provide cooling

Heat transfer medium		Denomination
Condenser/absorber	Evaporator	
Air	Water	Air Cooled Liquid Chiller Air Cooled Liquid Chiller Heater
Air	Air	Air Cooled Air Conditioner
Water ¹⁾	Water ¹⁾	Water Cooled Liquid Chiller Water Cooled Liquid Chiller Heater
Water ¹⁾	Air	Water Cooled Air Conditioner
¹⁾ This description also applies where the water contains additives as specified in the manufacturer's instructions.		

4.2.4.2 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 evaporator is indicated first, followed by the heat transfer medium for the condenser/absorber. Examples of such appliances are given in Table 3.

Table 3: Examples of appliances designed to provide heating.

Heat transfer medium		Denomination
Evaporator	Condenser/Absorber	
Air	Air	Air/Air Heat Pump or Air Conditioner
Water	Air	Water/Air Heat Pump or Air conditioner
Brine	Air	Brine/Air Heat Pump
Air	Water	Air/water Heat pump
Water	Water	Water/water Heat Pump
Brine	Water	Brine/Water Heat Pump

5 Construction and design requirements

5.1 General

5.1.1 Conversion to different gases

In accordance with the definitions given in 4.2.1.1, 4.2.1.2 and 4.2.1.3 the only acceptable modifications and/or adjustments when converting from a gas of one group or family to a gas of another group or family and/or for adapting to different gas distribution pressures are given in 5.1.1.1, 5.1.1.2 and 5.1.1.3 for each category.

5.1.1.1 Category I

Category I_{2H}, I_{2L}, I_{2E}, I_{2E+}: modification and/or adjustment of the appliance is not permitted.

Category I₃₊: No modification and/or adjustment of the appliance except for replacement of injectors or restrictors in order to convert from one pressure couple to another (for example, 28-30/37 mbar $\Leftrightarrow$ 50/67 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.

Categories I_{3P} and 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, adjustment of gas rates and exchange of fixed primary aeration restrictor is permitted.

5.1.1.2 Category II

5.1.1.2.1 Categories of appliance designed for use with gases of 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 governor;
- Replacement of a burner assembly;
- Replacement of complete ignition burner or some of its parts;
- Exchange of fixed primary aeration restrictor.

If the appliance is intended to function without an operational governor for use with gases of the second family, it is mandatory to put the governor 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 3.1.19).

5.1.1.2.2 Categories of appliance designed for use 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 governor;
- Replacement of a burner assembly;
- Replacement of complete ignition burner or some of its parts;
- Exchange of fixed primary aeration restrictor.

The governor 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 the requirements of 5.2.2.2.

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. 28-30/37 mbar $\Leftrightarrow$ 50/67 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.

5.1.1.3 Category III

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

5.1.2 Materials and method of construction

When the appliance is installed in accordance with the manufacturer's instructions, all components, including the heat 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 there is no condensation of combustion products at the operating temperature provided by the controls.

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

The appliance shall be designed such that gas carrying components, i.e. pipes and controls, are not located within passages used for conveying the conditioned air.

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

Asbestos or materials containing asbestos shall not be used.

Solder that has a melting point below 450 °C after application shall not be used for gas carrying parts. 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 1182:1990.

5.1.3 Accessibility for maintenance and use

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

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

Access shall be possible to all 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 shall be protected against mechanical damage, condensate and vermin.

5.1.5 Gas connection

The appliance gas connection shall be accessible.

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

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

A compression fitting suitable for copper tube shall comply with Table 2 of ISO 274:1975.

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

If flanges are used, they shall comply with ISO 7005-1:1992, ISO 7005-2:1988 or ISO 7005-3:1988 as appropriate and the manufacturer shall provide the counterflanges and sealing gaskets.

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

5.1.6 Soundness

5.1.6.1 Soundness of the gas circuit

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 normal conditions of appliance use.

5.1.6.2 Soundness of the combustion circuit

The appliance shall be of such construction that no products of combustion shall mix with the conditioned air.

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

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

5.1.7 Supply of combustion air and evacuation of combustion products

5.1.7.1 General

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

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

5.1.7.2 Appliance combustion air inlet

5.1.7.2.1 Type B₁₄ appliances

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

The appliance shall be so designed that during the shut-down condition it has sufficient ventilation to ventilate any minor gas leakage.

5.1.7.2.2 All appliances except type B₁₄

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

Automatic adjustment of the combustion air to the appliance is only permitted if the appliance is fitted with an air-gas ratio control⁴ or the combustion air and gas flows are changed simultaneously.

5.1.7.3 Appliance flue gas outlet

5.1.7.3.1 General

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

5.1.7.3.2 Type B₁₂, B₁₃ and B₁₄ 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 shall 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 (see A.6).

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.

5.1.7.3.3 Additional requirements for appliances of Type B₁₄

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

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

⁴ European Standards for air-gas ratio controls are under consideration in CEN/TC 58 e.g. EN 12067-1:1998.

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 that 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.

5.1.7.3.4 Type B₂₂ and B₂₃ appliances

The flue outlet shall be female and shall 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 (see A.6).

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.

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

Where the appliance is intended to be fitted to a flue having a wall termination, the manufacturer shall either supply a flue terminal or state the type of termination that 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.

5.1.7.3.5 Type C appliances

The terminal and any necessary flue/air ducts shall be supplied or specified by the appliance manufacturer.

The manufacturer shall state the minimum and maximum equivalent resistance of ducts that can be used.

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

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

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

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

5.1.7.4 Terminal guard

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

5.1.8 Checking the state of operation

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

If the means of observation is a viewing port, it shall, when located in an area of high temperature, be covered with a suitable material, 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.

5.1.9 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 50165:1997 which cover such hazards.

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

- 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.

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

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

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

Requirements and methods of test relating to the continued and safe operation of the appliance in the event of normal and abnormal fluctuation of the auxiliary energy are specified in 6.5.1/7.3.5.1.4.

5.1.11 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.

5.1.12 Pressurized parts of the appliance

The manufacturer shall specify the maximum working pressure of any chamber of the appliance containing refrigerant which has a part of its external surface at the atmospheric pressure and which is capable of being subjected to internal pressures in excess of 0,5 bar above this atmospheric pressure. This requirement applies to chambers 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 chamber is designed to relieve excess pressure to a lower pressure chamber.

NOTE: These maximum working pressures are verified by the requirements given in 6.9.

In addition, the manufacturer shall state the minimum yield strength of any chamber capable of being subjected to such internal pressures. 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.

The specified yield strength of each chamber 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 by the appliance manufacturer.

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.

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

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

The vent shall be so sited that it cannot be obstructed by foreign matter, birds etc.

5.2.2 Gas rate adjusters and range-rating devices

5.2.2.1 Common requirements

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

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

5.2.2.2 Gas rate adjusters

Appliances in categories I_{2H}, I_{2L}, I_{2E}, I_{2E+}, I_{3B/P}, I_{3P}, I₃₊, 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 governor.

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 and they shall be capable of being set in the operating position.

5.2.2.3 Range-rating devices

A range-rating device on an appliance is optional.

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

5.2.3 Aeration adjusters

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

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

5.2.4 Automatic gas/air ratio controls⁵

Where the appliance incorporates an air/gas ratio control, it shall comply with the following requirements as appropriate:

- a) In the case of a two-stage or multi-stage burner the flow rate of combustion air and gas are controlled in tandem. The air and gas adjustment devices shall be interconnected (e.g. by mechanical, pneumatic, electrical or electronic means) such that the relationship between combustion air and gas is fixed in a repeatable fashion at any operating condition of the burner.

⁵ European Standards for air-gas ratio controls are under consideration in CEN/TC 58 e.g. EN 12067-1:1998

The air flow shall either be controlled in conjunction with the supply of gas or shall be controlled by sequential switching. Whatever the case, it shall be so designed and arranged that, in the event of a fault, the control system will tend towards higher excess air or cause safety shut-down;

- b) If, for high/low or modulating burners the air and gas flows are not controlled simultaneously, there shall be either:
- 1) air lead on increasing the burner output and gas lead on reducing the burner output, or
 - 2) sufficient excess air to prevent gas-rich combustion.

The control system shall either tend to a safe condition in the event of failure, i.e. not become gas-rich, or, its operation shall be checked during the start sequence, e.g. by means of pressure or position switches.

5.2.5 Governors

Governors shall comply with the requirements of EN 88:1991.

All appliances shall be fitted with a governor, except appliances in categories I_{2L}, II_{2L3P} and II_{2L3B/P}.

Appliances in categories I_{2L}, II_{2L3P} and II_{2L3B/P} may be fitted with a gas governor.

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

Where a gas governor 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 governors 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 governor partially out of service when they are supplied with third family gases such that the governor is not operational in the range of the two normal pressures e.g. 28-30/37 mbar.

The design and accessibility of the governor 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 126:1995.

5.2.7 Automatic shut-off valves

5.2.7.1 General requirements

Automatic shut-off valves shall comply with the requirements of EN 161:1991

The sub-clauses of 5.2.7.2 give the minimum valve requirements.

5.2.7.2 Application

5.2.7.2.1 Type B₁₄ appliances

5.2.7.2.1.1 Appliances with a start gas flame

All gas supplies shall be under the control of automatic shut-off valves connected to the gas line in series, of a class according to Table 4.

5.2.7.2.1.2 Appliances with direct main burner ignition (see 5.7.1.2)

Such appliances shall be fitted with two automatic shut-off valves in series. One of these shall be of at least class B and the other shall be of at least class J in accordance with the main gas valve requirements given in Table 4.

Table 4: Minimum valving requirements for type B₁₄ appliances

Main gas valves required	Start gas valves required
B + J ¹⁾	B ²⁾ + J ^{1) 3)}
¹⁾ If this class J valve is used, a strainer shall be used such that it does not pass a 0,2 mm pin gauge. This strainer shall be fitted upstream of the valve. ²⁾ This valve may be the class B valve controlling the main burner gas supply. ³⁾ For start gas rates greater than 0,6 kW or 1 % of the nominal heat input of the main burner up to a maximum of 1,5 kW this additional valve shall be fitted.	

Table 5: Minimum valving requirements for Types B₁₂, B₂₂, C₁₂ and C₃₂ appliances, and outdoor appliances incorporating a fan in the combustion circuit downstream of the combustion chamber/heat exchanger

Main gas valves required	Start gas valves required
B + J ¹⁾	B ²⁾ + J ^{1) 3)}
¹⁾ If a class J valve is used, a strainer shall be used such that it does not pass a 0,2 mm pin gauge. This strainer shall be fitted upstream of the valve. ²⁾ This valve may be the valve controlling the main gas supply. ³⁾ This valve is not required if all of the following requirements are met: - the start gas rate is 10 % or below of the main gas rate; - the appliance is not capable of burning 3rd family gases; - the appliance is not capable of being installed such that the combustion air inlet is higher than the exit from the combustion chamber; - the pre-purge gives at least 5 volumes changes.	

Table 6: Minimum valving requirements for Types B₁₃, B₂₃, C₁₃ and C₃₃ appliances, and outdoor appliances incorporating a fan in the combustion circuit upstream of the combustion chamber/heat exchanger

Main gas valves required	Start gas valves required
2 × class B	1 × class B ¹⁾ plus 1 × class B ²⁾
¹⁾ This valve may be the valve controlling the main gas supply. ²⁾ This valve is not required if all of the following requirements are met: - the start gas rate is 10 % or below of the main gas rate; - the appliance is not capable of burning 3rd family gases; - the appliance is not capable of being installed such that the combustion air inlet is higher than the exit from the combustion chamber; - the pre-purge gives at least 5 volumes changes.	

5.2.7.2.2 Appliances of Types B₁₂, B₂₂, C₁₂ and C₃₂ and outdoor appliances incorporating a fan in the combustion circuit downstream of the combustion chamber/heat exchanger

Each main gas supply shall be under the control of at least two automatic shut-off valves in series (see Table 5). One valve shall be of at least class B and the other valve shall be either class B, class C or class J.

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

- under the control of the downstream main gas safety shut-off valve incorporating a start-gas rate control. The valve shall incorporate a device to enable the start-gas rate to be set such that the energy available during the start-gas flame ignition period cannot exceed the value given in 5.6; or,
- under the control of at least one class B safety shut-off valve (see Table 5). If, however, the conditions specified in Table 5, note 3), are not met, a second valve shall be fitted as specified in this table.

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

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

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

5.2.7.2.3 Appliances of Types B₁₃, B₂₃, C₁₃ and C₃₃ and outdoor appliances incorporating a fan in the combustion circuit upstream of the combustion chamber/heat exchanger

Each main gas supply shall be under the control of two safety shut-off valves in series (see Table 6). These valves shall be of at least class B.

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

- a) under the control of the downstream main gas safety shut-off valve incorporating a start-gas rate control. The valve shall incorporate a device to enable the start-gas rate to be set such that the energy available during the start-gas flame ignition period cannot exceed the value given in 5.6; or,
- b) under the control of at least one class B safety shut-off valve (see Table 6). If, however, the conditions specified in Table 6, note 2), are not met, a second valve shall be fitted as specified in this table.

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

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

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

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 298:1992.

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

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

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 Spillage monitoring system (Type B_{12BS} and B_{13BS} appliances only)

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

The 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.

5.2.10 Gas strainers

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

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

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

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.

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

5.4 Transportation of combustion air and/or flue gases

5.4.1 Type B₁₄ appliances

Appliances shall be fitted with a suitable device for proving adequate flow of flue gases prior to and during ignition and operation of the burner (see 6.4.1.3.2, 6.4.2.2, 6.5.1/7.3.5.1.5 and 6.5.2).

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

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

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

5.4.2 Appliances of types other than type B₁₄

5.4.2.1 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 6.4.1.3, 6.4.2.2, 6.5.1/7.3.5.1.5 and 6.5.2). Combustion air flow failure at any time during the pre-purge, ignition or operation of the main burner shall cause safety shut-down. The air proving device shall be proved in the “no air” position prior to start-up. Failure to prove “no air” shall prevent start-up or cause lock-out.

5.4.2.2 Pre-purge and post-purge

Immediately before any attempt at ignition or the opening of automatic gas shut-off valves, the appliance shall be purged. The pre-purge period shall have a minimum duration of 10 s. The pre-purge flow shall not be less than 25 % of the full combustion air rate.

Unless any start-gas supply is under the control of two automatic shut-off valves having classes at least equivalent to those of the main gas supply, the pre-purge shall be such as to give at least five volume changes of the combustion chamber and gas passages up to the flue exit from the appliance (see 6.9).

However, appliances capable of burning 3rd family gases, and all other appliances which can be installed such that the combustion air inlet is higher than the exit from the combustion chamber, shall have the start gas supply under the control of two automatic shut-off valves of classes at least equivalent to those of their main gas supply.

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

a) the burner shall go to safety shut-down;

or

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

Post purge is optional.

5.5 Flame supervision system

5.5.1 Type B₁₄ appliances

The burner shall be fitted with a flame supervision device.

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

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

Upon flame failure, the control system shall cause safety shut-down and non-volatile lock-out. The extinction safety time for the flame supervision system to detect the absence of flame and shut down the burner(s) shall not be more than 3 s. This shall be verified under the test conditions of 7.2.2.

5.5.2 Appliances of types other than type B₁₄

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

Upon flame failure the flame supervision device shall either:

- cause non-volatile 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, non-volatile lock-out shall result.

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

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

5.6 Ignition burner or start-gas flame establishment

5.6.1 Type B₁₄ appliances

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

No start-gas rate shall exceed 25 % of the main burner rating. Where the start-gas flame is established at a separate ignition burner, the ignition burner rate shall not exceed 10 % of the main burner rating.

Where the start-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.

If the means of proving closure described in a) above indicates that the valve is not closed, start-up shall be prevented or non-volatile lock-out shall occur.

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

If the start-gas flame has not been detected by the end of the first safety time, automatic safety shut-down and non-volatile lock-out shall result.