

# Gas-fired type B tumble dryers of nominal heat input not exceeding 20 kW —

## Part 1: Safety

The European Standard EN 12752-1:1999 has the status of a  
British Standard

ICS 97.060

# National foreword

This British Standard is the English language version of EN 12752-1:1999.

The UK participation in its preparation was entrusted to Technical Committee GSE/37, Gas-fired sorption and laundering appliances, which has the responsibility to:

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- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
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### Summary of pages

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EUROPEAN STANDARD

EN 12752-1

NORME EUROPÉENNE

EUROPÄISCHE NORM

August 1999

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ICS 97.060

English version

## Gas-fired type B tumble dryers of nominal heat input not exceeding 20 kW – Part 1: Safety

Sèche-linge du type B à tambour utilisant les combustibles gazeux, de débit calorifique nominal ne dépassant pas 20 kW - Partie 1: Sécurité

Gasbefeuerte Trommeltrockner Typ B mit Nennwärmebelastungen bis 20 kW -Teil 1: Sicherheit

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of an identical text or by endorsement, at the latest by February 2000, and conflicting national standards shall be withdrawn at the latest by February 2000.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

The Directive makes no specification in respect of the maximum rating of appliances falling within its scope. However, the scope of this standard has been limited to appliances having heat inputs not greater than 20 kW.

For domestic tumble dryers of types B<sub>22D</sub> and B<sub>23D</sub> of nominal heat input not exceeding 6 kW see prEN 1458-1 and prEN 1458-2.

The test gases, test pressures and appliance categories given in this European Standard are in accordance with those specified in EN 437: *"Test gases, test pressures and appliance categories"*.

The marking requirements in this European Standard take into account CR 1472 *"General guidance for the marking of gas appliances"*.

## 1 Scope

This European Standard specifies the requirements and test methods for the construction, safety and marking of gas-fired type B tumble dryers not exceeding a nominal heat input of 20 kW and with drum volume not exceeding 350 l, hereafter referred to as "Appliances".

This European Standard applies to types B<sub>22</sub> and B<sub>23</sub> direct gas-fired appliances and to types B<sub>11</sub> and B<sub>11BS</sub> indirect gas-fired appliances.

This standard does not apply to:

- a) catalytic combustion appliances;
- b) appliances intended to be used in locations where special conditions prevail, such as the presence of a corrosive or explosive atmosphere;
- c) appliances of the condensing type wherein the heated air and products of combustion used for the drying process are dehumidified by cooling with water or air;
- d) appliances intended to be used in vehicles or on board ships or aircraft;
- e) appliances of types B<sub>22D</sub> and B<sub>23D</sub>.

This standard covers type testing only.

## 2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate place 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 the undated references, incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

|              |                                                                                                                |
|--------------|----------------------------------------------------------------------------------------------------------------|
| EN 88        | Pressure governors for gas appliances for inlet pressures up to 200 mbar                                       |
| EN 126       | Multifunctional controls for gas burning appliances                                                            |
| EN 161       | Automatic shut-off valves for gas burners and gas appliances                                                   |
| EN 257       | Mechanical thermostats for gas-burning appliances                                                              |
| EN 298       | Automatic gas burner control systems for gas burners and gas burning appliances with or without fans           |
| EN 437: 1993 | Test gases - Test pressures - Appliance categories                                                             |
| EN 1057      | Copper and copper alloys - Seamless, round copper tubes for water and gas in sanitary and heating applications |
| EN 50165     | Electrical equipment of non-electric appliances for household and similar purposes - Safety requirements       |
| EN 60204-1   | Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1:1997)       |

|                     |                                                                                                                                                       |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| EN 60335-1          | Safety of household and similar electrical appliances - Part 1: General requirements (IEC 60335-1)                                                    |
| EN 60335-2-11: 1995 | Safety of household and similar electrical appliances - Part 2-11: Particular requirements for tumble dryers (IEC 60335-2-11: 1993)                   |
| EN 60529            | Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)                                                                               |
| EN 60730-2-9        | Automatic electrical controls for household and similar use - Part 2-9: Particular requirements for temperature sensing controls (IEC 60730-2-9:1992) |
| EN 61121            | Method for measuring the performance of tumble dryers for household use (IEC 61121:1993)                                                              |
| EN ISO 3166-1       | Codes for the representation of names of countries and their subdivisions - Part 1: Country codes (ISO 3166-1:1997)                                   |
| CR 1749             | European scheme for the classification of gas appliances according to the method of evacuation of the products of combustion (types)                  |
| ISO 7-1             | Pipe threads where pressure-tight joints are made on the threads - Part 1: Dimensions, tolerances and designation                                     |
| ISO 228-1           | Pipe threads where pressure-tight joints are not made on the threads - Part 1: Dimensions, tolerances and designation                                 |
| ISO 1182            | Fire tests - Building materials - Non-combustibility test                                                                                             |
| ISO 6976            | Natural gas - Calculation of calorific values, density, relative density and Wobbe index from composition                                             |

### 3 Definitions

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

#### 3.1 Tumble dryers

**3.1.1 direct gas-fired tumble dryer:** Appliance in which textile material is dried by tumbling in a rotating drum through which heated air and products of combustion are forced or induced by mechanical means.

**3.1.2 indirect gas-fired tumble dryer:** Appliance in which textile material is dried by tumbling in a rotating drum through which heated air is forced or induced by mechanical means. The drying air is heated in an integral heat exchanger.

**3.1.3 drum volume:** Internal net volume in litres of the drum in which the textile is placed.

#### 3.2 Gases

**3.2.1 reference conditions:** 15 °C, 1 013,25 mbar, unless otherwise specified.

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

A distinction is made between

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

Symbol:  $H_s$

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

Symbol:  $H_i$

Units: either

- megajoule per cubic metre ( $\text{MJ/m}^3$ ) of dry gas at the reference conditions, or
- megajoule per kilogram ( $\text{MJ/kg}$ ) of dry gas.

[EN 437: 1993].

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

Symbol:  $d$

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

Symbol: gross Wobbe index:  $W_s$ ; net Wobbe index:  $W_i$

Units: either

- megajoule per cubic metre ( $\text{MJ/m}^3$ ) of dry gas at the reference conditions, or
- megajoule per kilogram ( $\text{MJ/kg}$ ) of dry gas.

[EN 437: 1993].

**3.2.5 gas supply pressure:** Relative static pressure measured at the gas inlet connection of the appliance, with the appliance in operation.

**3.2.6 test gases:** Gases intended for the verification of the operational characteristics of appliances using combustible gases. They consist of reference gases and limit gases.

[EN 437: 1993].

**3.2.7 reference gases:** Test gases on which appliances operate under nominal conditions when they are supplied at the corresponding normal pressure. [EN 437: 1993].

**3.2.8 limit gases:** Test gases representative of the extreme variations in the characteristics of the gases for which appliances have been designed. [EN 437: 1993].

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

Unit: millibar (mbar).

**NOTE:** 1 mbar =  $10^2$  Pa

[EN 437: 1993].

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

Symbol:  $p_n$

[EN 437: 1993].

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

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

[EN 437: 1993].

**3.2.12 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].

### 3.3 Conditions of operation and measurement

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

**3.3.2 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, any thermostat remaining fully open.

### 3.4 Appliance construction

#### 3.4.1 Gas circuit

**3.4.1.1 gas circuit:** Part of an appliance between the gas inlet connection and the burner(s) conveying or containing the gas. The circuit can comprise several components.

EXAMPLES: restrictors, gas rate adjusters, gas rate controls, injectors.

**3.4.1.2 mechanical joint:** Connection device assuring soundness in an assembly of several parts, generally of metal.

EXAMPLES: cone seated joint, O-ring joint, flat faced washered joint.

**3.4.1.3 restrictor:** Device with an orifice, which is placed in the path of the gas flow between the appliance inlet connection and the burners 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.

**3.4.1.4 gas rate adjuster:** Component intended for the manufacturer or installer to set the gas rate to each burner at a predetermined value according to the supply conditions.

The adjustment can be progressive (screw adjuster) or discontinuous (changing restrictors).

The adjuster of an adjustable governor is regarded as a gas rate adjuster.  
The action of setting this device is called "setting the gas rate".

**3.4.1.5 gas rate control:** Component intended for the user to open or close the gas supply to one or more burners. It can also be used to adjust the gas rate of certain burners to a predetermined value, called the "reduced rate". This device can be a "tap".

**3.4.1.6 injector:** Component that admits the gas into an aerated burner.

### **3.4.2 Burners**

**3.4.2.1 main burner:** Burner that assures the thermal function of an appliance. It is usually called simply "burner".

**3.4.2.2 ignition device:** Device that ignites one or more burners. Such a device can be, for example, an ignition burner.

**3.4.2.3 ignition burner:** Burner intended to ignite a main burner.

**3.4.2.4 intermittent ignition burner:** Ignition burner that is ignited and extinguished at the same time as the main burner.

**3.4.2.5 fixed primary aeration restrictor:** Device containing an orifice of fixed cross section which limits the supply of air to a burner.

**3.4.3 flue outlet:** Part of an appliance that connects with a flue to evacuate the products of combustion.

**3.4.4 equivalent resistance (of the flue outlet):** Resistance to flow in millibar, measured at the outlet of the appliance, which is equivalent to that of the actual flue.

**3.4.5 draught diverter:** Device placed in the combustion products circuit to reduce the influence of flue-pull and that of downdraught on the burner performance and combustion.

### **3.4.6 Auxiliary equipment**

**3.4.6.1 governor:** Device that maintains, within a fixed range, a constant downstream pressure, independent of the upstream pressure and/or the gas rate.

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

**3.4.6.3 control knob:** Component designed to be moved by hand in order to operate an appliance control (tap, thermostat, etc.).

**3.4.6.4 programming unit:** Unit which reacts to impulses from control and safety devices, gives control commands, controls the start up programme, supervises the burner operation and causes controlled shut-down, safety shut-down and lock-out if necessary. The programming unit follows a predetermined sequence of actions and operates in conjunction with a flame detector device.

**3.4.6.5 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 can be in one or more housings.

**3.4.6.6 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.

**3.4.6.7 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.

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

**3.4.6.9 overheat cut-off device:** Device that shuts-off and locks-out the gas supply before the appliance is damaged (and before safety is put into question) and that requires manual intervention to restore the gas supply.

**3.4.6.10 spillage monitoring device:** Device that causes at least safety shut-down of the main burner, when there is an unacceptable spillage of combustion products from the draught diverter of type B<sub>11BS</sub> appliances.

### 3.5 Immobilizing an adjuster or a control

**3.5.1 setting an adjuster:** Procedure by which an adjuster is immobilized in a position by some means such as a screw or similar.

**3.5.2 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 pre-set 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.

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

### 3.6 Appliance performance

#### 3.6.1 Gas rates

**3.6.1.1 volume flow rate:** Volume of gas consumed by the appliance in unit time during continuous operation.

Practical unit: cubic metre per hour (m<sup>3</sup>/h), litre per minute (l/min), cubic decimetre per hour (dm<sup>3</sup>/h).

Symbol: *V*

**3.6.1.2 mass flow rate:** Mass of gas consumed by the appliance in unit time.

Practical units: kilogram per hour (kg/h) or gram per hour (g/h).

Symbol: *M*

**3.6.1.3 heat input:** Quantity of energy used in unit time corresponding to the volume and mass flow rates, the calorific value to be used being the net or gross calorific value.

Practical unit: kilowatt (kW)

Symbol: *Q*

**3.6.1.4 nominal heat input:** Value of the heat input stated by the manufacturer:

Symbol: *Q<sub>n</sub>*

### 3.6.2 Gas combustion

**3.6.2.1 flame stability:** State of the flames resting in a stable manner on the burner ports or the flame contact area provided by the design with no danger of flame lift or light-back.

**3.6.2.2 flame lift:** Phenomenon characterized by the total or partial lifting of the base of the flame from the burner port or the flame contact area provided by the design.

**3.6.2.3 light-back:** Phenomenon characterized by the entry of a flame into the body of a burner.

**3.6.2.4 light-back at the injector:** Phenomenon characterized by ignition of the gas at the injector, either as a result of the flame entering the burner or by the propagation of a flame around the outside of the burner.

**3.6.2.5 sooting:** Phenomenon characterized by deposits of soot on the surfaces of parts of the appliance in contact with the products of combustion or with the flame.

**3.6.2.6 yellow tipping:** Phenomenon characterized by the appearance of yellow colouring at the top of the blue cone of an aerated flame.

**3.6.2.7 first safety time<sup>1)</sup>:** Timespan between the ignition burner (pilot) gas valve being energized to the time that the flame detector is required to monitor the presence of that ignition burner (pilot) gas flame.

**3.6.2.8 second safety time:** Timespan between the main gas valve being energized to the time that the flame detector is required to monitor the presence of the main flame alone.

**3.6.2.9 extinction safety time:** Timespan between the extinction of the supervised flame and the order to shut off the gas supply to the burner.

**3.6.2.10 start gas flame:** Flame established at the start gas rate either at the main burner or at a separate ignition burner (pilot).

### 3.6.3 Lock-out

**3.6.3.1 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.

**3.6.3.2 volatile lock-out:** Safety shut-down condition of the system, such that a restart can only be accomplished by either the manual reset of the system, or a failure of the main power and its subsequent restoration.

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

**3.6.5 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.

**3.6.6 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.

**3.6.7 automatic recycling:** Process by which, following loss of flame signal during the running

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<sup>1)</sup> Where there is no second safety time, this is called the safety time.

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.

### 3.7 Marking of the appliance and packaging

**3.7.1 direct country of destination:** Country for which the appliance has been certified and which is specified by the manufacturer as the intended country of destination. At the time of putting the appliance on the market and/or 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 normal pressure.

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

**3.7.2 indirect country of destination:** Country for which the appliance has been certified, but for which, in its present state of adjustment, it is not suitable. Subsequent modification or adjustment is essential in order that it can be utilized safely and correctly in this country.

**3.7.3 manufacturer:** Person responsible for designing and manufacturing a product covered by the directive, with a view to placing it on the Community market on his own behalf.

**NOTE:** This definition is as given in the guide to the implementation of Community harmonization directives based on the new approach and global approach provisions.

## 4 Classification of appliances

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

#### 4.1.1 Families 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 gases used in this standard.

**Table 1: Classification of gases**

| Gas families and Groups | Gross Wobbe Index at 15 °C and 1 013,25 mbar MJ/m <sup>3</sup> |         |
|-------------------------|----------------------------------------------------------------|---------|
|                         | 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    |

## 4.1.2 Categories of appliances

### 4.1.2.1 General

Appliances are classified into categories defined according to the gases and the pressures for which they are designed.

The definitions of categories are given in 4.1.2.2, 4.1.2.3 and 4.1.2.4.

In each country, taking account of the local gas distribution conditions (gas composition and supply pressures), only some of the categories defined in 4.1.2.2, 4.1.2.3 and 4.1.2.4 are marketed.

The conditions concerning the marketing of these appliance categories in each country and the corresponding supply pressures, are given in tables A.1 and A.2 (see also A.3 for the categories marketed locally and nationally, corresponding to the test gases and test pressures given in table A.4; Annex B gives the particular conditions specific to one country).

### 4.1.2.2 Category I

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

#### 4.1.2.2.1 Appliances designed for use on first family gases only

**Category I<sub>1a</sub>:** Appliances using only gases of group a of the first family at the prescribed supply pressure. (This category is not used).

#### 4.1.2.2.2 Appliances designed for use on second family gases only

**Category I<sub>2H</sub>:** Appliances using only gases of group H of the second family at the prescribed supply pressure.

**Category I<sub>2L</sub>:** Appliances using only gases of group L of the second family at the prescribed supply pressure.

**Category I<sub>2E</sub>:** Appliances using only gases of group E of the second family at the prescribed supply pressure.

**Category I<sub>2E+</sub>:** 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 pressure regulating device, if it exists, is not operative in the range of the two normal pressures of the pressure couple.

#### 4.1.2.2.3 Appliances designed for use on 3<sup>rd</sup> family gases only

**Category I<sub>3B/P</sub>:** Appliances capable of using the third family gases (propane and butane) at the prescribed supply pressure.

**Category I<sub>3+</sub>:** Appliances capable of using gases of 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 gas pressure regulating device is permitted on the appliance.

**Category I<sub>3P</sub>:** Appliances using only gases of group P of the third family (propane) at the prescribed supply pressure.

**Category I<sub>3B</sub>:** Appliances using only gases of group B of the third family (butane) at the prescribed supply pressure.

#### 4.1.2.3 Category II

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

##### 4.1.2.3.1 Appliances designed for use on gases of the first and second families

**Category II<sub>1a2H</sub>:** 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<sub>1a</sub>. The second family gases are used under the same conditions as for category I<sub>2H</sub>.

##### 4.1.2.3.2 Appliances designed for use on gases of the second and third families

**Category II<sub>2H3B/P</sub>:** 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<sub>2H</sub>. The third family gases are used under the same conditions as for category I<sub>3B/P</sub>.

**Category II<sub>2H3+</sub>:** 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<sub>2H</sub>. The third family gases are used under the same conditions as for category I<sub>3+</sub>.

**Category II<sub>2H3P</sub>:** 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<sub>2H</sub>. The third family gases are used under the same conditions as for category I<sub>3P</sub>.

**Category II<sub>2L3B/P</sub>:** 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<sub>2L</sub>. The third family gases are used under the same conditions as for category I<sub>3B/P</sub>.

**Category II<sub>2L3P</sub>:** 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<sub>2L</sub>. The third family gases are used under the same conditions as for category I<sub>3P</sub>.

**Category II<sub>2E3B/P</sub>:** 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<sub>2E</sub>. The third family gases are used under the same conditions as for category I<sub>3B/P</sub>.

**Category II<sub>2E+3+</sub>:** 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<sub>2E+</sub>. The third family gases are used under the same conditions as for category I<sub>3+</sub>.

#### 4.1.2.4 Category III

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

This category is not in general use.

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

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

Appliances are classified into several types according to the method of evacuation of the products of combustion and of admitting the combustion air. This appliance classification is based on that described in CR 1749.

**4.2.1 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.

**4.2.2 Type B<sub>1</sub>:** A type B appliance incorporating a draught diverter.

**4.2.3 Type B<sub>11</sub>:** A natural draught B<sub>1</sub> appliance.

**4.2.4 Type B<sub>11BS</sub>:** A type B<sub>11</sub> appliance fitted with a spillage monitoring device.

**4.2.5 Type B<sub>2</sub>:** A type B appliance without a draught diverter.

**4.2.6 Type B<sub>22</sub>:** A type B<sub>2</sub> appliance incorporating a fan downstream of the combustion chamber/heat exchanger.

**4.2.7 Type B<sub>23</sub>:** A type B<sub>2</sub> appliance incorporating a fan upstream of the combustion chamber/heat exchanger.

**4.2.8 Type B<sub>22D</sub>:** A type B<sub>22</sub> appliance that is intended to be connected to a flexible non-metallic duct that evacuates humid air and products of combustion to the outside of the room containing the appliance. This type is excluded in this standard.

**4.2.9 Type B<sub>23D</sub>:** A type B<sub>23</sub> appliance that is intended to be connected to a flexible non-metallic duct that evacuates humid air and products of combustion to the outside of the room containing the appliance. This type is excluded in this standard.

## 5 Construction and design requirements

### 5.1 General

#### 5.1.1 Conversion to different gases

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

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

#### 5.1.1.1 Category I

- **Categories I<sub>2H</sub> and I<sub>2L</sub>, I<sub>2E</sub> and I<sub>2E+</sub>:** No modification of the appliance;
- **Categories I<sub>3B/P</sub> and I<sub>3B</sub>:** No modification of the appliance;
- **Category I<sub>3+</sub>:** Replacement of injectors or restrictors but only in order to convert from one pressure couple to another (e.g. 28-30/37 mbar  $\Leftrightarrow$  50/67 mbar);
- **Category I<sub>3P</sub>:** No modification to appliance relative to a change of gas. For changing pressure, replacement of injectors and adjustment of gas rates.

#### 5.1.1.2 Category II

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

- Adjustment of the gas rate with, if necessary, a change of injector, restrictors or governor;
- Adjustment of the gas rate of ignition burners, either by using an adjuster or by a change of injectors or restrictors and, if necessary, a change of complete ignition burners or of some of their parts;
- Putting the governor out of service under the conditions of 5.2.5;
- Putting the gas rate adjusters out of service under the conditions of 5.2.6.

These adjustments or component changes are only acceptable when converting from a gas of the 1st family to a gas of the 2nd family or vice versa.

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

- Adjustment of the gas rate with, if necessary, a change of injector, restrictors or governor;
- Adjustment of the gas rate of ignition burners, either by using an adjuster or by a change of injectors or restrictors and, if necessary, a change of complete ignition burners or of some of their parts;
- Putting the governor out of service under the conditions of 5.2.5;
- Putting the gas rate adjusters out of service under the conditions of 5.2.6.

These adjustments or component changes are only acceptable when:

- converting from a gas of the 2nd family to a gas of the 3rd family or vice versa;
- converting from one butane/propane pressure couple to another, (e.g. 28-30/37 mbar  $\Leftrightarrow$  50/67 mbar).

#### 5.1.1.3 Category III

Category III appliances admitted in certain countries and the conversion criteria are also given in A.3.

#### 5.1.2 Materials and method of construction

The quality and thickness of the materials used in the construction of the appliance, and the method of assembling the various parts, shall be such that the constructional and operational characteristics do

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not alter significantly during a reasonable life under normal conditions of installation and use.

In particular, when the appliance is installed according to the instructions and accepted practice, all components shall withstand the mechanical, chemical and thermal conditions to which they can be subjected during service.

In normal conditions of use, maintenance or adjustment, they shall not show any alteration likely to impair their marking and, in particular, their safety.

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

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.

Hard solder containing cadmium in its formulation shall not be used in the construction of the appliance.

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

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

Condensation produced at the start-up and/or during use shall not affect the safety of the appliance.

### **5.1.3 Screws**

Screws affecting electrical safety shall comply with the relevant requirements of EN 60335-2-11.

Self-tapping screws shall not be used to ensure gas soundness.

In addition, a single self-tapping screw shall not be used to secure devices essential to the safe operation of the gas burner.

### **5.1.4 Maintenance and use**

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

Levers and other controlling and setting devices shall be clearly marked and give appropriate instructions so as to prevent any error in handling. Their design shall be such as to preclude accidental manipulation.

Removable parts shall be so designed or marked that they are easy to reassemble correctly and difficult to reassemble incorrectly.

It shall be possible for the user to clean without difficulty the external parts of the appliance likely to become soiled by dust, possibly after removing the outer case or a part of this case. This exercise shall be carried out in accordance with the manufacturer's instructions.

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

Removable parts (with the exception of the heat exchanger) shall be dismountable for maintenance by a service engineer using commonly available tools, such as a screwdriver or a spanner.

Connection to the flue shall be possible when the appliance is installed in accordance with the manufacturer's instructions.

### 5.1.5 Thermal insulation

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

### 5.1.6 Gas connection

The appliance gas inlet shall permit the connection to the gas supply by means of a flexible hose, suitable for the appliance category, with mechanical end fittings. The connection shall be capable of being made in an easy manner; the appliance being in place or the appliance being removed, according to the manufacturer's instructions.

Subject to the requirements given below, the appliance inlet connection shall be accessible and in accordance with table A.5.

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

- a) a thread conforming to ISO 228-1. In this case the end of the gas inlet connection shall have a flat annular surface at least 3 mm wide for thread nominal sizes 1/2 and 3/8 and at least 2,5 mm wide for thread nominal size 1/4, to allow the interposition of a sealing washer; moreover, when the end of the gas inlet connection has a thread of nominal size 1/2, it shall be possible to insert a gauge of 12,3 mm diameter to a depth of at least 4 mm;
- b) a thread conforming to ISO 7-1;
- c) a compression fitting suitable for copper tube conforming to EN 1057;
- d) a straight tube at least 30 mm long, the end of which is cylindrical, smooth and clean, to allow connection by means of a compression fitting as specified in c).

This may be achieved, if necessary, by the use of an adapter fitted on the appliance by the manufacturer in such a way that the end of the gas inlet to the appliance conforms to the installation practices of the country of destination. If such an adapter is supplied, it shall have a label indicating the type of thread. The details for the utilization of such an adapter shall appear in the installation instructions (see 7.4.2). The installation practices in force in the various countries are given in table A.5.

The end of the gas inlet connection shall be positioned to allow the free movement of a flexible hose connection.

### 5.1.7 Soundness

#### 5.1.7.1 Soundness of the gas circuit

Holes for screws, studs, etc. intended for the assembly of components shall not open into the gasways.

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

However, sealing compounds can be used for permanent threaded assemblies including injectors. The sealing material shall remain effective under normal conditions of appliance use.

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

#### **5.1.7.2 Soundness of the combustion circuit**

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

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

### **5.1.8 Supply of combustion air and evacuation of combustion products**

#### **5.1.8.1 Requirements for all appliances**

The appliance shall be so constructed that a sufficient supply of combustion air is always assured.

The cross section of the orifices for the supply of fresh air to the combustion chamber and for the evacuation of the combustion products shall be capable of being adjusted and fixed by the installer in accordance with the manufacturer's instructions.

Air, lint and products of combustion associated with the drying process shall only discharge from the appliance through the purpose designed outlet(s).

The flue outlet shall be female and shall allow, if necessary by means of an adapter supplied with the appliance, connection to a flue duct whose diameter complies with the standards in force in the country where the appliance is to be installed (see table A.6).

It shall be possible to insert a flue pipe with an external diameter of  $(D - 2)$  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.

#### **5.1.8.2 Additional requirements for type B<sub>11</sub> and B<sub>11BS</sub> appliances (indirect heated appliances)**

Such appliances shall be fitted with a draught diverter integral with the appliance.

The outlet connection of the draught diverter shall be female. It is admissible for the manufacturer to supply an adapter to permit the connection between the draught diverter outlet and the flue duct to which the appliance is connected.

It shall be possible to insert the flue duct to a depth of at least 15 mm. When inserted as far as possible, the evacuation of the combustion products shall not be impaired.

The evacuation of the drying air shall be independent of the evacuation of the combustion products.

#### **5.1.9 Lint collection**

A lint filter or other means shall be provided for minimizing the discharge of lint.

The filter screen shall be easily accessible for cleaning without disconnecting the flue duct.

### 5.1.10 Flame visibility

Appliances shall be designed so that correct ignition and operation of the burner(s) and the flame length of the ignition burner(s), if any, can always be directly confirmed.

Where mirrors or windows are used, they shall retain their optical properties. Where it is not possible to see the main burner an indirect means of signalling (e.g. control lamp) is required. In this case, it shall not be possible for the signal of the existence of the flame to be confused with a signal for any malfunction, apart from that of a malfunction of the flame control itself, which shall be expressed by the indication of an absence of flame.

### 5.1.11 Electrical equipment

#### 5.1.11.1 General

For appliances with drum volume up to 160 l (considered as domestic appliances), the electrical equipment of the appliance shall comply with EN 60335-2-11 and EN 50165.

For appliances with drum volume exceeding 160 l (considered as commercial appliances), the manufacturer is given the option of complying with EN 60204-1 (industrial use) or EN 60335-2-11 and EN 50165 (non-industrial use).

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

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

- 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.

#### 5.1.11.2 Supply voltage tolerance

The electrical circuits and components of the appliance shall function safely when the appliance is connected to a supply of 85 % of the minimum rated voltage and of 110 % of the maximum rated voltage. This shall be verified by the test described in 6.15.3.2 a).

#### 5.1.11.3 Internal wiring

In addition to the requirements of EN 60335-2-11, solid or rigid internal conductors shall not be used where they are subject to vibration, repeated bending or undue strain.

### 5.1.12 Motors and fans

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

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

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

Belt drive arrangement for the rotation of the drum of the appliance can use a self-tensioning spring system.

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

Lubrication points, if provided, shall be readily accessible.

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

The control system shall be so arranged that a hazardous condition cannot arise in the event of failure of the supply electricity or upon its subsequent restoration nor shall any damage to the appliance occur.

Interruption of the electricity supply at any time during starting up or operation of the appliance shall result in the continued safe operation or safety shut-down such that re-start may only take place after manual intervention or by means of a single automatic re-start. If this automatic re-start is unsuccessful non-volatile lock-out shall result.

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

**NOTE:** The method for testing for the safety of the appliance in the event of normal and abnormal fluctuation of the main voltage supply is described in 6.15.3.2 a).

#### **5.1.14 Combustion air flow failure (direct gas-fired appliances)**

In the event of the fan failing to produce the necessary flow of combustion air or flue gases for any reason during start-up or during normal operation, no hazard shall arise and the gas supply to the main burner shall be shut off within 30 s.

Five attempts to re-ignite are permitted. However, if the air or flue gas flow failure still exists, the gas supply to the main burner shall be shut off within 30 s after each attempt and no hazard shall arise.

Any control for carrying out this function shall be so designed that, should failure of the control occur, the appliance remains in a safe condition.

### **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.

#### **5.2.2 Automatic shut-off valves**

Automatic shut-off valves shall comply with EN 161.

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

The gas line shall be fitted with a Class A valve or Class B valve to shut off the gas supply to the main burner and ignition burner, if any; the overheat cut-off device, the safety temperature limiter and also the flame detector can operate on this valve.

An appliance shall have a second valve of either Class A, Class B or Class C for purposes of controlled shut-down or shut-down caused by the limit thermostat.

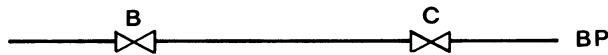
If the appliance has an ignition burner, the gas line to the ignition burner shall be fitted with either a Class A valve, Class B valve or a Class C valve downstream of the main gas valve.

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

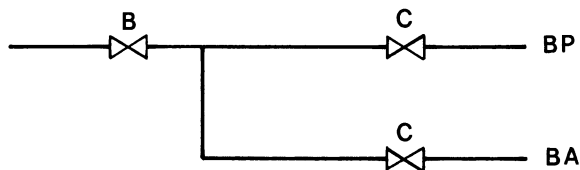
Legend: BA - ignition burner

BP - main burner

1) Appliances with direct ignition of the main burner



2) Appliances with intermittent ignition burner



A shut-off device shall be protected against internal blocking, e.g. by means of a strainer.

### 5.2.3 Multifunctional controls

Any multifunctional control shall comply with EN 126.

### 5.2.4 Flame supervision devices

The burner shall be fitted with a flame supervision device.

The presence of a flame shall be detected by at least the flame detector of an automatic burner control system.

Where the main burner is ignited by an ignition burner, the presence of the ignition burner flame shall be detected before gas is admitted to the main burner.

The programme shall be designed so that it is never possible to perform two or more actions which would be unacceptable in combination. The order of the actions shall be fixed in such a manner that it is not possible to change it.

Upon flame failure, the flame supervision device shall cause volatile lock-out, or, provided the

conditions of 5.5.2 are met, a single attempt at re-ignition by spark restoration or three attempts of automatic recycling are permitted.

### 5.2.5 Governors

Any governor shall comply with EN 88.

Appliances intended to operate with first family gases shall have a gas governor. A gas governor is optional for other appliances.

A governor intended for operation with a pressure couple shall be adjusted or shall be capable of being adjusted in such a way that it cannot operate between the two normal pressures.

However, when operating with a pressure couple, a non-adjustable gas governor is permitted for the ignition burner.

The design and accessibility of the gas governor shall be such that it can be easily adjusted or put out of service or, possibly, the governor or its components can be changed on conversion to another gas, but precautions shall be taken to make unauthorized interference with the preset adjuster difficult.

### 5.2.6 Gas rate adjusters

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

Any parts of the appliance that are not to be manipulated by the installer or user, shall also be protected in an appropriate manner. Paint may be used for this purpose provided that it resists the heat to which it is subjected during normal operation of the appliance.

A preset gas rate adjuster is mandatory for appliances using more than one group of the first gas family, and optional for other appliances.

The preset adjuster shall:

- be sealed if the adjustment is only made by the manufacturer;
- be able to be sealed if an adjustment is carried out by the installer.

The gas rate adjuster shall be locked and sealed when a gas of a family or group carrying a "+" suffix is used.

The adjustment can be continuous (adjusting screw) or discrete (change of restrictors).

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

The action of adjusting these devices is called "adjusting the gas rate".

These devices shall be designed so that after normal, even prolonged, use, they can be moved easily with commonly available tools.

### 5.2.7 Automatic burner control systems

Automatic burner control systems shall comply with EN 298.

The manufacturer shall specify the first safety time. This time shall not exceed 10 s.

### 5.2.8 Gas strainers

A strainer shall be fitted at the inlet of any system incorporating safety shut-off valve(s) to prevent the

ingress of foreign matter. The strainer can be integral with the upstream safety shut-off valve. The maximum strainer hole dimension shall not be greater than 1,5 mm and the mesh shall not allow the penetration of a pin gauge > 1 mm.

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

Where a governor is fitted upstream of the safety shut-off system, the strainer shall be fitted upstream of the governor.

### **5.2.9 Spillage monitoring device**

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

This can be achieved with a spillage monitoring device (in this case, the appliance is designated as a type B<sub>11BS</sub>).

The safety device shall not have any adjustment. Adjustable components shall be sealed by the manufacturer.

The safety device shall be so designed that it cannot be dismantled without a tool.

Incorrect refitting, after servicing, shall be made difficult.

The safety device shall be designed so that the electrical insulation withstands the thermal stresses resulting from spillage of the combustion products.

If the control and its link are arranged such that they shall be removable or they can be damaged during maintenance, the instructions shall specify the test which shall be carried out to check the operation of the control after servicing.

Appliances intended to be installed in a room separated from inhabited rooms (kitchens, bedrooms, bathrooms, living rooms, etc.) and provided with appropriate ventilation directly to the outside need not be fitted with such a device but, in this case, appropriate warnings on the packaging and in the instructions shall clearly indicate the limit on the use of this type of appliance; in this case, the appliance is designated as a type B<sub>11</sub> appliance.

## **5.3 Ignition devices**

### **5.3.1 General**

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 ignite.

### **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 5.2.8).

#### **5.4 Ignition burner or start-gas flame establishment**

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

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

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

The start-gas flame proving period shall establish that the flame is stable on its own. If the flame fails during this period, safety shut-down and non-volatile lock-out shall result.

#### **5.5 Main flame establishment**

##### **5.5.1 Establishment by means of an ignition burner or start-gas 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 burner or start-gas flame has been detected and proved.

Flame failure at any time after the main gas safety shut-off valves have been signalled to open shall lead to safety shut-down.

##### **5.5.2 Direct establishment of the main flame e.g. spark ignition or hot surface igniter**

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 safety time. Where a hot surface ignition system is used, the ignition system shall be so energized that the ignition source is capable of igniting incoming gas before the gas valves are opened.

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

A single attempt at re-ignition by spark restoration shall commence within 1 s of flame failure. If the flame is not detected within the first safety time, safety shut-down and non-volatile lock-out shall result. Three automatic recycling attempts are also permitted. Following automatic recycling, if the flame is not detected within the first safety time, safety shut-down and non-volatile lock-out shall result.

#### **5.6 Burners**

The section of the flame ports shall not be adjustable.

Removal and replacement of the burner in accordance with the manufacturer's instructions shall be possible with commonly available tools.

The burner position shall be well defined and the burner shall be fitted so that it is difficult to place it incorrectly.

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

For an appliance burning 3rd family gas, the space below the burner shall be designed such that in the case of release of unburnt gas this gas can escape out of the appliance without risk of accumulation.

## **5.7 Thermostats and control of air temperature**

### **5.7.1 General requirements**

The appliance shall be equipped with (a) suitable device(s), e.g: control thermostat(s), to control the temperature in the drum.

Integral mechanical thermostats shall comply with EN 257.

Electrical thermostats shall comply with EN 60730-2-9.

### **5.7.2 Temperature limiting device**

A safety device which functions independently of the operating temperature control device (e.g. an overheat cut-off device) shall be fitted. This device shall cause shut-down and non-volatile lock-out in the event of an overheat condition occurring.

This safety device shall be set and sealed by the manufacturer. The device shall not operate during the normal operation of the appliance.

## **5.8 Clocks and timing devices**

The failure of a clock or timing device shall in no way affect the safety of the appliance. The operation of a manual override, if provided, shall not affect the safe operation of the appliance.

## **5.9 Gas pressure test points**

An ungoverned appliance shall have at least one pressure test point. A governed appliance shall have at least two pressure test points, one to measure pressure at the appliance inlet and another immediately upstream of the burner.

In all cases, a pressure test point shall be provided on the appliance for measurement of the manufacturer's stated operating pressure. The pressure test nipple shall have an external diameter of  $(9^{+0}_{-0.5})$  mm, and a useful length of at least 10 mm for connection to tubing. The diameter of the hole in the test point shall be not greater than 1 mm.

## **5.10 Door interlocks**

All appliances shall be fitted with a door interlock.

The interlock shall disconnect the motor before the door opening exceeds 20 mm. In addition, it shall not be possible to start the motor while the door opening exceeds 20 mm.

The interlock shall be so designed that unexpected operation of the appliance is unlikely to occur while the door is open.

## **6 Operational safety**

### **6.1 General**

#### **6.1.1 Characteristics of test gases: reference and limit gases**

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