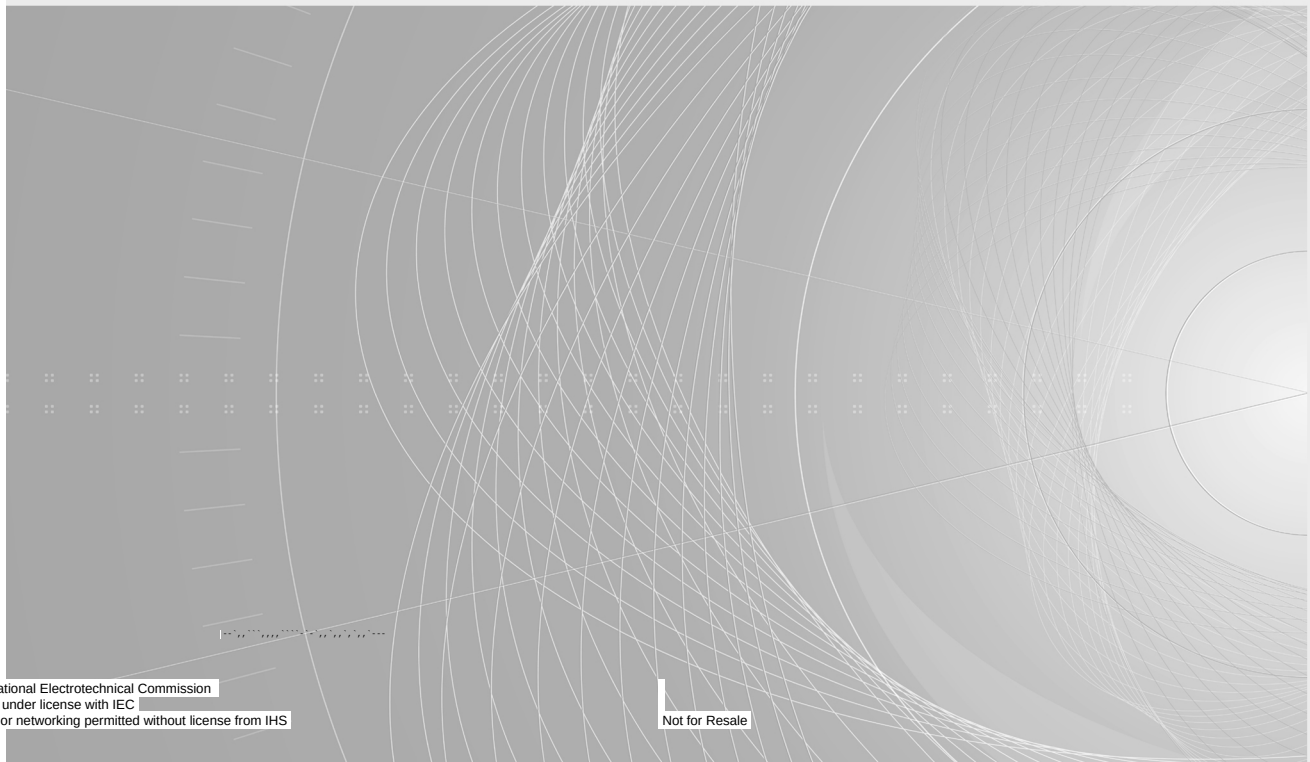
IEC 60335-2-79

Edition 2.2 2007-09

INTERNATIONAL STANDARD

Household and similar electrical appliances – Safety – Part 2-79: Particular requirements for high pressure cleaners and steam cleaners



IEC 60335-2-79:2002+A1:2004+A2:2007(E)

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IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-79: Particular requirements for high pressure cleaners and steam cleaners

FOREWORD

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This part of International Standard IEC 60335 has been prepared by sub-committee 61J: Electrical motor-operated cleaning appliances for industrial use, of IEC technical committee 61: Safety of household and similar electrical appliances.

This consolidated version of IEC 60335-2-79 consists of the second edition (2002) [documents 61J/128/FDIS and 61J/133/RVD], its amendment 1 (2004) [documents 61J/165/FDIS and 61J/171/RVD] and its amendment 2 (2007) [documents 61J/252/FDIS and 61J/258/RVD].

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience.

It bears the edition number 2.2.

A vertical line in the margin shows where the base publication has been modified by amendments 1 and 2.

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This part 2 is to be used in conjunction with the latest edition of IEC 60335-1 and its amendments. It was established on the basis of the fourth edition (2001) of that standard.

NOTE 1 When “Part 1” is mentioned in this standard, it refers to IEC 60335-1.

This part 2 supplements or modifies the corresponding clauses in IEC 60335-1, so as to convert that publication into the IEC standard: Safety requirements for electric high pressure cleaners and steam cleaners.

When a particular subclause of Part 1 is not mentioned in this part 2, that subclause applies as far as is reasonable. When this standard states “addition”, “modification” or “replacement”, the relevant text in Part 1 is to be adapted accordingly.

NOTE 2 The following numbering system is used:

– subclauses, tables and figures that are numbered starting from 101 are additional to those in Part 1;
– unless notes are in a new subclause or involve notes in Part 1, they are numbered starting from 101, including those in a replaced clause or subclause;
– additional annexes are lettered AA, BB, etc.

NOTE 3 The following print types are used:

– requirements: in roman type;
– *test specifications: in italic type;*
– notes: in small roman type.

Words in **bold** in the text are defined in Clause 3. When a definition concerns an adjective, the adjective and the associated noun are also in bold.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

The following differences exist in the countries indicated below.

– Clause 1: Different pressure limitations apply (USA).
– 6.1: Ground fault current interrupters are required for appliances rated 250 V or less, single phase (USA).
– 7.12: No requirements for sound and vibration markings exist (USA).
– 11.101: The losses of burners are subject to regulations (Germany). Smoke spot requirements are different (USA).
– 20.103: The fuel tank capacity is limited (USA).
– 21.101, 21.101.2 and 21.102: Different burner tests are required (USA).
– 25.7: Different power supply cord lengths are required (Canada, USA).
– Clause 32: The connection with the water mains is subject to regulations (Canada).

A bilingual version of this publication may be issued at a later date.

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INTRODUCTION

It has been assumed in the drafting of this International Standard that the execution of its provisions is entrusted to appropriately qualified and experienced persons.

This standard recognizes the internationally accepted level of protection against hazards such as electrical, mechanical, thermal, fire and radiation of appliances when operated as in normal use taking into account the manufacturer's instructions. It also covers abnormal situations that can be expected in practice.

This standard takes into account the requirements of IEC 60364 as far as possible so that there is compatibility with the wiring rules when the appliance is connected to the supply mains. However, national wiring rules may differ.

If an appliance within the scope of this standard also incorporates functions that are covered by another part 2 of IEC 60335, the relevant part 2 is applied to each function separately, as far as is reasonable. If applicable, the influence of one function on the other is taken into account.

This standard is a product family standard dealing with the safety of appliances and takes precedence over horizontal and generic standards covering the same subject.

An appliance that complies with the text of this standard will not necessarily be considered to comply with the safety principles of the standard if, when examined and tested, it is found to have other features that impair the level of safety covered by these requirements.

An appliance employing materials or having forms of construction differing from those detailed in the requirements of this standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be considered to comply with the standard.

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HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-79: Particular requirements for high pressure cleaners and steam cleaners

1 Scope

This clause of Part 1 is replaced by the following.

This International Standard deals with the safety of high pressure cleaners for household, industrial and commercial use having a pressure not less than 2,5 MPa and not more than 25 MPa and with an input to the drive for the high pressure pump not exceeding 10 kW, their **rated voltage** being not more than 250 V for single-phase appliances and 480 V for other appliances.

It also applies to industrial and commercial steam cleaners having a water container with a capacity not exceeding 1 000 l, a **rated pressure** not exceeding 3,2 MPa and a product of capacity and **rated pressure** not exceeding 300.

It is also applicable to appliances making use of other forms of energy for the motor, but it is necessary that their influence is taken into consideration.

As far as it is practicable, this standard deals with the common hazards presented by appliances that are encountered by all persons in and around the home. However, in general, it does not take into account

– the use of appliances by young children or infirm persons without supervision,
– playing with the appliance by young children.

NOTE 101 Attention is drawn to the fact that

– for appliances intended to be used in vehicles or on board ships or aircraft, additional requirements may be necessary;
– in many countries additional requirements are specified by the national health authorities, the national authorities responsible for the protection of labour, the national water supply authorities and similar authorities.

NOTE 102 This standard does not apply to

– appliances that are incorporated in process equipment;
– appliances intended to be used in locations where special conditions prevail, such as the presence of corrosive or explosive atmosphere (vapour or gas);
– audio, video and similar electronic apparatus (IEC 60065);
– appliances for medical purposes (IEC 60601);
– hand-held motor-operated electric tools (IEC 60745);
– personal computers and similar equipment (IEC 60950);
– transportable motor-operated electric tools (IEC 61029);
– steam cleaners for household use only (IEC 60335-2-54).

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2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

IEC 60364-1, *Electrical installations of buildings – Part 1: Fundamental principles, assessment of general characteristics, definitions*

IEC 60704-1, *Household and similar electrical appliances – Test code for the determination of airborne acoustical noise – Part 1: General requirements*

IEC 61558-2-3, *Safety of power transformers, power supply units and similar – Part 2-3: Particular requirements for ignition transformers for gas and oil burners*

ISO 5349 (all parts), *Mechanical vibration – Measurement and evaluation of human exposure to hand-transmitted vibration*

3 Definitions

This clause of Part 1 is applicable except as follows.

3.1.9 *Replacement:*

normal operation
operation of the appliance under the following conditions

The appliance is supplied at **rated voltage** and operated at **rated flow** and **rated pressure** with the nozzle and hose specified by the manufacturer fitted to it; all strainers and filters are in a clean operating condition and the **unloader valve** is set to the **rated pressure**. The **water heater**, if fitted, is operated at maximum power.

Power outlets for accessories are loaded with a resistive load in accordance with the marking.

3.101
unloader valve
pressure operated valve which, when the pump pressure exceeds the preset value, returns the excess fluid to the inlet system. In addition it bypasses the total pump flow at reduced pressure when its outlet flow is cut off

3.102
safety valve
pressure operated valve which, when the pump or steam cleaner pressure exceeds the preset value, returns the excess fluid or steam to the inlet system or into the atmosphere

3.103
rated pressure
maximum pressure at the pump or at the steam cleaner assigned to the appliance by the manufacturer

3.104
permissible pressure
limiting pressure up to which an appliance and/or parts of the appliance can be operated without impairing its integrity

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3.105
rated flow
flow at **rated pressure** at the nozzle assigned to the appliance by the manufacturer

3.106
water heater
means of heating water or **cleaning agent** by electricity, gas, liquid fuel or heat exchanger

3.107
cleaning agent
water with or without the addition of a soluble or miscible chemical

3.108
pressure switch
device which, in response to varying fluid pressure, provides a controlling function at a pre-set value

3.109
flow switch
device which, in response to a varying rate of fluid flow, provides a controlling function at a pre-set value

3.110
primary safety control
control device that responds directly to flame properties sensing the presence of flame and, in event of ignition failure or unintentional flame extinguishment, causes safety shut down

NOTE **Primary safety controls** are also known as flame failure devices.

3.111
trigger gun
device that shuts off the supply of fluid through its outlet if the trigger is not held in its operating position

3.112
continuous ignition
ignition by an energy source that is continuously maintained throughout the time the burner is in service, whether the burner is firing or not

3.113
rated temperature
maximum temperature of the **cleaning agent** assigned by the manufacturer

3.114
pencil jet nozzle
nozzle that gives a concentrated, parallel water jet; also called needle jet nozzle, solid jet nozzle or 0 degree jet nozzle

3.115
water jetter
high-pressure pipe-cleaning device, consisting of a nozzle at the end of a high-pressure hose

3.116
motorized cleaning head
accessory containing a motor that is supplied from the appliance and which is attached to the end of a hand-held hose or tube

NOTE The main cleaning head permanently attached is not regarded as a **motorized cleaning head**.

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3.117
low pressure accessory
accessories to be connected to a high pressure cleaner equipped with one or more nozzles with an equivalent diameter exceeding 2 mm

NOTE 101 Nozzles with an equivalent diameter exceeding 2 mm used in a high pressure cleaner system are not considered to become clogged.

NOTE 102 Typical examples of **low pressure accessories** are washing brushes, foam nozzles, washing sponges.

3.118
hand-guided appliance
appliance to be moved on the floor while in operation, guided by a mechanically coupled handle

4 General requirement

This clause of Part 1 is applicable.

5 General conditions for the tests

This clause of Part 1 is applicable except as follows.

5.1 *Addition*:

The burner is operated at rated power. Appliances intended for operation at more than one rated power are additionally tested at the most disadvantageous power.

The burner-air adjustment, where provided, is regulated to establish the air/fuel ratio to produce the combustion characteristics recommended in the user instructions. The combustion characteristics may be specified by the appearance of the flame, the percentage of carbon dioxide (CO_2) in the flue gases, or by other characteristics.

On appliances designed for use with a flue pipe, a section of flue pipe is attached to the appliance. Flue gas determinations are taken in this flue pipe.

The draught is adjusted to that recommended in the instructions for use.

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 *Replacement:*

Appliances shall be **class I, class II** or **class III** with respect to the protection against electric shock. However, **hand-held appliances** and hand-held parts of steam cleaners and high pressure cleaners shall be **class II** or **class III.**

Compliance is checked by inspection and by the relevant tests.

6.2 *Replacement:*

The appliances shall have a degree of protection against harmful ingress of water according to Table 101:

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Table 101 – Degree of protection against harmful ingress of water

		Protection class (electric shock)	**Protection degree** (IEC 60529)
Steam cleaners	for indoor use only	I – II	IPX4
		III	IPX3
	for outdoor use	I-II-III	IP X5
	Hand-held parts	II	IPX7
		III	IP X3
High pressure cleaners	**Hand-held appliances**	II-III	IP X7
	Other types of appliances	I-II-III	IP X5
	Hand-held parts	II-III	IP X7

However, **fixed appliances** that are specified for installation in an independent room, where they will not be subject to spillage or splashing of water, shall be at least IPX0**.**

Compliance is checked by inspection and by the relevant tests.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 *Addition*:

- **rated pressure** in Pascal;
- **permissible pressure** in Pascal;
- maximum **rated flow** in litre per minute;
- maximum **rated temperature** where this is above 50 ºC;
- serial number;
- year of production. The year of production may be indicated by the last two digits of the year;
- maximum inlet water pressure in Pascal if not given in the instruction manual;
- maximum power of the water heater in kW.

NOTE 101 For electric heaters the input power is specified.

For gas-fired or oil-fired heaters the output power is specified.

A yellow label with black lines showing the substance of the warning symbols in accordance with Figure 101 shall be permanently fixed to the appliance.

All pressure hoses shall be marked with a pressure of at least the **permissible pressure** in megapascals and the maximum temperature in degrees Celsius and shall be marked with the name of the manufacturer and the date of production. These data may be coded.

NOTE 102 For low pressure accessories, no marking of the **permissible pressure** is necessary.

The **trigger gun** and the spray lance shall be marked with the **permissible pressure** in megapascals and the maximum temperature in degrees Celsius and with a mark giving the manufacturer of the **trigger gun**.

NOTE 103 It is recommended that the safety valve should be marked with an identification.

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When the surface of a flue or duct for exhaust gases from the heater exceeds a temperature rise of 60 K, a warning notice shall be fitted near to the hot surface stating

WARNING: Hot. Do not touch.

or displaying symbol No. 5041 of IEC 60417-1.

The height of the lettering shall be not less than 4 mm.

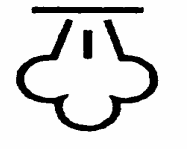
Steam cleaners shall be marked with symbol IEC 60417-5597.

Appliances not intended to be connected to the potable water mains shall be marked with the symbol according to Figure 104. It is acceptable to show this symbol in monochrome colour.

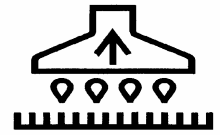
Appliances that can be used indoors and are powered by internal combustion engines, except LPG-powered engines, shall be marked with the symbol according to Figure 105. It is acceptable to show this symbol in monochrome colour.

Add the following subclause:

7.6 *Addition*:



[symbol IEC 60417-5597 (DB:2002-10)] steam



[symbol IEC 60417-5935 (DB:2002-10] motorized cleaning head for water-suction cleaning

7.12 *Addition:*

The cover of the instruction sheet shall carry the following:

WARNING: Do not use the appliance without reading the instruction sheet.

This warning may be replaced by symbol 0434 and symbol 1641 of ISO 7000. In this case the meaning of these symbols shall be explained.

If symbol No. 5041 of IEC 60417-1 is marked on the appliance, its meaning shall be explained.

The instructions shall contain the substance of the following.

– The electric supply connection shall be made by a qualified electrician and comply with IEC 60364-1.

NOTE 101 It is recommended that the electric supply to this appliance should include either a residual current device that will interrupt the supply if the leakage current to earth exceeds 30 mA for 30 ms or a device that will prove the earth circuit.

– WARNING: This appliance has been designed for use with the **cleaning agent** supplied or recommended by the manufacturer. The use of other **cleaning agents** or chemicals may adversely affect the safety of the appliance.

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– WARNING: Do not use the appliance within range of persons unless they wear protective clothing.

– WARNING: High pressure jets can be dangerous if subject to misuse. The jet must not be directed at persons, live electrical equipment or the appliance itself.

– Do not direct the jet against yourself or others in order to clean clothes or foot-wear.

– Disconnect from the electrical power supply before carrying out **user maintenance.**

– High pressure cleaners shall not be used by children or untrained personnel.

– To ensure appliance safety, use only original spare parts from the manufacturer or approved by the manufacturer.

– WARNING: High pressure hoses, fittings and couplings are important for the safety of the appliance. Use only hoses, fittings and couplings recommended by the manufacturer.

– Do not use the appliance if a **supply cord** or important parts of the appliance are damaged, e.g. safety devices, high pressure hoses, **trigger gun.**

– If an extension cord is used, the plug and socket must be of watertight construction.

– WARNING: Inadequate extension cords can be dangerous.

– Where gas or liquid fuel are used the specification of the correct fuel and the following warning:

  - WARNING: Incorrect fuels shall not be used as they may prove hazardous.

– For oil fired appliances without a **primary safety control**, the statement:

  - This appliance must be attended during operation.

– The intended use of the appliance.

– For gas or oil-heated appliances it is important to provide adequate ventilation and make sure that the flue gases are properly discharged.

– Adequate information about the starting/stopping of the appliance and storage.

– For **fixed appliances** intended to be used in a dry independent room, and for steam cleaners intended for indoor use only, the installation instructions shall carry the following notice:

  - Do not splash or wash down.

– Adequate information about the nozzles to be used, the danger of the kickback force and the sudden torque on the spray assembly when opening the **trigger gun.**

– The kickback forces have to be given in the manual if they exceed 20 N.

– The functioning of the safety devices, e.g. **safety valves, flow switches, pressure switches.**

– Adequate information about **user maintenance.**

– Adequate information about malfunction.

– Where provision is made for remote signalling, reference must be made to the wiring installation requirements of the country.

– Adequate information about the connection with the water mains, including the maximum inlet pressure, if not given on the rating plate.

– The A-weighted sound pressure level L_{pA} in dB(A), emitted by the appliance. If the A weighted sound pressure level exceeds 85 dB(A), it shall also state the sound power level L_{WA} in dB(A) and that appropriate ear protection has to be used. The sound level is measured in accordance with IEC 60704-1.

– The weighted r.m.s. acceleration value to which the operators' arms are subjected in m/s², separately for each arm (if applicable). The weighted r.m.s. acceleration value is measured in accordance with ISO 5349 for arm vibrations, the appliance being supplied at **rated voltage** or at the maximum **rated voltage** for machines with a range of voltages.

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Instructions for use for **water jetters** (if applicable) shall be given, such as “Insert hose to red mark before turning on the appliance”.

The instructions for appliances having a current-carrying hose operating at other than **safety extra-low voltage** shall include the substance of the following:

CAUTION: This hose contains electrical connections:

– do not use to collect water;
– do not immerse in water for cleaning;
– the hose should be checked regularly and must not be used if damaged.

If the symbol IEC 60417-5935 is used, its meaning shall be explained.

The instructions shall contain the substance of the following, if applicable.

– WARNING: Do not use combustion engine powered appliances indoors unless adequate ventilation is assessed by national labour authorities.
– WARNING: Ensure that any exhaust emissions are not in the vicinity of air intakes.

For appliances intended to be connected to the potable water mains, the instruction shall contain the substance of the following, if applicable:

– adequate information for the correct connection to the potable water mains;
– necessary length and quality of the water supply hose;
– necessary measures for conversion of the connection from water mains supply to supply from other water sources.

For appliances not intended to be connected to the water mains, the instruction shall contain the substance of the following, if applicable:

– adequate information for the correct connection to the water supply;
– adequate information about suction operation;
– necessary length and quality of the water supply hose;
– necessary measures for conversion of the connection from supply from other water sources to supply from the potable water mains (if applicable).

For all appliances, the instruction shall contain the substance of the following:

– water that has flown through backflow preventers is considered to be non-potable.

7.14 *Addition:*

The height of symbol IEC 60417-5935 shall be at least 15 mm.

Compliance is checked by measurement.

7.101 Motorized cleaning heads shall be marked with

– **rated voltage** or **rated voltage range** in volts;
– **rated power input** in watts;
– name, trade mark or identification mark of the manufacturer or responsible vendor;
– model or type reference.

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Motorized cleaning heads, except those of **class III construction** having a **working voltage** up to 24 V shall be marked with symbol IEC 60417-5935.

NOTE This symbol is an information sign and, except for the colours, the rules of ISO 3864-1 apply.

Compliance is checked by inspection.

7.102 Power outlets for accessories shall be marked with the maximum load in watts.

NOTE This marking may be on the appliance close to the appliance outlet.

Compliance is checked by inspection.

8 Protection against access to live parts

This clause of Part 1 is applicable except as follows.

8.1 *Addition:*

NOTE 101 Water and water-borne **cleaning agents** are considered as being conductive.

8.1.4 *Addition:*

Isolated battery systems of 18 to 24 cells of either acid or alkaline electrochemistry, including gel batteries, shall be regarded as **class III** provided that

– the maximum voltage per cell on charge does not exceed 2,7 V;
– there are no earthed parts;
– conductive parts cannot fall on to and thereby bridge **live parts** of opposite polarity.

9 Starting of motor-operated appliances

This clause of Part 1 is not applicable.

10 Power input and current

This clause of Part 1 is applicable except as follows.

10.1 *Addition:*

The power input of **motorized cleaning heads** is measured separately.

10.101 At **normal operation** the pressure shall not deviate more than ± 10 % from the **rated pressure,** and the **permissible pressure** shall not be exceeded.

NOTE The burner performance is adjusted in accordance with the manufacturer's instructions.

Compliance is checked by measurement.

The **permissible pressure** shall not exceed 1,5 times the **rated pressure**.

11 Heating

This clause of Part 1 is applicable except as follows.

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11.4 *Modification:*

Replace "***Heating appliances***" by "*Electric* ***heating appliances***".

11.7 *Addition:*

Appliances are operated until steady conditions are established.

11.101 The maximum temperature of the flue gases shall not exceed 400 ºC.

The required test observations shall be recorded for any test input for the appliance. After 15 min of operation, samples of the flue gas shall be taken at a point between the flue outlet and the draught hood. Operation is considered to be stable when three consecutive samples taken at 15 min intervals show consistent analysis values.

The amount of smoke in the flue gases shall not exceed,

- for atomising and wall burners, that corresponding to a No. 2 Shell-Bacharach smoke spot;
- for vaporising burners, that corresponding to a No. 2 Shell-Bacharach smoke spot.

The amount of carbon monoxide (CO) in the flue gases shall not exceed 0,04 % (volume) on an air-free and dry basis.

Compliance is checked by measurements under the conditions specified in 11.2 to 11.7.

11.102 Hoses, spray lances and fittings containing the **cleaning agent** shall not exceed the **rated temperature.**

Compliance is checked by measurement under the conditions specified in 11.2 to 11.7.

11.103 The temperature rise of external enclosures that form part of exhausts or ducts from a combustion chamber and the temperature rise of flue gases have no limit.

Adequate protection against unintentional contact with hot metal parts by the user shall be ensured.

The temperature rise of the protection means shall not exceed 60 K.

Compliance is checked by inspection and by measurement under the conditions specified in 11.2 to 11.7.

11.104 Where liquid fuel is used the temperature of the fuel in the tank shall be at a maximum of 10 ºC below the flash-point temperature, if there is a source of ignition in contact with the air/fuel mixture.

Compliance is checked by measurement under the conditions specified in 11.2 to 11.7.

12 Void

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable.

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14 Transient overvoltages

This clause of Part 1 is applicable.

15 Moisture resistance

This clause of Part 1 is applicable except as follows.

15.2 *Replacement:*

Appliances shall be constructed so that spillage of liquid due to **normal operation**, overfilling or overturning of unstable, **hand-guided appliances** and **hand-held appliances** does not affect their electrical insulation.

NOTE 101 An appliance is considered to be unstable if it overturns when a force of 180 N is applied to the top of the appliance in the most unfavourable horizontal direction. The appliance is placed on a support inclined at an angle of 10º to the horizontal, the liquid container being filled to half the level indicated in the instructions for use.

Compliance is checked by the following test.

*Appliances with **type X attachment**, except those having a specially prepared cord, are fitted with the lightest permissible type of flexible cord of the smallest cross-sectional area specified in Table 11.*

***Hand-guided appliances** and **hand-held appliances** and appliances that are unstable are then, with the containers completely filled for the float tank, if any, and with the most conductive detergent recommended by the manufacturer for the detergent tank, if any, and with the cover lid in place, overturned from the most unfavourable of the normal positions of use, and are left in that position for 5 min, unless the appliance returns automatically to its normal position of use.*

Liquid containers that are filled by hand are completely filled with water containing approximately 1% NaCl and a further quantity, equal to 15% of the capacity of the container or 0,25 l, whichever is the greater, is poured in steadily over a period of 1 min.

***Hand-held appliances** and appliances that are unstable are then, with the containers completely filled for the float tank, if any, and with the most conductive detergent recommended by the manufacturer for the detergent tank, if any, and with the cover lid in place, overturned from the most unfavourable of the normal positions of use, and are left in that position for 5 min, unless the appliance returns automatically to its normal position of use.*

***Motorized cleaning heads** are placed in a container, the base of which is level with the surface supporting the appliance. The container is filled with a detergent solution to a level of 5 mm above its base, this level being maintained throughout the test. The solution consists of 20 g of NaCl and 1 ml of a solution of 28 % by mass of dodecyl sodium sulphate in each 8 l of water.*

The appliance is operated until its liquid container is completely full and for a further 5 min.

NOTE 102 The solution is to be stored in a cool atmosphere and used within seven days of its preparation.

NOTE 103 The chemical designation of dodecyl sodium sulphate is $C_{12}H_{25}NaSO_4$.

After each of these tests, the appliance shall withstand the electric strength test of 16.3.

*Inspection shall show that there is no trace of liquid on insulation that could result in a reduction of **clearances** or **creepage distances** below the values specified in Clause 29.*

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15.3 *Modification:*

The relative humidity shall be 93 % ± 6 %.

15.101 Motorized cleaning heads of shall be resistant to liquids that may come into contact with them.

Compliance is checked by the following tests.

*The **motorized cleaning head** is subjected to an impact test as described in IEC 60068-2-75, the value of the impact being 2 J. The **motorized cleaning head** is rigidly supported and three blows are applied to every point of the enclosure that is likely to be weak.*

It is then subjected to the free fall test procedure 1 of IEC 60068-2-32. It is dropped 4 000 times from a height of 100 mm onto a steel plate having a thickness of not less than 15 mm. It is dropped

– *1000 times on its right side;*
– *1000 times on its left side;*
– *1000 times on its front face;*
– *1000 times on its cleaning surface.*

*The **motorized cleaning head** is then subjected to the test described in 14.2.7 of IEC 60529, the water containing approximately 1% NaCl.*

*The **motorized cleaning head** shall then withstand the electric strength test of 16.3 the voltage being applied between the **live parts** and the solution and inspection shall show that there is no trace of saline solution on insulation which could result in a reduction of **clearances** and **creepage distances** below the values specified in Clause 29.*

NOTE The test is not carried out on **motorized cleaning heads** of **class III construction** having a **working voltage** up to 24V.

16 Leakage current and electric strength

This clause of Part 1 is applicable except as follows.

16.3 *Addition:*

Current-carrying hoses, except for their electrical connections, are immersed for 1 h in water containing approximately 1 % NaCl, at a temperature of 20 °C ± 5 °C. While the hose is still immersed, a voltage of 2 000 V is applied for 5 min between each conductor and all the other conductors connected together. A voltage of 3 000 V is then applied for 1 min between all the conductors and the saline solution.

17 Overload protection of transformers and associated circuits

This clause of Part 1 is applicable.

18 Endurance

This clause of Part 1 is applicable except as follows.

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18.101 Appliances shall be constructed so that, in normal use, there will be no electrical or mechanical failure that could impair compliance with this standard. The insulation shall not be damaged and contacts and connections shall not work loose as result of heating, vibration, etc.

Moreover, **overload protective devices** and **safety valves** shall not operate under **normal operation**.

*For **motor-operated appliances,** compliance is checked by the tests of 18.102 and 18.106, and by such of the additional tests of 18.103 to 18.105 as applicable.*

18.102 *The appliance is operated under **normal operation** and at **rated voltage** for 96 h, reduced by the running time necessary for the tests of Clauses 11 and 13.*

Appliances are operated continuously, or for a corresponding number of periods, each period being not less than 8 h.

The specified operating time is the actual running time.

If the appliance incorporates more than one motor, the operating times specified apply to each motor separately.

*The test shall be carried out with a **cleaning agent** that has not been heated.*

All hoses are coiled on concrete during this test.

18.103 *Appliances are started under **normal operation**, 50 times at a voltage equal to 1,1 times **rated voltage** and 50 times at a voltage equal to 0,85 times **rated voltage**, the duration of each period of supply being at least equal to ten times the time necessary from start of full speed, but not less than 10 s.*

An interval sufficient to prevent overheating and at least equal to three times the period of supply is introduced after each running period.

18.104 *Appliances provided with a centrifugal or other automatic starting switch are started 10 000 times under **normal operation** and at a voltage equal to 0,9 times **rated voltage**, the operating cycle being that specified in 18.103.*

Forced cooling may be used, if necessary.

18.105 *Appliances provided with **self-resetting thermal cut-outs** are supplied at a voltage equal to 1,1 times **rated voltage,** under such a load as will cause the **thermal cut-out** to operate within a few minutes until the **thermal cut-out** has performed 200 cycles of operation.*

18.106 *During the tests of 18.102 and 18.103, overload **protective devices** and **safety valves** shall not operate.*

After the tests of 18.102 to 18.105, the appliance shall withstand the tests of Clause 16.

Connections, handles, guards, brush-caps and other fittings or components shall not have worked loose, and there shall be no deterioration impairing safety in normal use.

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19 Abnormal operation

This clause of Part 1 is applicable except as follows.

19.1 *Addition:*

The test of 19.7 is not carried out on the pump motor of three-phase appliances.

19.7 *Addition:*

Motorized cleaning heads *are tested with the rotating brush or similar device locked for 30 s.*

19.11.2 *Addition:*

Contactors complying with the relevant IEC standard are not open-circuited or short-circuited, provided the appropriate standard covers the conditions that occur with the appliance. However, locking in the ON-position of the main contacts of a contactor intended for switching on and off the electrical heating element(s) in normal use is considered to be a fault condition, unless the appliance is provided with at least two sets of contacts connected in series. This condition is, for example, achieved by providing two contactors operating independently of each other or by providing one contactor having two independent armatures operating two independent sets of main contacts.

19.101 For oil-fired and fan-assisted gas-fired appliances the following applies.

When the combustion air supply to an appliance having fan-assisted draught is restricted, the appliance shall continue to operate so as not to create a hazardous condition, shut off the fuel supply or extinguish the flame.

Compliance is checked by applying 11.101 under the test conditions specified in 19.101.1 and 19.101.2.

19.101.1 *The exhaust flue is blocked with a flat metal plate of sufficient area to cover the entire aperture. It is placed in the most disadvantageous way on top of the flue.*

19.101.2 *With the appliance under normal operation, the combustion air intake is restricted. The air intake to the burner assembly is blocked by means of an adequately sized terry-towel introduced with no force whatsoever.*

19.102 For atmospheric gas-fired appliances the following applies.

19.102.1 With the outlet of the draught hood blocked, the concentration of carbon monoxide in an air-free sample of the flue gases shall not exceed 0,04 % when the appliance is tested in an atmosphere having a normal oxygen supply.

The appliance is operated for at least 15 min at normal test pressure. The outlet of the draught hood is then blocked and a sample of the flue gases is secured and analysed.

The concentration of carbon monoxide is measured as specified in 11.101.

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19.102.2 Total downdraught pressures ranging from 0 Pa to 13 Pa imposed at the outlet of the draught hood shall not extinguish the main burner flames nor cause them to flash back, lift, float or burn outside the appliance, nor produce a concentration of carbon monoxide in an air-free sample of the flue gases in excess of 0,04 % when the appliance is tested in an atmosphere having a normal oxygen supply.

Compliance is checked by inspection and by the following test.

The appliance is operated for at least 15 min at normal test pressure. A straight section of flue pipe of suitable diameter and of a length at least equal to ten pipe diameters is attached directly to the outlet of the draught hood and connected to the outlet of a blower. The total draught pressure is measured with a resolution of 1 Pa in the straight section of the flue pipe at a point midway between its ends so that the measuring head is coincident with the axis of the flue pipe.

The draught in the flue pipe is varied from the minimum total pressure to the maximum value specified and the effect noted. A sample of the flue gases is secured and analysed.

The amount of CO in the flue gases shall not exceed 0,04 % (volume) on an air-free and dry basis.

19.102.3 Downdraughts imposed as stated for the main burner shall not extinguish the pilot burner flames nor cause them to flash back when they are operated separately from the main burner(s).

The construction of an appliance equipped with a power burner or operating under forced or induced draught shall be such that its performance is not impaired by chimney draughts or chimney stoppage. This requirement shall be deemed met when the appliance meets the following conditions:

With the flue outlet or outlet of the draught diverting device, if one is provided, blocked to any degree up to and including complete closure, the concentration of carbon monoxide in an air-free sample of the flue gases shall not exceed 0,04 % when the appliance is tested in an atmosphere having a normal oxygen supply.

Should outage occur, raw gas shall not be forced into the combustion chamber on reopening of the flue outlet.

Compliance is checked by inspection and by the following test.

The appliance is operated for at least 15 min at normal test pressure. When the appliance incorporates a control to automatically shut off the main gas supply under blocked flue conditions, the area of the flue outlet is gradually decreased to the lowest point at which the control will remain in its open position. A sample of the flue gases is then taken and analysed.

The amount of CO in the flue gases shall not exceed 0,04 % (volume) on an air-free and dry basis.

19.102.4 Total downdraught pressures ranging from 0 Pa to 13 Pa imposed at the flue outlet or outlet of the draught diverting device, if provided, shall not extinguish the main burner flames nor cause them to flash back, lift, float, burn outside the appliance, nor produce a concentration of carbon monoxide in an air-free sample of the flue gases in excess of 0,04 % when the appliance is tested in an atmosphere having a normal oxygen supply.

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A straight section of flue pipe of suitable diameter and of a length at least equal to 10 pipe diameters is attached directly to the flue outlet or the outlet of the draught diverting device and connected to the outlet of a blower. The total draught pressure is measured with a resolution of 1 Pa in the straight section of flue pipe at a point midway between its ends so that the head of the measuring device is coincident with the axis of the flue pipe.

The total downdraught pressure is adjusted to 13 Pa. The appliance is then operated for at least 15 min. A sample of the flue gases is taken and analysed. The total downdraught pressure is then varied from 0 Pa to 13 Pa and the effect on the main burner flames noted.

Compliance is checked by observation of the flame and the concentration of carbon monoxide is measured as specified in 11.101.

19.103 The appliance shall be able to start with a successful ignition, as far as applicable.

Compliance is checked by the following test.

*The appliance is supplied with 0,75 times its **rated voltage**. Starting the appliance shall not lead to a hazardous condition.*

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.101 Pumps, pipes, hoses, hose connectors, couplers, seals, valves and other components that are likely to carry **cleaning agent**, either directly or in solution shall be designed to withstand any mechanical, chemical or thermal stress that may occur during use at their maximum **rated operating temperatures** under **normal operation.**

Compliance is checked either by the following tests or by furnishing evidence to the testing organisation.

*Hoses, when tested at 85 ºC for 7 days with the normally diluted **cleaning agent,** shall not be damaged. Seals used in the construction of the appliance shall not differ from untested seals when immersed in the normally diluted cleaning liquid at 85 ºC for 7 days and then rinsed in water.*

Metal used in the construction of the parts of the appliance subjected to the pressure shall not be etched, pitted or corroded when immersed in the normally diluted cleaning liquid.

A convenient specimen of metal (e.g. 200 mm x 200 mm x 2 mm) shall have its surface area recorded as dm² then degreased in a solvent such as acetone or toluene, dried and weighed to the nearest 0,1 mg. This specimen shall be immersed in the cleaning solution at 85 ºC for 7 days. At the end of this time it shall be removed, rinsed in water, allowed to dry and the mass change calculated as mg/dm². There shall be no significant signs of corrosion present on the test piece and the mass change shall be within 40 mg/dm².

When testing for the suitability of hoses, seals and metals with the cleaning solution as above, duplicate tests shall be carried out using local potable water only as the test liquid. The results using water only shall be well within the allowed tolerances and will serve as a guide to the corrosiveness, etc. of the cleaning solution used in the test.

20.102 Appliances with **water heaters** shall be protected against overpressure occurring as a result of heat applied to the water or water-borne **cleaning agents**. The appliance shall be equipped with safety devices that do not allow the temperature to exceed the **rated temperature** + 20 K or the **permissible pressure** to be exceeded.

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Compliance is checked by inspection and appropriate tests.

20.103 Oil-heated or gas-heated appliances shall not cause uncontrolled combustion of gas or liquid fuel. They shall have a **primary safety control** unless they are oil-fired, **portable** and unless there is re-ignition during operation by a **continuous ignition** device.

Compliance is checked by inspection.

20.104 Injury due to unintentional closing or slamming of parts, such as movable side walls and covers, shall be prevented.

Wheels or rollers for the transport of appliances heavier than 20 kg shall be located or protected so that injury to the feet of the operator is prevented.

Compliance is checked by inspection, by measurement and by manual test.

21 Mechanical strength

This clause of Part 1 is applicable except as follows.

The impact value is increased to 1,0 J ± 0,04 J.

21.101 Parts subjected to the **rated pressure** of the appliance shall be of sufficient mechanical strength.

Compliance is checked by the following tests in 21.101.1 and 21.101.2.

21.101.1 *The high pressure system is subjected to a static pressure test of two times the **rated pressure** for 5 min at room temperature.*

*The high pressure hose shall be subjected to a static pressure test of four times the **rated pressure** at room temperature, whereby the test pressure shall be reached between 15 and 30 s after starting at zero pressure.*

NOTE It will be necessary to render the pressure relief valve and/or alternative sensing device inoperative.

During this test there shall be no rupture.

21.101.2 *A supply hose, if any, is subjected to a static pressure test of two times the maximum inlet pressure for 5 min at room temperature.*

During this test there shall be no rupture.

21.101.3 A **low pressure accessory** is subjected to a static pressure test of two times the measured pressure in the system, when connected to the most severe high pressure cleaner it is intended to be used with, for 5 min at room temperature.

21.102 Pressure safety devices shall operate reliably.

Compliance is checked by the following test.

The pressure is increased to 110 % of the permissible pressure, or by 1,5 MPa for unheated appliances, and the device shall operate.

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21.103 Hand-held appliances, hand-guided appliances and appliances carried on the operator's body in normal use and spray guns shall be resistant to dropping.

Compliance is checked by the following test.

The appliance and/or the spray gun is dropped from a height of 1 m onto a surface of hydraulically pressed concrete paving slabs.

The test is made five times, the appliance and/or spray gun being in a position such that its major axis is horizontal and so that a different part of the device is exposed to the impact each time.

The appliance or spray gun is then dropped five times, with its major axis vertical, and with the nozzle pointing downwards.

*After this test, the appliance or spray gun shall show no damage to such an extent that compliance with this standard is impaired; in particular, **live parts** shall not have become accessible.*

22 Construction

This clause of Part 1 is applicable except as follows.

22.7 *Addition:*

Any safety device shall be either inaccessible to the user or it shall be evident that the setting of the **safety valve** is sealed and there is no provision for rendering the device inoperative.

Cleaning agent ejected from the **safety valve** shall be directed safely.

22.12 *Addition:*

It shall not be possible to disconnect parts of the high pressure system without **tools** if this results in impairing the safety within the meaning of this standard.

22.35 *Modification:*

Delete the note.

Addition:

These parts are subject to the hammer test of Clause 21. If this insulation does not meet the requirement of 29.3, these are subject to the following impact test.

A sample of the covered part is conditioned at a temperature of 70 °C ± 2 °C for 7 days (168 h). After conditioning, the sample is allowed to attain approximately room temperature.

Inspection shall show that the covering has not shrunk to such an extent that the required insulation is no longer given or that the covering has not peeled off, so that it may move longitudinally.

After this, the sample is maintained for 4 h at a temperature of – 10 °C ± 2 °C.

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While still at this temperature, the sample is then subjected to impact by means of the apparatus shown in Figure 102. The weight "A", having a mass of 0,3 kg, falls from a height of 350 mm onto the chisel "B" of hardened steel, the edge of which is placed on the sample.

One impact is applied to each place where the insulation is likely to be weak or damaged in normal use, the distance between the points of impact being at least 10 mm.

After this test, it shall show that the insulation has not peeled off and an electric strength test as specified in 16.3 is made between metal parts and metal foil wrapped round the insulation in the required area.

22.47 This clause of Part 1 is not applicable.

22.48 This clause of Part 1 is applicable except as follows:

Replace the existing text of the test by:

Compliance is checked by the relevant tests of IEC 61770, as modified in Annex AA of this standard.

22.101 Appliances shall have no opening less than 60 mm from the floor that could admit liquid to **live parts.**

Compliance is checked by measurement.

22.102 A drain hole for condensed water or spillage of any liquid shall have a diameter of not less than 5 mm or an area of not less than 30 mm, the width not being less than 3 mm.

Compliance is checked by measurement.

22.103 The appliance or the **trigger gun** shall be provided with a device for stopping the liquid flow to the nozzle. For hand-held washing devices, steam cleaners and **trigger guns** this device shall operate automatically without hydraulic pressure when its operating means is not actuated by the user.

The operating means of hand-held washing devices, steam cleaners and **trigger guns** shall have a device by means of which it can be locked when the device is in the non-operating condition.

Hand-held washing devices, steam cleaners and **trigger guns** shall not have any locking means in the operating condition.

The operating means shall be positioned so that there is no risk of inadvertent actuation when put down on a flat surface.

Water jetters shall not be operated by a valve lever that projects out from the apparatus in the off-position in such a way that accidental contact would cause inadvertent actuation.

Compliance is checked by inspection and the following test:

*The operating means of the **trigger gun** of a high pressure cleaner or of a hand-held washing device shall be locked in the non-operating condition. The pressure in the fluid system is adjusted to 2,5 MPa. The actuator of the operating means shall then be stressed for 1 min at room temperature with a force of 150 N, applied in the middle of the actuator in the normal direction of operation.*

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During and after the test, there shall be no leakage of water. After the test, the locking device shall still be functional.

NOTE 101 Drainage of water from the nozzle is permissible during the test of the first requirement.

22.104 Appliances, except steam cleaners, provided with a fixed or adjustable **pencil jet nozzle** facility shall have a distance from the trigger to the nozzle greater than 750 mm.

Compliance is checked by measurement.

22.105 Fitments on the high-pressure hoses shall only be accomplished by the manufacturer or his agent using specialist tools.

Water jetters shall have a clearly visible red marking around the high-pressure hose at a distance of 50 cm from the rigid part of the nozzle.

Compliance is checked by inspection and measurement.

22.106 Appliances and their parts shall not have uncontrolled movement to a hazardous degree when used in accordance with the manufacturers' instructions.

Portable appliances having a mass exceeding 100 kg shall have a parking brake or equivalent means.

Compliance is checked by inspection.

22.107 The component of the reaction force of the nozzle in the direction of the spray gun, F_r, shall be limited to 150 N.

F_r is calculated as follows:

$$W = \sqrt{(200 \times \Delta p)}$$

where

W is the water exit velocity, in m/s;

Δp is the rated pressure, in bar.

$$F = \frac{W \times Q}{60}$$

where

F is the reaction force in the direction of the nozzle, in newtons;

Q is the rated flow, in l/min.

$$F_r = F \times \cos(\alpha)$$

where

α is the angle between the nozzle and the spray lance, see Figure 103.

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If the reaction force in the direction of the handle exceeds 150 N, the trigger gun shall be equipped with a support by which the reaction force is completely or partially transferred to the operator's body. Instead of a support, trigger guns can also be equipped with a two-hand activation mechanism that can only be operated when both operating elements are activated at the same time.

Considering the middle of the finger grip as a pivot point, the torque reaction T on the handle shall not be more than 20 Nm in any direction. T is calculated as follows:

$$T = F \times l \times \sin(\alpha)$$

where

l is the distance between nozzle and trigger, in m. See figure 103.

Compliance is checked by calculation and inspection.

22.108 The **trigger gun** and lance shall be provided with two handles. One of the handles could be a suitable shape of the spraying pipe.

Compliance is checked by inspection.

22.109 High pressure cleaners shall be fitted with a switch or contactor in their supply circuit that ensures **all-pole disconnection**.

23 Internal wiring

This clause of Part 1 is applicable.

24 Components

This clause of Part 1 is applicable except as follows.

24.1.2 *Addition:*

The relevant standard for ignition transformers is IEC 61558-2-3.

24.1.3 *Addition:*

The mains disconnecting switch shall be suitable for at least 10 000 operations.

*Switches and mechanical devices operated by the trigger of the **trigger gun** shall be tested for 50 000 operations.*

NOTE 101 After the test, the device should stop the liquid flow to the nozzle immediately. Small leakages are allowed.

24.7 Not applicable.

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25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows.

25.1 *Addition:*

NOTE 101 Three-phase appliances are not required to be provided with a plug.

Appliances classified as IPX7 shall not be provided with an appliance inlet.

Appliances classified as IPX4, IPX5 or IPX6 shall not be provided with an appliance inlet, unless both inlet and connector have the same classification as the appliance when coupled or separated, or unless inlet and connector can only be separated by the use of a **tool** and have the same classification as the appliance when coupled.

Appliances provided with appliance inlets shall also be provided with an appropriate cord set.

25.7 *Addition:*

Supply cords of non-fixed appliances shall not be less than 5 m in length.

However, for **hand-held appliances** and appliances carried on the operator's body the supply cord shall be not less than 15 m.

Ordinary tough rubber sheathed flexible cord shall not be used for this type of appliance due to attack by cleaning agents, hence PVC or polychloroprene-sheathed flexible cords are acceptable for use at temperatures at or above 0 °C.

Only polychloroprene sheathed flexible cords (code designation 60245 IEC 57 or higher) are allowed for use at temperatures below 0 °C. For industrial and commercial use, heavy polychloroprene sheathed flexible cord (code designation 60245 IEC 66 or higher specification) is required.

25.15 *Modification:*

Replace table 12 by the following:

Table 12 – Pull force and torque

Mass of appliance *kg*	***Pull force*** *N*	***Torque*** *Nm*
≤ 1	*30*	*0,1*
>1 and ≤ 4	*60*	*0,25*
> 4	*125*	*0,40*

Addition:

The test is also applied to the cord in the cord set for appliances classified as IPX4 or higher that are provided with an appliance inlet. The cord set is fitted to the appliance inlet prior to the commencement of the test.

25.23 *Addition:*

NOTE 101 There is no limitation on the length of conductors in flexible hoses.

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26 Terminals for external conductors

This clause of Part 1 is applicable.

27 Provision for earthing

This clause of Part 1 is applicable.

28 Screws and connections

This clause of Part 1 is applicable.

29 Clearances, creepage distances and solid insulation

This clause of Part 1 is applicable except as follows.

29.1 *Addition:*

The requirement is not applicable to the air gap between the spark electrodes.

29.2 *Addition:*

The microenvironment is pollution degree 3 unless the insulation is enclosed or located so that it is unlikely to be exposed to pollution due to normal use of the appliance.

30 Resistance to heat and fire

This clause of Part 1 is applicable except as follows.

30.2.3 Not applicable

31 Resistance to rusting

This clause of Part 1 is applicable.

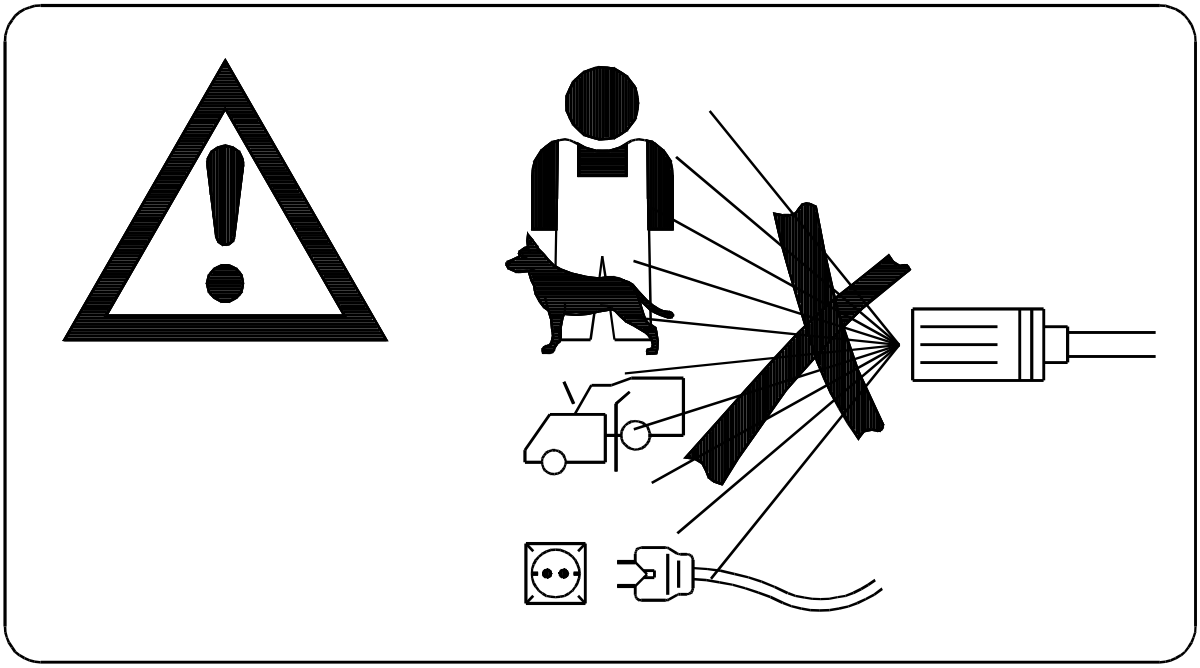
32 Radiation, toxicity and similar hazards

This clause of Part 1 is applicable.

Addition:

NOTE 101 For appliances intended to be connected to the water mains, requirements and test methods are under consideration to check that the appliance is so constructed or provided with a device to prevent backflow of contaminated water from the appliance, should the pressure of the water mains become lower than atmospheric pressure.

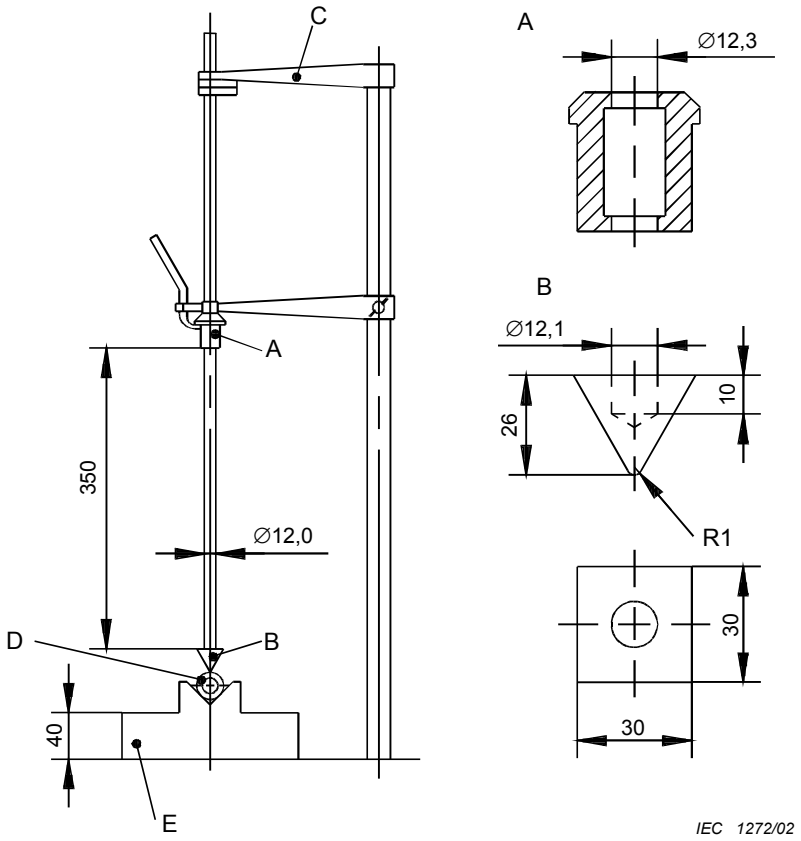
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IEC 1295/02

Figure 101 – Warning symbol

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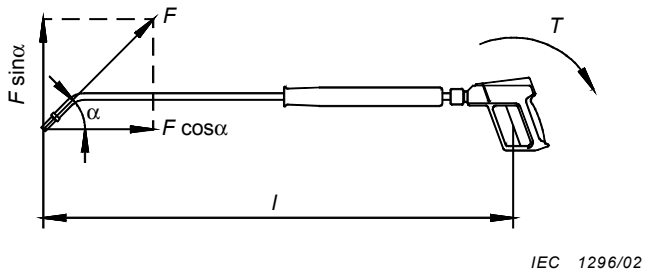
Dimensions in millimeters

Key

A Weight
B Chisel
C Fixing arm
D Sample
E Base having mass of 10 kg

Figure 102 – Impact test apparatus

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$$T = F \times l \times \sin(\alpha)$$

Figure 103 – Reactions on handle

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IEC 1256/07

Figure 104 – Warning symbol: Appliance not suitable for connection to the potable water mains



IEC 1257/07

Figure 105 – Warning symbol: Do not inhale fumes

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Annexes

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Annex AA
(normative)

Requirements to avoid backsiphonage

The requirements of IEC 61770 are applicable except as follows:

1 Scope

Replace the text of this clause by the following new text:

This standard specifies requirements for the connection of high pressure cleaners and steam cleaners to water mains having a water pressure not exceeding 1,2 MPa. These requirements are intended to prevent the backsiphonage of non-potable water into the potable water mains.

NOTE The connection of the appliance to the water mains may be temporary or permanent.

3 Definitions

3.3 *Replace the note by:*

NOTE Examples are airgaps and backflow preventers with reduced pressure zone.

3.4 *Add, after "feed pipe and", the following:*

"…. the maximum or ……"

3.9 *Add the following Note:*

NOTE For three-phase appliances 5 s and for single phase appliances 2 s may be appropriate.

Add the following new definitions:

3.101
backflow preventer with reduced pressure zone
safety device which artificially provides disconnection by the action or the reaction of one or more hydromechanical closing and venting devices activated by pressure differences

3.102
protection point
location in a hydraulic circuit where a safety device is installed

4 General requirements

4.2 *Replace the existing text by:*

Backflow prevention devices shall be incorporated in, or fixed to, the appliance or to the water supply system and constructed so that

– their functional characteristics cannot be changed, even intentionally,
– their selection of the necessary safety level is in compliance with Annex BB.

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4.3 Not applicable.

4.4 Not applicable.

5 General conditions for the tests

5.4 *Replace the text by:*

Tests, except the functional and endurance tests on airgaps and backflow preventers with reduced pressure zone, are made on the appliance, unless this is impracticable. The compliance is then checked by the tests according to Annex A of IEC 61770.

NOTE During the functional and endurance tests, additional samples may be required.

7 Pipe interrupters

This clause of IEC 61770 is not applicable.

8 Dynamic backflow preventers

This clause of IEC 61770 is not applicable.

9 Hose-sets

This clause of IEC 61770 is not applicable.

Add the following new clause:

10 Backflow preventer with reduced pressure zone

10.1 The settings of the action- and difference pressure of the device shall be fixed and not adjustable.

Only the pressure of the water of the supply network can operate the control of the internal components of the device.

Possible additional control devices (electric, pneumatic) shall not adversely affect the backflow protection function.

When installed according to the instructions for use, the drain of the backflow preventer with reduced pressure zone shall point downwards.

The design of the relief valve operation shall be such that when the differential pressure over the upstream check valve is less than 14 kPa (140 mbar), the relief valve shall be open to ensure positive safety.

Any water retention shall not be possible within the reduced pressure zone.

The cross-sections of the passage orifices and of the pilot tube for operation of the relief device shall be equal to or greater than 12,5 mm^2, no dimension for the calculation of the cross-section shall be less than 4 mm.

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An air break to drain shall exist between any waste drain and any means of collecting the discharged water.

The backflow preventer with reduced pressure zone, with an air break to drain fitted, shall evacuate the full relief flow rate without spilling to the outside.

This air break to drain shall be directly incorporated into the backflow preventer with reduced pressure zone.

The relief orifice of the device shall permit neither the fitting of a standardized threaded pipe nor the connection of a standardized pipe or shape, be it by glue, welding or interlocking.

10.2 Verification of the pressure difference between the upstream and the reduced pressure zones

For the following tests, the manufacturer has to provide a special sample having the necessary test ports to verify the function of the backflow preventer with reduced pressure zone.

Test ports have to be provided on the type test sample:

– upstream of the first anti-pollution check valve;
– in the reduced pressure zone;
– downstream of the second anti-pollution check valve.

Compliance is checked as follows (static test):

Record the pressure difference between upstream and reduced pressure zone over the upstream pressure from 0,1 MPa to 1 MPa (1 bar to 10 bar).

The pressure difference between the upstream zone and the reduced pressure zone shall be greater than 14 kPa (140 mbar).

10.3 Verification of the tightness of the downstream check valve (in the closing direction)

Compliance is checked as follows:

Downstream of the backflow preventer with reduced pressure zone, apply a pressure of 1,6 MPa (16 bar) with water at 20 °C, the upstream zone being at atmospheric pressure. The pressure is to be applied in increments of 0,1 MPa (1 bar) per 5 s.

Hold the pressure for 2 min.

Isolate the backflow preventer with reduced pressure zone from the supply system for 10 min.

There shall be no leakage, no permanent deformation or deterioration of the downstream anti-pollution check valve after the test.

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10.4 Verification of the tightness of the upstream check valve at low pressure

Compliance is checked as follows:

Fill the backflow preventer with reduced pressure zone with water so that the water column has a height of (200 ± 50) mm in the tube (diameter inside $10\ ^{0}_{-2}$) mm.

Isolate for 5 min ± 30 s.

Raise the level in the tube to (1 000 ± 50) mm.

Isolate for 5 min ± 30 s.

Raise the level in the tube to (2 000 ± 50) mm.

Isolate for 5 min ± 30 s.

The tightness of the upstream anti-pollution check valve shall be verified by the water level in the tube which shall be constant at each test stage.

No sagging of the water level in the tube is allowed at any of the stages.

10.5 Verification of opening start of the relief valve and of its closing

Compliance is checked as follows:

The following pressures are applied upstream of the device:

0,175 MPa - 0,3 MPa - 0,6 MPa and 1 MPa (1,75 bar – 3 bar – 6 bar and 10 bar).

Each of these pressure values is reduced slowly.

The value of the pressure when the relief valve opens has to be checked.

In each case, the pressure difference between upstream and reduced pressure zone shall be greater than 14 kPa.

After this test, the pressure is increased to its initial value.

The device shall then close again in an absolutely tight manner.

10.6 Durability test

The complete device is conditioned for 72 h in an environment at a temperature of (65 ± 5) °C, and at a relative humidity of (50 ± 5) %.

There shall be no distortion of any part of the device to such an extent that compliance with the standard is impaired.

Without replacement of any component, the device shall be capable of fulfilling the requirements of 10.2 to 10.5.

Compliance is checked as follows:

A test arrangement has to be provided according to Figure AA.1. The device is submitted to 5 000 $^{+50}_{0}$ cycles at a temperature of (65 ± 5) °C.

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Each cycle has to be performed in the following order:

– *Stage 1: open valve 5, then valve 1, circulation at a flow rate as given in Table AA.1 at the value ± 5 % for (6 ± 2) s;*

– *Stage 2: close valve 5, then immediately close valve 1;*

– *Stage 3: open valve 3, static pressure at 0,3 MPa (3 bar) for (6 ± 2) s;*

– *Stage 4: close valve 3, open valve 4. Upstream drain for (6 ± 2) s (opening of the relief valve);*

– *Stage 5: close valve 4;*

– *Stage 6: open valve 5, then immediately open valve 1, circulation at a flow rate as specified in Table AA.1 at the value ± 5 % for (6 ± 2) s;*

– *Stage 7: Close valve 5, then immediately close valve 1;*

– *Stage 8: Open valve 2, static pressure at 1 MPa (10 bar) for (6 ± 2) s;*

– *Stage 9: Close valve 2, open valve 4. Upstream drain (opening of the relief valve) for (6 ± 2) s;*

– *Stage 10: Close valve 4.*

The complete series of test cycles is divided into the following test cycles:

– *1 250 cycles;*

– *the device is at rest for 14 h at ambient temperature;*

– *1 250 cycles;*

– *after this test cycle, the device is stored under a static pressure of 1 MPa (10 bar) for 14 h at room temperature;*

– *1 250 cycles;*

– *after this test cycle, the device is submitted for 14 h to an upstream pressure of 0,3 MPa (3 bar) and to a downstream pressure of 1 MPa (10 bar) at room temperature;*

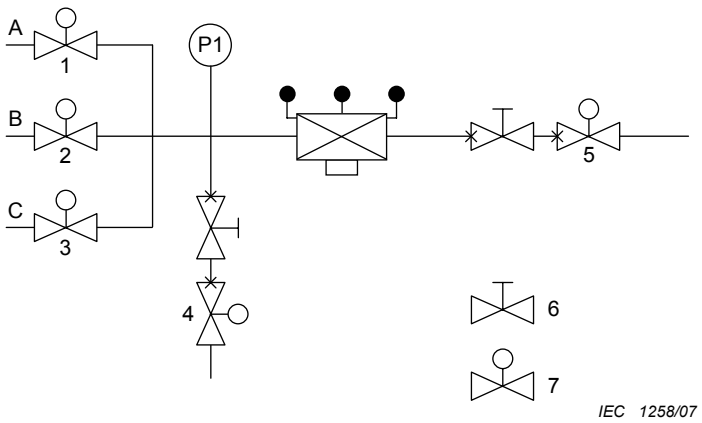
– *1 250 cycles.*

Table AA.1 – Nominal size versus durability test flow rate

Nominal size of check valve DN mm	8	10	15	20	25
Flow rate m^3/h	0,4	0,6	1,3	2,2	3,5

At the end of the test, the device shall be fit for further use. Compliance is checked by the tests of 9.2 to 9.6.

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Key

A	flow rate:	maximum pressure 0,3 MPa (3 bar) at zero-flow rate
B	static pressure:	1 MPa ± 0,05 MPa (10 bar ± 0,5 bar)
C	static pressure:	0,3 MPa ± 0,03 MPa (3 bar ± 0,3 bar)
P1	pressure gauge	
6	regulating valve	
7	valve with time control of opening and closing	

Figure AA.1 – Arrangement for the durability test on backflow preventers with reduced pressure zone

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Annex BB
(normative)

Analysis method for determining the necessary safety device to prevent backsiphonage

BB.1 Overview

The method for determining the necessary safety device to prevent backsiphonage consists of the following steps.

– Ascertain which fluid categories are used in the appliance in accordance with Clause BB.2.

– Ascertain which are the installation characteristics for the safety device to be taken into account in accordance with Clause BB.3.

– Determine the maximum water level.
The result determines if the situation at the point of protection is $p = atm$ or $p > atm$.

– Consider which are the safety devices to be used, by referring to the protection matrix according to Clause BB.4.

– Verify if the drainage systems are fitted with an air break to drain in accordance with Clause BB.5.

BB.2 Determination of fluid categories which are or might be in contact with potable water

BB.2.1 In normal use, fluids which are or may be in contact with potable water are classified in five categories as defined below.

In cases where insignificant concentrations or substantial amounts of substances are present, it may be appropriate to redefine the safety measurement.

High pressure cleaners and steam cleaners according to IEC 60335-2-79 are classified as fluid category 4.

BB.2.2 Category 1

Water to be used for human consumption coming directly from a potable water distribution system.

BB.2.3 Category 2

Fluid presenting no human health hazard.

Fluid recognised as being fit for human consumption, including water taken from a potable water distribution system, which may have undergone a change in taste, odour, colour or a temperature change (heating or cooling).

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BB.2.4 Category 3

Fluid representing some human health hazard due to the presence of one or more harmful substances.

NOTE The border between category 3 and category 4 is in principle LD_{50} = 200 mg/kg body weight. LD_{50} is the quantity of substances or the mixture which, given in one intake through oral and parenteral path, brings about within 15 days (the required time to take into account potential delayed effect) the death of 50 out of 100 treated animals.

BB.2.5 Category 4

Fluid presenting a human health hazard due to the presence of one or more toxic or very toxic substances or one or more radioactive, mutagenic or carcinogenic substances.

BB.2.6 Category 5

Fluid presenting a human health hazard due to the presence of microbiological or viral elements.

BB.3 Determination of installation characteristics – Pressure

For each hydraulic circuit present in the appliance, locate the desired or existing protection point(s) to be protected, or, failing this, the point of connection of the appliance to the potable water main.

Determine the maximum water level.

Define whether the protection point or, failing this, the point of connection of the appliance to the potable water mains is subjected to atmospheric pressure ($p = atm$) or to a pressure exceeding atmospheric pressure ($p > atm$).

– $p = atm$ applies if the protection point or, failing this point, the point of connection of the appliance to the potable water main is located above the maximum water level;
– $p > atm$ applies if the protection point or, failing this point, the point of connection of the appliance to the potable water main is located below this maximum water level.

BB.4 Matrix of the safety devices appropriate to fluid categories

The suitability of each safety device is indicated in Table BB.1.

Table BB.1 – Matrix of the safety devices appropriate to fluid categories

Safety device to prevent backsiphonage	Category of fluids				
	1	2	3	4	5
Air gap	–	●	●	●	●
Backflow preventer with reduced pressure zone	–	●	●	●	

Key:
● Covers the risk
– Protection not required

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BB.5 Air break to drain

All appliances connected to a potable water mains and including a water draining device have to be provided with an air-break before their discharge to the drainage system.

This air gap shall comply with the above described requirements. Otherwise, the fluid in the apparatus has to be considered as fluid category 5.

The air breaks to drain shall be realised by a full disconnection or by air inlets.

Requirements on air breaks to drain:

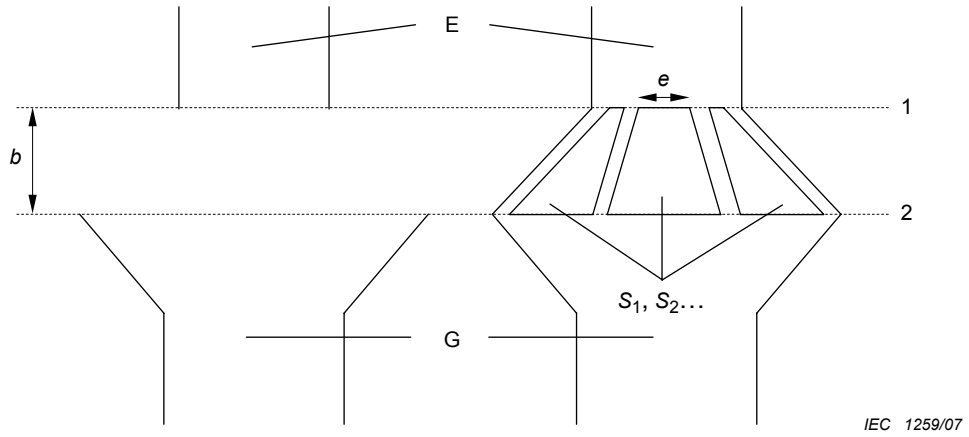
$b \geq G$;

$b \geq 20$ mm;

$G \geq E$ and drain shall be capable of taking the full flow of the discharge $S_1 + S_2 + ... \geq \frac{b \times 2\pi G}{3}$

$e \geq 4$ mm.

An example of an air break to drain is shown in Figure BB.1.



Key

1	outlet evacuation
2	spillover level
Evacuation E:	bore E
Drain G: bore G	
Air inlets :	S_1, S_2, cross-sections for air passage
e	smallest dimension for calculation of a cross-section
b	air gab height

Figure BB.1 – Example for an air break to drain

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Bibliography

The bibliography of Part 1 is applicable except as follows.

Addition:

IEC 60335-2-54, *Household and similar electrical appliances – Safety – Part 2-54: Particular requirements for surface cleaning appliances for household use employing liquids or steam*

ISO 3864-1, *Graphical symbols – Safety colours and safety signs – Part 1: Design principles for safety signs in workplaces and public areas*

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

3, rue de Varembé
P.O. Box 131
CH-1211 Geneva 20
Switzerland

Tel: + 41 22 919 02 11
Fax: + 41 22 919 03 00
info@iec.ch
www.iec.ch

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