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REDLINE VERSION

INTERNATIONAL STANDARD

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

IEC 60335-2-79:2021-06 RLV(en)

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

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

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

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 60335-2-79:2016. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

International Standard IEC 60335-2-79 has been prepared by subcommittee 61J: Electrical motor-operated cleaning appliances for commercial use, of IEC technical committee 61: Safety of household and similar electrical appliances. It is an International Standard.

This fifth edition cancels and replaces the fourth edition published in 2016. It constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition (minor changes are not listed):

– editorial and technical alignment with IEC 60335-1:2020;
– clarification on hand-held and battery-operated high pressure cleaners;
– general editorial improvements.

The text of this International Standard is based on the following documents:

Draft	Report on voting
61J/739/CDV	61J/746A/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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 sixth edition (2020) 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: Particular requirements for high pressure cleaners and steam cleaners.

When a particular sub clause of Part 1 is not mentioned in this part 2, that sub clause 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 sub clause 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.

NOTE 4 The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 12 months or later than 36 months from the date of publication.

A list of all parts of the IEC 60335 series, under the general title: *Household and similar electrical appliances – Safety* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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 and takes into account the way in which electromagnetic phenomena can affect the safe operation of appliances.

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.

When a part 2 standard does not include additional requirements to cover hazards dealt with in Part 1, Part 1 applies.

NOTE 1 This means that the technical committees responsible for the part 2 standards have determined that it is not necessary to specify particular requirements for the appliance in question over and above the general requirements.

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.

NOTE 2 Horizontal and generic standards covering a hazard are not applicable since they have been taken into consideration when developing the general and particular requirements for the IEC 60335 series of standards. For example, in the case of temperature requirements for surfaces on many appliances, generic standards, such as ISO 13732-1 for hot surfaces, are not applicable in addition to Part 1 or part 2 standards.

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.

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 part of IEC 60335 deals with the safety of high-pressure cleaners without traction drive, intended for household and commercial indoor or outdoor use, having a **rated pressure** not less than 2,5 MPa and not exceeding 35 MPa.

It also applies to steam cleaners and those parts of hot water high pressure cleaners incorporating a steam stage which have a capacity not exceeding 100 l, a **rated pressure** not exceeding 2,5 MPa and a product of capacity and **rated pressure** not exceeding 5 MPa·l.

They are not equipped with a traction drive. The following power systems of the drive for the high pressure pump are covered:

– mains powered motors up to a **rated voltage** of 250 V for single-phase machines and 480 V for other machines,
– battery-operated motors,
– internal combustion engines,
– hydraulic or pneumatic motors.

This standard does not apply to

– high pressure water jet machines having a **rated pressure** exceeding 35 MPa;

NOTE 101 In Europe, those machines are covered by EN 1829-1.

– liquid or steam cleaners intended for domestic use (IEC 60335-2-54);
– hand-held and transportable motor-operated electric tools (IEC 60745 series, IEC 61029 series, IEC 62841 series);
– appliances for medical purposes (IEC 60601);
– agricultural sprayers (ISO 4254-6);
– non-liquid, solid abrasive cleaners;
– machines designed to be part of a production process;
– machines designed for use in corrosive or explosive environments (dust, vapour or gas);
– machines designed for use in vehicles or on board of ships or aircraft.

NOTE 102 Attention is drawn to the fact that in many countries additional requirements on the safe use of the equipment covered can be specified by the national health authorities, the national authorities responsible for the protection of labour, the national water supply authorities and similar authorities.

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

IEC 60364-1, *Low-voltage electrical installations – Part 1: Fundamental principles, assessment of general characteristics, definitions*

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

Replacement:

IEC 61770:2008, *Electric appliances connected to the water mains – Avoidance of backsiphonage and failure of hose-sets*

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1.9 ~~*Replacement*~~ *Addition:*
normal operation
conditions under which the machine is operated in normal use

It denotes the operation at **rated flow** and **rated pressure** with the appropriate nozzle and **hose line** fitted, all strainers and filters in a clean operating condition and the **unloader valve** set to the **rated pressure**. The **water heater**, if fitted, is operated at maximum power. Electric motor driven machines are supplied at **rated voltage**.

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

The burner is operated at rated power. Machines designed for operation at more than one rated power setting are additionally tested at the most disadvantageous power.

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

The draught is adjusted as recommended in the instructions.

3.1.12 *Addition:*
Functions not controlling the starting and stopping of the high pressure jet exiting the nozzle are not regarded as remote operation. Functions for other purposes e.g. detergent or water flow control are not considered to be remote operation.

3.5.2 *Addition:*

NOTE 101 to entry: High pressure cleaners are regarded as **hand-held**, if the motor/pump unit and the **trigger gun**/spray lance/nozzle element form a single unit while in operation and being held by hand. High pressure cleaners where the motor/pump unit and the **trigger gun** are separated and connected to each other through a high pressure **hose line** are not regarded as **hand-held**.

3.101
unloader valve
pressure operated device which, when the pump pressure exceeds a preset value, releases the pressure and leads the excess fluid into 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 device which, when the pump or steam cleaner pressure exceeds a preset value, releases the pressure and which may return the excess fluid or steam either to the inlet system or into the atmosphere

3.103
rated pressure
maximum working pressure at the pressure generator during **normal operation**

3.104
allowable pressure
maximum pressure up to which a machine and/or parts of the machine may be subjected without impairing its safety

3.105
rated flow
maximum flow at **rated pressure** at the nozzle during **normal operation**

3.106
maximum flow rate
highest possible flow rate at the nozzle

Note 1 to entry: Typically, the **maximum flow rate** occurs at working pressures lower than **rated pressure** and with a nozzle designed for spraying of **cleaning agents**.

3.107
rated temperature
maximum temperature of the **cleaning agent** during **normal operation**

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
trigger gun
hand-held spraying device where the flow of the **cleaning agent** is regulated by an integrated manually operated control device

3.111
pencil jet nozzle
nozzle that gives a concentrated, parallel water jet

Note 1 to entry: **Pencil jet nozzles** are also known as needle jet nozzles, solid jet nozzles or zero degree jet nozzles.

3.112
water jetter
pipe-cleaning device, connected to and controlled by a **trigger gun**, consisting of a high pressure hose and a cleaning head with nozzles

3.113
cleaning agent
water with or without the addition of gaseous, soluble or miscible detergent or solid abrasive

3.114
water heater
device for heating the **cleaning agent** by means of electricity, gas, liquid fuel or heat exchange

3.115
continuous ignition
ignition of an oil or gas fired burner that is continuously maintained throughout the time the burner is operational, whether the burner is firing or not

3.116
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 1 to entry: **Primary safety controls** are also known as flame failure devices or flame safety controls.

3.117
motorized cleaning head
hand-held or hand-guided cleaning device connected to the machine, with an integrated electrical motor

3.118
low pressure accessory
device, connected to and controlled by a **trigger gun**, with large nozzle openings generating a pressure below **rated pressure**

Note 1 to entry: Typical examples of **low pressure accessories** are washing brushes, foam nozzles, washing sponges.

3.119
hand-guided machine
machine that needs to be moved on the floor

3.120
hose line
assembly of high pressure hoses mounted with appropriate fittings

3.121
guard
part of the machine specifically designed to provide protection by means of a physical barrier, such as a casing, a shield, a cover, a screen, a door, an enclosure or a fence; other parts of the machine that fulfil a primarily operational function, for example, the frame of the machine, may also fulfil a protective function but are not referred to as **guards**

Note 1 to entry: Three main kinds of **guards** can be distinguished: fixed **guards**, interlocking moveable **guards** and adjustable **guards**. Interlocking movable **guards** are required where frequent access is envisaged, while fixed **guards** can be used where frequent access is not envisaged.

3.122
operator
person installing, operating, adjusting, cleaning, moving, or performing **user maintenance** on the machine

3.123
test solution
a solution which 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

Note 1 to entry: The chemical designation of dodecyl sodium sulphate is $C_{12}H_{25}NaSO_4$.

3.124
reaction force
force which reacts on the spraying device (and thereby on the **operator**) as a result of the action force by the water jet leaving the nozzle

Note 1 to entry: The **reaction force** can also be called recoil force. For other standards with regard to hand-arm-vibration, the technical term is feed force (e.g. ISO 28927 series) or push force (e.g. ISO 15230) what describes another force. For high-pressure cleaners, the **reaction force** is the relevant physical dimension.

3.125
commercial use
intended use of machines covered by this standard, i.e. not intended for normal housekeeping purposes by private persons but which may be a source of danger to the public

I.e. in particular that

– the machines may be used by cleaning contractors, cleaning staff, etc.;
– they are used in commercial or public premises (i.e. offices, shops, hotels, hospitals, schools, etc.) or in industrial (plants, etc.) and light industrial (workshops, etc.) environments.

Note 1 to entry: **Commercial use** is also called professional use.

3.126
typical operational mass
mass of the most usual configuration of a machine ready for use including the following, if applicable:

– hose,
– spraying device (lance and gun),
– standard nozzle,
– fuel tank filled to max level, and
– tank for descaling filled to max level,

excluding the following:

– any contents of the hydraulic system (supply- and high pressure hoses, pump, tank for **cleaning agent**),
– any accessory, not required for normal operation (e.g., additional nozzles, foam bottle), and
– **supply cord** with plug

NOTE 1 to entry: **typical operational mass** is also known as **ToM**

4 General requirement

This clause of Part 1 is applicable except as follows.

Replacement of the first paragraph by the following:

Machines shall be constructed so that they function safely so as to cause no danger to persons or surroundings during normal use, even in the event of carelessness, and during installation, adjusting, maintenance, cleaning, repairing or transportation.

Addition:

For the purposes of this standard, the term 'appliance' as used in Part 1 is to be read as 'machine'.

5 General conditions for the tests

This clause of Part 1 is applicable except as follows.

5.101 *The **test solution** shall be stored in a sealed container, in an ambient between 3 °C and 8 °C and used within seven days after its preparation.*

5.102 ***Protective devices** and **safety valves** shall remain fully functional but shall not operate under **normal operation**.*

5.103 *If a requirement is based upon the mass of the appliance, the **typical operational mass** shall be applied.*

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 *Replacement:*

Machines shall be one of the following classes with respect to the protection against electric shock:

– **class I**,
– **class II**, or
– **class III**.

However, **hand-held appliances** and hand-held parts containing electrical components 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 machines shall have a degree of protection against harmful ingress of water according to Table 101.

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	IPX5
	Hand-held parts	II	IPX7
		III	IPX3
High pressure cleaners	**Hand-held appliances**	II-III	IPX7
	Other types of machines	I-II-III	IPX5
	Hand-held parts	II-III	IPX7

However, **fixed appliances** that are specified for installation in a separate 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 *Modification:*

Replace the fourth dashed item as follows:

– the business name and address of the manufacturer and, if applicable, his authorized representative; any address shall be sufficient to ensure postal contact;

Addition:

Machines shall be marked in addition with the following:

– serial number, if any;
– designation of the machine and series or type, allowing the technical identification of the product. This may be achieved by a combination of letters and/or numbers;

NOTE 101 Designation of machine, series or type includes the model or type reference as required in Part 1.

NOTE 102 Prefixes for pressure values according ISO 80000-1, such as MPa, are allowed.

– year of construction, i.e. the year in which the manufacturing process is completed;
– **rated pressure** in pascals;
– **allowable pressure** in pascals;
– **rated flow** in litres per minute;
– **maximum flow rate** in litres per minute, if necessary. The number of flow rate markings is limited to two;
– maximum **rated temperature** where this is above 50 °C;
– maximum power of the **water heater** in kW, if applicable (for electric heaters, the input power, for gas-fired or oil-fired heaters the output power).

Machines equipped with wheels and other mobile machinery shall be marked with the ~~mass of the most usual configuration~~ **ToM** in kg.

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

Machines shall be marked in addition with the following, if applicable:

– 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.

The height of the lettering shall be not less than 4 mm. This wording may be replaced by symbol IEC 60417-5041 (2002-10).

– Steam cleaners shall be marked with symbol IEC 60417-5597 (2014-06).
– Machines not intended to be connected to the potable water mains shall be marked with the symbol according to Figure 104 , coloured as shown or in monochrome colour.
– Machines intended to be used indoors and 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.

7.1.101 All high pressure hoses shall be marked with the following:

– with a pressure of at least the **allowable pressure** in pascals;

NOTE Prefixes for pressure values according ISO 80000-1, such as MPa, are allowed.

– maximum temperature in degrees Celsius;
– business name of the manufacturer of the hose and the date of production. These data may be coded.

Compliance is checked by inspection.

7.1.102 All high pressure accessories (e.g. **trigger gun**, spray lance) shall be marked with the following:

– a pressure of at least the **allowable pressure** in pascals;

NOTE Prefixes for pressure values according ISO 80000-1, such as MPa, are allowed.

– maximum temperature in degrees Celsius.

Compliance is checked by inspection.

7.1.103 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;
– year of construction, i.e. the year in which the manufacturing process is completed;
– mass of the most usual configuration in kg.

Motorized cleaning heads for water-suction cleaning appliances, except those of **class III construction** having a **working voltage** up to 24 V shall be marked with symbol IEC 60417-5935 (2012-09).

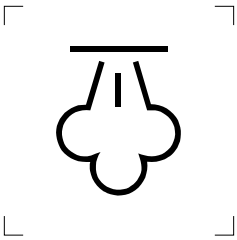
NOTE This symbol is an information sign and, except for the colours, the rules of ISO 3864-1 apply.

Compliance is checked by inspection.

~~**7.1.104** Socket-outlets for accessories shall be marked with the maximum load in watts on the socket-outlet or close to it.~~

~~*Compliance is checked by inspection.*~~

7.6 *Addition:*



[symbol IEC 60417-5597 (2014-06)] steam, low jet

[symbol IEC 60417-5041 (2002-10)] caution, hot surface

7.12 *Modification:*

Replace the fourth paragraph by the following text.

This machine is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge.

Addition:

The front cover of the instructions shall include the substance of the following warning:

CAUTION Read the instructions before using the machine.

This wording may be replaced by symbols ISO 7000-0434A (2004-01) and ISO 7000-0790 (2004-01).

The instructions shall contain at least the following:

– the business name and full address of the manufacturer and, if applicable, his authorized representative;
– designation of the machine and series or type, except for the serial number, allowing the technical identification of the product. This may be achieved by a combination of letters and/or numbers;

NOTE 101 The designation of series or type can be abstracted, as long as the identification of the product is ensured.

– the general description of the machine;
– the intended use of the machine and the auxiliary equipment as covered by the scope of this standard;

NOTE 102 Examples of auxiliary equipment are such as, but not limited to, lights and powered brushes as required by this standard.

NOTE 103 Alternative requirements for instructions in hard copy form are available in 7.12.9.

– the meaning of the symbols used on the machine and in the instructions as required by this standard;

– drawings, diagrams, descriptions and explanations necessary for the safe use, maintenance and repair of the machine and for checking its correct functioning;

~~– technical data including the markings on the machine and the maximum inlet water pressure in Pascal;~~

– information regarding putting into service, safe operation, handling, transportation, and storage of the machine taking into account its ~~weight~~ mass;

– instructions to enable adjustment and maintenance to be carried out safely, including the protective measures that should be taken during these operations;

– the conditions in which the machine meets the requirement of stability during use, transportation, assembly, dismantling when out of service, testing or foreseeable breakdowns;

– the procedure to be followed to prevent unsafe situations in the event of accident (e.g. contact with or spillage of detergents, battery acid, fuel or oil) or equipment breakdown (such as flat tire or component failure).

The instructions shall indicate the type and frequency of inspections and maintenance required for safe operation, including the preventive maintenance measures. They shall, if applicable, give the specifications of the spare parts if they affect the health and safety of the **operator**.

In addition, the instructions shall give the following information, if applicable:

– information about appropriate personnel protection equipment (PPE) for high pressure cleaners in operation, e.g. safety boots, safety gloves, safety helmets with visors, hearing protection etc. which shall be worn while operating the equipment;

– instructions for **water jetters** shall be given, such as “Insert hose ~~to~~ beyond the red mark before turning on the machine to prevent the **operator** being hit by the water jet or debris/sewage”;

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

– adequate information about the nozzles to be used, the danger of the **reaction force** and the sudden torque on the spray assembly when ~~opening~~ operating the **trigger gun**;

– the **reaction forces** if they exceed 20 N;

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

– for battery-operated machines, the precautions to be taken for safe charging;

– information regarding safe disposal of batteries;

– if split rims are used for pneumatic tyres, instructions shall be given for the safe change of tyres;

– for mains operated machines, the substance of the following:

The electric supply connection shall be made by a qualified electrician and comply with IEC 60364-1. It is recommended that the electric supply to this machine 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.

– for oil fired machines without a **primary safety control**, the substance of the following:

This machine must be attended during operation.

– for **fixed appliances** intended to be used in a dry independent room, and for steam cleaners intended for indoor use only, the substance of the following:

Do not splash or wash down.

For machines intended to be connected to the potable water mains, the instructions shall give the following information, 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 supply from the potable water mains to supply from other water sources.

For machines not intended to be connected to the potable water mains, the instructions shall give the following information, 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.

7.12.9 *Add the following text after the second paragraph:*

Instead of hard copy, electronic form can be used if the following conditions are met:

– instructions for unpacking, installation and enabling access to the complete safety instructions on a suitable reading device shall be provided on paper or marked on the machine,
– the suitable reading device shall be provided with the machine or be necessary to operate the machine, and
– the content of the electronic instructions shall be provided with the machine.

For non-safety related functional use, the operational manual may be provided in electronic form either:

– on a suitable electronic display incorporated in the appliance, or
– on a separate electronic device provided with the appliance, or

from a provided link to a website, where they may be viewed and/or downloaded.

7.12.101 The instructions shall include warnings concerning ways in which the machine shall not be used, which in the experience of the manufacturer are likely to occur. At least, they shall include the substance of the following warnings, if applicable.

– WARNING This machine 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 machine.
– WARNING During use of high pressure cleaners, aerosols may be formed. Inhalation of aerosols can be hazardous to health.
– WARNING High pressure jets can be dangerous if subject to misuse. The jet must not be directed at persons, live electrical equipment or the machine itself.
– WARNING Do not use the machine within range of persons unless they wear protective clothing.
– WARNING Do not direct the jet against yourself or others in order to clean clothes or foot-wear.
– WARNING Risk of explosion – Do not spray flammable liquids.
– WARNING High pressure cleaners shall not be used by children or untrained personnel.
– WARNING High pressure hoses, fittings and couplings are important for the safety of the machine. Use only hoses, fittings and couplings recommended by the manufacturer.

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

– WARNING Water that has flowed through backflow preventers is considered to be non-potable.

– A warning that the machine shall be disconnected from its power source during cleaning or maintenance and when replacing parts or converting the machine to another function:

  - for mains operated machines, by removing the plug from the socket-outlet;
  - for battery-operated machines, by safely disconnecting at least the positive or negative terminal of the battery or by an equivalent method (disconnecting device; for non-**SELV** both terminals must be disconnected);
  - for internal combustion engine powered machines, by removing the ignition key and by disconnecting the battery.

NOTE 1 Where no ignition key and no battery exist, the disconnection can be achieved by equivalent means.

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

– WARNING Inadequate extension cords can be dangerous. If an extension cord is used, it shall be suitable for outdoor use, and the connection has to be kept dry and off the ground. It is recommended that this is accomplished by means of a cord reel which keeps the socket at least 60 mm above the ground.

NOTE 2 Extension cords are also called extension cables

– WARNING Do not use combustion engine powered machines indoors unless adequate ventilation is assessed by ~~national~~ a competent person or labour authorities.

– WARNING Ensure that any exhaust emissions are not in the vicinity of air intakes.

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

– WARNING Always switch off the mains disconnecting switch when leaving the machine unattended.

Instructions for machines where gas or liquid fuel are used shall also include the specification of the correct fuel and the substance of the following:

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

Instructions for machines having a current-carrying hose, operating at other **than safety extra-low voltage**, shall also include the substance of the following:

– WARNING This hose contains electrical connections: do not use it to collect water and do not immerse in water for cleaning.

The instructions for machines not intended for commercial use shall include the substance of the following:

– WARNING Depending on the application, shielded nozzles can be used for high pressure cleaning, which will reduce the emission of hydrous aerosols dramatically. However, not all applications allow the use of such a device. If shielded nozzles are not applicable for the protection against aerosols, a respiratory mask of class FFP 2 or equivalent may be needed, depending on the cleaning environment.

The instructions for machines intended for commercial use shall include the substance of the following:

– WARNING The employer shall perform a risk assessment in order to specify the necessary protective measures regarding aerosols, depending on the surface to be cleaned and its environment. Respiratory masks of class

FFP 2, an equivalent or higher are suitable for the protection against hydrous aerosols.

7.12.102 Information on noise

NOTE The instructions can include information on airborne noise emission as indicated in CC.2.7.

7.12.103 Information on vibration

NOTE The instructions can include information on vibration emission as indicated in Clause DD.2.

7.13 *Addition:*

The words “Original instructions” shall appear on the language version(s) verified by the manufacturer.

7.14 *Addition:*

The height of symbol IEC 60417-5935 (2012-09) shall be at least 15 mm.

Compliance is checked by measurement.

8 Protection against access to live parts

This clause of Part 1 is applicable except as follows.

8.1 *Addition:*

Water and water-borne **cleaning agents** are considered conductive.

8.1.1 *Modification:*

Replace, in the second paragraph, “mass” *by* “**ToM**”.

Add the following text after the sixth paragraph:

NOTE Appliances that are for **commercial use** in accordance with this standard are considered not to be installed in an area open to the public.

9 Starting of motor-operated appliances

This clause of Part 1 is replaced by the following.

It shall only be possible to start the machine by intended actuation of a control device provided for the purpose. The same requirement applies when restarting the machine after a stoppage, whatever the cause.

Compliance is checked by inspection and test.

10 Power input and current

This clause of Part 1 is applicable except as follows.

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

Compliance is checked by measurement. During measurement, the heat exchanger, if any, is adjusted to the highest water temperature during high pressure cleaning mode.

NOTE Pressure peaks, detected by a pressure gauge with high sampling rate are being averaged to yield the pressure.

11 Heating

This clause of Part 1 is applicable except as follows.

11.4 *Modification:*

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

11.7 *Addition:*

Machines are operated until steady conditions are established.

11.8 *Addition to Table 3, at the end of footnote a:*

Motors which are hermetically sealed are considered to be airtight.

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

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, taking into account the following:

The required test observations are recorded for any test input for the machine. After 15 min of operation, samples of the flue gas are 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.

11.102 Hoses, spray lances and fittings containing the **cleaning agent** shall withstand at least the **rated temperature**.

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

11.103 Adequate protection against unintentional contact with hot metal parts by the user shall be ensured. The protection means shall be considered as an external enclosure.

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 not exceed a temperature of 10 °C 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~~ Charging of metal-ion batteries

This clause of Part 1 is applicable.

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable.

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:*

All machines shall be constructed so that

– spillage of liquid due to **normal operation**,
– filling including overfilling, and
– overturning of **hand-guided machines**, **hand-held appliances** and unstable machines

does not affect their electrical insulation.

Tanks for the following liquids are excluded from the tests:
– hydraulic oil,
– coolant,
– fuel (diesel, gasoline, LPG).

Compliance is checked by the following test.

The machine is placed on a support inclined at an angle of 10° to the horizontal, the liquid container, if any, is filled to half the level indicated in the instructions. A machine is considered to be unstable if it overturns when a force of 180 N is applied to the top of the machine in the most unfavourable horizontal direction.

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

Liquid containers that are filled by hand are completely filled with a saline solution of water containing approximately 1 % NaCl and 0,6 % rinsing agent 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.

Any commercially available non-ionic rinsing agent may be used, but if there is any doubt with regards to the test results, the rinsing agent shall have the following properties:

- viscosity, 17 mPa s;
- pH 2,2 (1 % in water)
- and its composition shall comprise the following substances

– Plurafac ® LF 221[1]	15,0 % parts by mass
– Cumene sulfonate (40 % solution)	11,5 % parts by mass
– Citric acid (anhydrous)	3,0 % parts by mass
– Deionized water	70,5 % parts by mass

Hand-held appliances *and machines that are unstable are then, with the containers completely filled for the float tank, if any, and with the most conductive detergent 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 machine returns automatically to its normal position of use.*

Motorized cleaning heads *are placed in a tray, the base of which is level with the surface supporting the machine. The tray is filled with the* ***test solution*** *to a level of 5 mm above its base, this level being maintained throughout the test. The machine including the* ***motorized cleaning head*** *is operated until its liquid container is completely full and afterwards for a further 5 min.*

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

There shall be no trace of liquid on insulation that reduces the ***clearances*** *or* ***creepage distances*** *below the values specified in Clause 29.*

15.3 *Modification:*

The relative humidity shall be (93 ± 6) %.

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

The following test is not applicable to **motorized cleaning heads** of **class III construction** having a **working voltage** up to 24 V.

Compliance is checked by the following four 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 60068-2-31. 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

- *1 000 times on its right side;*
- *1 000 times on its left side;*

[1] Plurafac ® LF 221 is the trade name of a product supplied by BASF. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named.

– *1 000 times on its front face;*

– *1 000 times on its cleaning surface.*

*The **motorized cleaning head** is then subjected to the test described in IEC 60529:1989, 14.2.4, as amended by IEC 60529:1989/AMD2:2013 using the **test solution**.*

*The **motorized cleaning head** shall be operated in a flat-bottomed vessel filled with a saline solution of water containing approximately 1 % NaCl so that a depth of 3,0 mm of water is maintained. The vessel is to be a size such that the **motorized cleaning head** moves about freely; and is to be operated with or without connection to the high pressure cleaner for 15 min whichever applicable. The **motorized cleaning head** shall then withstand the electric strength test of 16.3, the voltage being applied between the **live parts** and the **test solution**. There shall be no trace of saline solution on insulation that reduces **clearances** or **creepage distances** below the values specified in Clause 29.*

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 a saline solution of 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.

18.101 The insulation, contacts and connections shall not be damaged and shall not work loose, as result of heating, vibration, etc.

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

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

18.102 *The machine 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.*

The machine is 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 machine 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 **hose lines** are coiled on concrete during this test.*

18.103 *Machines 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 *Machines 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 the **rated voltage**, the operating cycle being that specified in 18.103.*

If the temperature rise of any part of the machine exceeds the temperature rise determined during the test of 11.8, forced cooling or rest periods may be applied, the rest periods being excluded from the specified operating time. If forced cooling is applied, it shall not alter the air flow of the machine or redistribute carbon deposits.

18.105 *Machines provided with **self-resetting thermal cut-outs** shall work reliably under overvoltage conditions.*

Compliance is checked by the following test.

*The machine is supplied at a voltage equal to 1,1 times the **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 *After the tests of 18.102 to 18.105, the machine 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.*

19 Abnormal operation

This clause of Part 1 is applicable except as follows.

19.1 *Addition:*

The test of 19.7 is not applicable to the pump motor of three-phase machines. Machines with appliance outlets complying with the standard sheets in IEC 60320-3 and socket outlets are subjected to the test of 19.104.

19.5 *Modification:*

In the fourth paragraph, delete the following text: "used in a system with polarized plugs intended for connection to polarized socket outlets".

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 shall not be open-circuited or short-circuited, provided the appropriate standard covers the conditions that occur with the machine. 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 machine 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 machines, the following applies.

When the combustion air supply to a machine having fan-assisted draught is partially or completely blocked, the machine shall either continue to operate safely or the fuel supply shall be shut off.

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 machine 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 a force not exceeding 1 N.*

19.102 For atmospheric gas-fired machines, 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 %.

Compliance is checked by inspection and by the following test.

The machine is tested in an atmosphere having a normal oxygen supply. The machine 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 amount of CO in the flue gases shall not exceed 0,04 % (volume) on an air-free and dry basis.

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 machine, nor produce a concentration of carbon monoxide in an air-free sample of the flue gases in excess of 0,04 %.

Compliance is checked by inspection and by the following test.

The machine is tested in an atmosphere having a normal oxygen supply. The machine 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 a machine 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.

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 %.

Compliance is checked by inspection and by the following test.

The machine is tested in an atmosphere having a normal oxygen supply.

The machine is operated for at least 15 min at normal test pressure. When the machine 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.

In case outage occurs, raw gas shall not be forced into the combustion chamber on reopening of the flue outlet.

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 machine, nor produce a concentration of carbon monoxide in an air-free sample of the flue gases in excess of 0,04 %.

Compliance is checked by inspection and by the following test.

The machine is tested in an atmosphere having a normal oxygen supply.

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 machine 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.

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

19.103 The machine shall be able to start with a successful ignition even under undervoltage condition, if applicable.

Compliance is checked by the following test.

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

19.104 *Machines with appliance outlets, complying with the standard sheets in IEC 60320-3 and socket outlets shall be operated under conditions of **normal operation**, except the appliance outlet or socket outlet is loaded with the maximum load corresponding to its configuration in accordance with IEC 60320-3 or IEC TR 60083, respectively. Machines with more than one appliance outlet or socket outlet are tested with each outlet loaded one at the time.*

However, this test is not applied for appliances with appliance outlets or socket outlets

- *intended only to supply accessories supplied with the machine,*
- *inaccessible to the user, or*
- *provided with a **protective device** as specified in 22.61.*

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.1 *Replacement of the first sentence by the following:*

Machines, other than **fixed appliances**, **hand-held appliances** and **hand-guided machines** without a fixed upright parking position of the handle, intended to be used on a surface such as the floor or a table, shall have adequate stability.

20.2 *Add the following text after the second paragraph of the test specification:*

NOTE 101 Appliances according to this standard are not regarded as being intended to be installed in an area open to the public.

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 by the following tests.

*Hoses, when tested at 45 °C for 7 days with the normally diluted **cleaning agent**, shall not be damaged. Seals used in the construction of the machine shall not differ from untested seals when immersed in the normally diluted cleaning liquid at 45 °C for 7 days and then rinsed in water.*

Metal used in the construction of the parts of the machine 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 × 200 mm × 2 mm) shall have its surface area recorded as dm^2 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 45 °C 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/dm^2. There shall be no significant signs of corrosion present on the test piece and the mass change shall be within 40 mg/dm^2.

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

Compliance is checked by inspection and by measurement.

20.103 Oil-heated or gas-heated machines 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 The unintentional closing and lowering of doors, lids, covers etc., which could cause injury, shall be prevented.

Wheels or rollers for the transport of machines 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.

21.1 *Replacement of the first paragraph by the following:*

The machine and its components and fittings shall have adequate mechanical strength and be constructed to withstand such rough handling that may be expected in normal use, during transportation, assembly, dismantling, scrapping and any other action involving the machine.

Modification in the third paragraph:

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

21.101 Parts subjected to the ~~**rated**~~ hydraulic pressure ~~of the machine~~ shall be of sufficient mechanical strength.

Compliance is checked by the following tests in 21.101.1, 21.101.2, and 21.101.3.

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 used externally outside of the high pressure cleaner to connect the **trigger gun** with the high pressure cleaner 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 s and 30 s after starting at zero pressure.*

NOTE 1 It will be necessary to render the pressure relief valve and/or alternative sensing device inoperative.

NOTE 2 This test is related to the high pressure hose, not the high pressure **hose line**. Effects of the fittings can be ignored.

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****, if any, 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****.*

During this test, there shall be no rupture.

21.102 Pressure safety devices shall operate reliably.

Compliance is checked by the following test.

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

21.103 **Hand-held appliances**, **hand-guided machines** and machines 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 machine 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 machine 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 machine or spray gun is then dropped five times, with its major axis vertical, and with the nozzle pointing downwards.

After this test, the machine 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.*

21.104 During **normal operation**, the **allowable pressure** shall not be exceeded.

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

Equipped with the nozzle for highest flow assigned by the manufacturer, the flow rate shall not deviate more than ± 10 % from the **maximum** ~~**rated**~~ **flow rate**.

Compliance is checked by measurement.

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 *Addition:*

The parts are subject to the hammer test of 21.1. 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.

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 during **normal operation**, 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 Not applicable.

22.48 *Replacement of the compliance paragraph by the following:*

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

22.61 *Add the following at the end:*

The **protective device** is not necessary for appliances for which 30.2.2 is applicable, fitted with a supply cord or cord set, having a plug of the identical maximum current rating as the socket-outlet or appliance outlet integrated into the appliance.

22.101 The machine shall be constructed so as to prevent the penetration of objects from the floor, which may impair the safety of the machine.

NOTE This requirement is not applicable to **hand-held appliances** or hand-held accessories (e.g. **trigger guns**).

~~The machine shall have no opening less than 60 mm from the floor that could admit liquid to **live parts**. If applicable, for portable products stable vertical and horizontal positions have to be considered, also taking into account that external hoses are connected or not.~~

The machine, placed in the intended operation position according the user instructions shall have no **live parts** less than 60 mm from the floor that could come to contact with liquid.

Portable appliances having a **ToM** not exceeding 40 kg shall also be positioned in all stable positions as defined by the manufacturer with all necessary hoses and supply cords connected and shall have no **live parts** less than 30 mm from the floor that could come to contact with liquid.

Compliance is checked by inspection and 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^2, the width not being less than 3 mm.

Compliance is checked by measurement.

22.103 The machine 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. It shall not be possible to supply the nozzle with high pressure fluid without having the **trigger gun** or equivalent means in the high pressure system.

NOTE Requirements for electronic devices to control the liquid flow are under consideration.

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 is locked in the non-operating condition. The pressure in the fluid system is adjusted to 2,5 MPa. The actuator of the operating means is then 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.*

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

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

22.104 Machines, 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 The machine and its parts shall not have uncontrolled movement to a hazardous degree when used in accordance with the manufacturer's instructions.

Portable appliances with wheels and having a ~~mass~~ **ToM** 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.

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

where

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

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 Except for battery-operated appliances, high pressure cleaners shall be fitted with a switch or contactor in their supply circuit that ensures **all-pole disconnection**. Except for stationary appliances and for battery-operated appliances, circuits not controlling the motor driving the high pressure pump are acceptable to be directly connected to the supply mains without this switch.

Compliance is checked by inspection.

22.110 The equivalent nozzle diameter of **low pressure accessories** shall not be less than 2 mm.

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

Compliance is checked by inspection and measurement.

22.111 Guards

Fixed **guards** shall be secured by systems that can be opened or removed only with **tools**, and shall be incapable of remaining in place without their fixings, if applicable.

Their fixing systems shall remain attached to the **guards** or to the machine when the **guards** are removed, with the exception of fixing systems that can remain detachable without impairing safety. This does also not apply if, after removal of the fixing systems, or if the component is incorrectly repositioned, the machine becomes inoperative or is obviously incomplete.

NOTE This requirement does not necessarily apply to fixed **guards** that are only liable to be removed, for example, when the machine is completely overhauled, is subject to major repairs or is dismantled for transfer to another site. For the same reason, it is not be necessary to apply the requirement to the casings of machinery intended for use by laymen, where the manufacturer's instructions specify that the repairs requiring removal of these casings are only to be carried out in a specialist repair workshop. In that case, fixing systems can be used that are not easy to remove.

If movable **guards** are interlocked, the interlocking devices shall prevent the start of hazardous machine functions until the **guards** are fixed in their position, and give a stop command whenever they are no longer closed.

Interlocking movable **guards** shall, as far as possible, remain attached to the appliance when open and they shall be designed and constructed in such a way that they can be adjusted only by means of an intentional action.

Interlocking movable **guards** shall be designed in such a way that the absence or failure of one of their components prevents starting or stops the hazardous functions of the appliance.

Adjustable **guards** may be used only to restrict access to those areas of the moving parts strictly necessary for the work. They shall be manually or automatically adjustable based on the type of work involved and shall be adjustable without use of **tools**.

Compliance is checked by inspection.

22.112 The machine shall be designed in such a way as to avoid incorrect mounting, if this can lead to an unsafe situation. If this is not possible, information on the correct mounting shall be given directly on the part and/or the enclosure.

Compliance is checked by inspection.

22.113 For machines where the **operator** is required to use personal protective equipment (PPE), controls shall be designed in such a way that they can be operated safely.

Compliance is checked by inspection and by functional test.

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 cycles of operations.

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

After the test, the device should stop the liquid flow to the nozzle immediately. Small leakages are allowed (e.g. for frost protection purposes).

24.1.4 *Replacement of the last paragraph:*

***Thermal cut-outs** of the capillary type shall comply with the requirements of IEC 60730-2-9:2015 including IEC 60730-2-9:2015/AMD1:2018.*

24.7 Not applicable.

25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows:

25.1 *Addition:*

Three-phase machines are not required to be provided with a plug.

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

Machines 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 machine 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 machine when coupled.

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

25.7 *Addition:*

Supply cords of ~~non-fixed~~ machines other than **stationary machines** shall not be less than 5 m in length~~. However,~~, except that for **hand-held** ~~**appliances**~~ **machines** and machines 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 machine 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:*

Replacement of Table 12 by the following:

Table 12 – Pull force and torque

~~*Mass of machine*~~ *ToM* *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 machines 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.

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. The requirement is not applicable to the distance between high voltage spark electrodes and PE for appliances using galvanic isolated sparking transformers with common earth for generating the sparking voltage.

This requirement is not applicable to the air gap between the 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 machine.

30 Resistance to heat and fire

This clause of Part 1 is applicable except as follows.

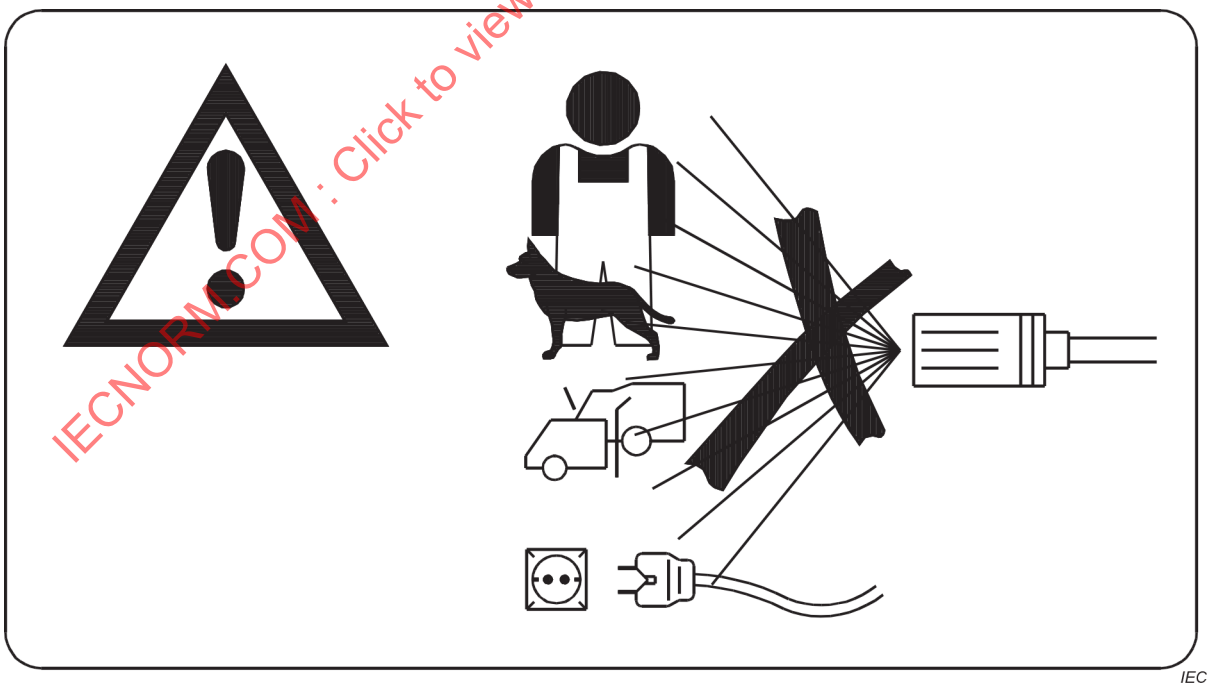
30.2.3 Not applicable.

31 Resistance to rusting

This clause of Part 1 is applicable.

32 Radiation, toxicity and similar hazards

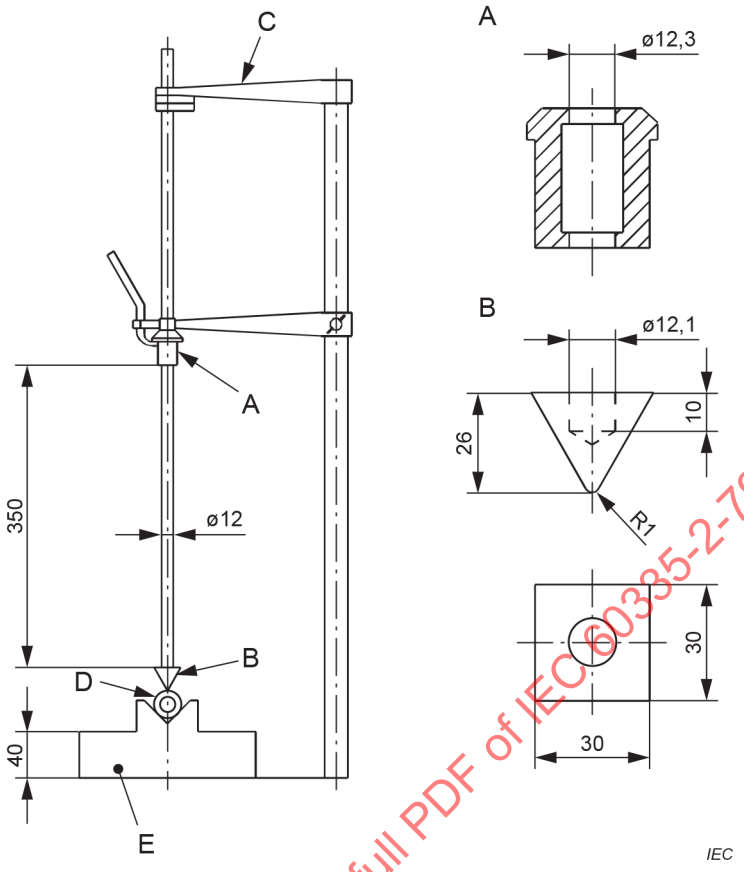
This clause of Part 1 is applicable.



IEC

Figure 101 – Warning symbol

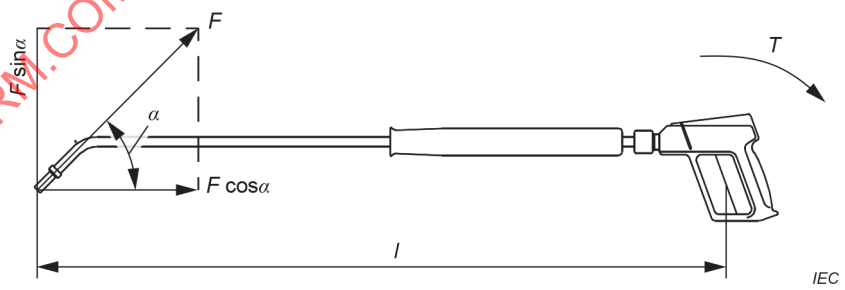
Dimensions in millimetres



Key

A weight
B chisel
C fixing arm
D sample
E base having a mass of 10 kg

Figure 102 – Impact test apparatus



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

Figure 103 – Reactions on handle

IEC

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

IEC

Figure 105 – Warning symbol: Do not inhale fumes

Annexes

The annexes of Part 1 are applicable, except as follows.

~~Annex B~~
~~(normative)~~

~~Appliances powered by rechargeable batteries that are recharged in the appliance~~

~~Annex B of Part 1 is applicable except as follows.~~

~~7 Marking and instructions~~

~~**7.1** *Delete the last paragraph.*~~

~~**7.12** *Replace the last two paragraphs by:*~~

~~For machines intending to be supplied from a **detachable supply unit** or a battery charger for the purposes of recharging the battery, the type reference of the **detachable supply unit** or battery charger shall be stated.~~

~~**7.15** *Delete the last paragraph.*~~

Annex B
(normative)

Battery-operated appliances, separable batteries and detachable batteries for battery-operated appliances

Annex B of Part 1 is applicable except as follows:

6 Classification

Addition:

6.2 **Battery-operated** high pressure cleaners shall be IPX5.

7 Markings and instructions

7.1 *Modification:*

Add at the end of the fourth paragraph (“If appliances use more than one battery,”): "except for machines with hardwired **battery** sets."

19 Abnormal operation

B.19.2 *Addition:*

This subclause is not applicable for machines with hardwired **battery** sets.

22 Construction

B.22.3 *Modification:*

Add the following text after the sixth paragraph of the test specification:

NOTE 101 Appliances according to this standard are not regarded as being intended to be installed in an area open to the public.

NOTE 102 During this test two test probes are applied simultaneously.

B.22.4 *Modification:*

Add the following text after the fifth paragraph of the test specification:

NOTE 101 Appliances according to this standard are not regarded as being intended to be installed in an area open to the public.

NOTE 102 During this test two test probes are applied simultaneously.

Annex S
(normative)

Battery-operated appliances powered by batteries that are non-rechargeable or not recharged in the appliance

Annex S of Part 1 is applicable except as follows.

7 Marking and instructions

7.1 Add to the last sentence at the beginning: "If relevant and".

Delete, after the last sentence, Note 1.

Renumber "Note 2" to "Note".

Delete Figure S.1.

Annex AA
(normative)

Requirements to avoid backsiphonage

The requirements of IEC 61770:2008 are applicable except as follows:

1 Scope

Replace the text of this clause by the following:

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.

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

3 Terms and definitions

3.3 *Replace the Note by:*

NOTE Examples are air gaps 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 1 to entry: For three-phase machines 5 s and for single phase machines, 2 s can be appropriate.

Add the following new definitions:

3.12
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

3.13
protection point
location in a hydraulic circuit where a safety device is installed

4 General requirements

4.2 *Replace the existing text by the following:*

Backflow prevention devices shall be incorporated in, or fixed to, the machine or 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 normative Annex BB.

4.3 Not applicable.

4.4 Not applicable.

5 General conditions for the tests

5.4 *Replace the text by the following:*

Tests, except the functional and endurance tests on airgaps and backflow preventers with reduced pressure zone, are made on the machine, unless this is impracticable. The compliance is then checked by the tests according to Annex A of IEC 61770:2008.

NOTE During the functional and endurance tests, additional samples can 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 General requirements

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.

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.

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.

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;

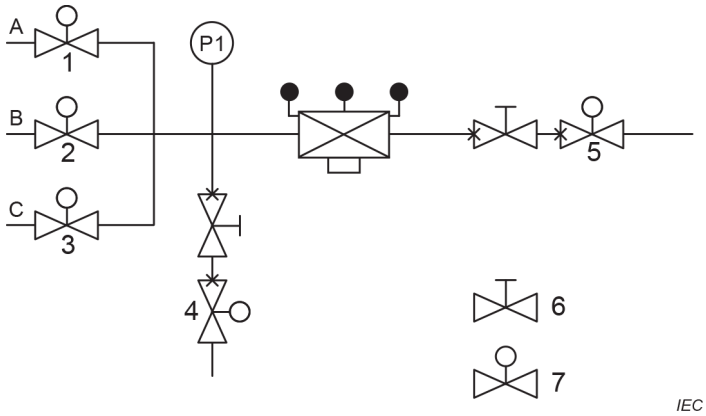
– after this test cycle, the device is submitted for 14 h to an upstream pressure of 0,3 MPa (3 bar) and to a downstream pressure of 1 MPa (10 bar) at **room temperature**;

– 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 10.2 to 10.5.



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

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 machine 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).

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 machine, locate the desired or existing **protection point**(s) to be protected, or, failing this, the point of connection of the machine to the potable water main.

Determine the maximum water level.

Define whether the **protection point** or, failing this, the point of connection of the machine 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 machine 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 machine 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					

BB.5 Air break to drain

All machines 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 realized by a full disconnection or by air inlets.

Requirements on air breaks to drain:

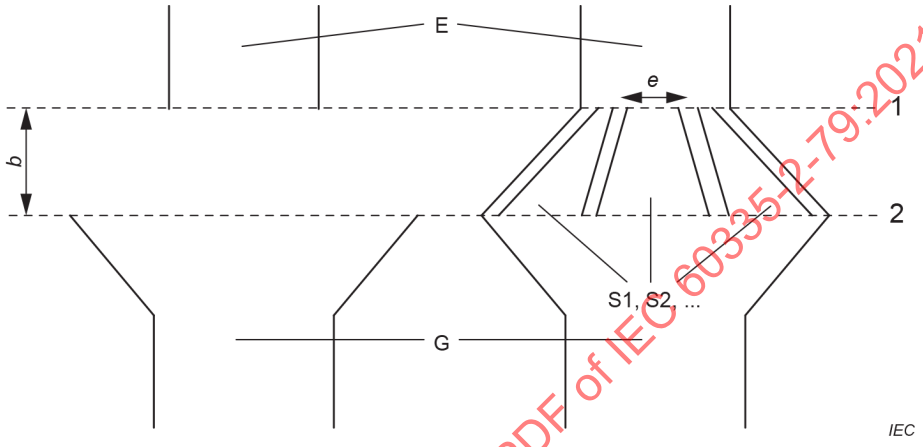
b ≥ G;

b ≥ 20 mm;

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

e ≥ 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:	S1, S2, cross-sections for air passage
e	smallest dimension for calculation of a cross-section
b	air gap height

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

Annex CC
(informative)

Emission of acoustical noise

CC.1 Noise reduction

Noise reduction at high pressure cleaners is an integral part of the design process and shall be achieved by applying measures at source to control noise, see for example ISO/TR 11688-1. The success of the applied noise reduction measures is assessed on the basis of the actual noise emission values in relation to other machines of the same type with comparable non-acoustical technical data. The major sound sources of high pressure cleaners are pumps and burners.

CC.2 Noise test code

CC.2.1 Emission sound pressure level determination

The emission sound pressure level is determined in accordance with ISO 11203, using the method with Q calculated for machines without a specified work station, with the measurement distance d = 1 m.

NOTE In this case, the emission sound pressure level is equal to the surface sound pressure level used for calculating the sound power level according to ISO 3744 when applying a rectangular parallelepiped measurement surface at a distance of 1 m from the reference box.

CC.2.2 Sound power level determination

The sound power level is measured in accordance with ISO 3744, or with ISO 3743-1 if a suitable hard-walled test room is available.

CC.2.3 Operating and mounting conditions

The operating conditions shall be identical for the determination for both sound power and emission sound pressure level at the specified positions.

In addition to **normal operation** in accordance with 3.1.9, the following requirements shall be taken into account.

The high pressure cleaner shall be installed on the reflecting plane; skid-mounted machines shall be placed on a support 0,40 m high, unless otherwise required by the manufacturer's conditions of installation.

The high pressure cleaner is operated under **normal operation**. Immediately before each series of measurement, the machine shall be operated for at least 10 min. The noise emitted by the nozzle and the emission of the water jet hitting any surfaces shall be excluded from measurement.

The period of observation shall be at least 15 s.

CC.2.4 Measurement uncertainties

A standard deviation of reproducibility σ_{RO} of less than 1,5 dB is expected for both the A-weighted emission sound pressure level according to ISO 11203 and the A-weighted sound power level determined according to ISO 3744 or ISO 3743-1.

CC.2.5 Information to be recorded

The information to be recorded covers all of the technical requirements of this noise test code. Any deviations from this noise test code or from the basic standards upon which it is based are to be recorded together with the technical justification for such deviations.

CC.2.6 Information to be reported

The information to be included in the test report is at least that which the manufacturer requires for a noise emission declaration or the user requires to verify the declared values.

CC.2.7 Declaration and verification of noise emission values

The declaration of the emission sound pressure level shall be made as a dual-number noise emission declaration according to ISO 4871, where it exceeds 70 dB(A). Where the emission sound pressure level does not exceed 70 dB(A), this fact may be stated in place of the emission value and uncertainty, e.g. by declaring $L_{pA} \leq 70$ dB(A).

It shall declare the noise emission value L_{pA} and separately the respective uncertainty K_{pA}.

The sound power level shall be given as a single value declaration according to ISO 4871 declaring the sum of L_{WA} and the respective uncertainty K_{WA}, where the emission sound pressure level exceeds 80 dB(A).

NOTE K_{pA} and K_{WA} are expected to be 3 dB.

The noise declaration shall state that the noise emission values have been obtained according to this noise test code. If this statement is not applicable, the noise declaration shall indicate clearly what the deviations from this standard, and from the basic standards, are.

If undertaken, verification shall be conducted according to ISO 4871 by using the same mounting, installation and operating conditions as those used for the initial determination of the noise emission values.

Annex DD
(informative)

Emission of vibration

DD.1 General

Informative Annex DD specifies a laboratory method for measuring hand-transmitted vibration emission at the handles of high-pressure cleaners. It is a type-test procedure for establishing the magnitude of vibration in the gripping areas of a machine run under specified test conditions. It is intended that the results be used to compare different models of the same type of machine.

Figure DD.1 and Figure DD.2 show an example of a typical **trigger gun** (spraying device) covered by this document.

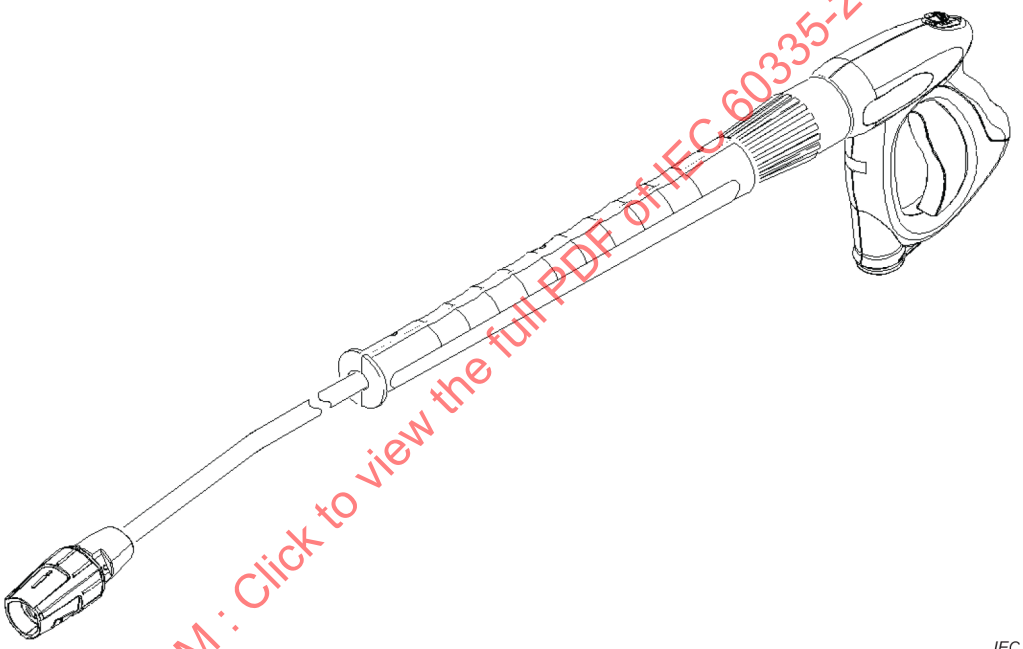


Figure DD.1 – Trigger gun

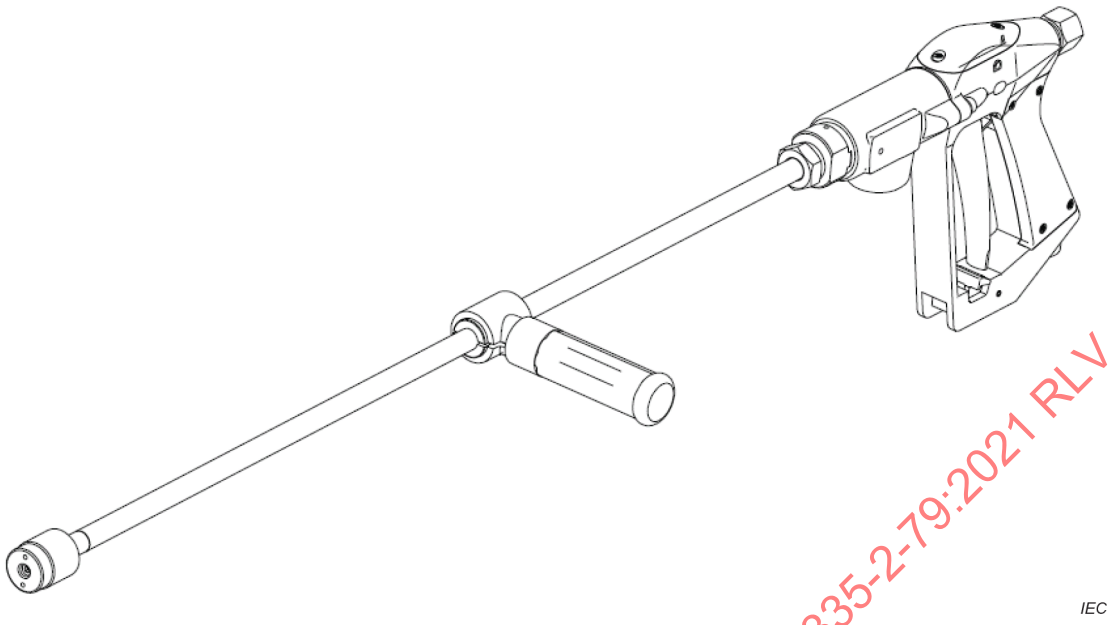


Figure DD.2 – Trigger gun with additional side handle

DD.2 Reduction of vibration

The machine shall be designed and constructed in such a way that risks resulting from vibrations produced by the machine are reduced to the lowest level, taking account of technical progress and the availability of means of reducing vibration, in particular at source.

The handles shall be designed and constructed in such a way as to reduce the vibrations transmitted to the upper limbs of the **operator** to the lowest level that is reasonably possible.

DD.3 Terms, definitions and symbols

For the purposes of this document, the terms and definitions given in ISO 20643 and the symbols given in Table DD.1 apply.

Table DD.1 – Description and units of the symbols used

Symbol	Description	Unit
a_{hw}	root-mean-square (RMS) single-axis acceleration value of the frequency-weighted hand-transmitted vibration	m/s^2
a_{hv}	vibration total value of frequency-weighted RMS acceleration; root sum of squares of a_{hw} values for the three measured axes of vibration	m/s^2
$\overline{a_{hv}}$	arithmetic mean value of a_{hv} values of runs for single **operator** using one hand position	m/s^2
a_h	arithmetic mean value of $\overline{a_{hv}}$ values for all **operators** for one hand position	m/s^2
$\overline{a_h}$	arithmetic mean value of a_h values for one hand position on several machines	m/s^2
a_{hd}	declared vibration emission value	m/s^2
s_{n-1}	standard deviation for a test series (for a sample, *s*)	m/s^2
σ_R	standard deviation of reproducibility (for a population, σ)	m/s^2
C_v	coefficient of variation for a test series	
K	uncertainty	m/s^2

DD.4 Information on vibration emission

The instructions shall give the following information:

– the vibration total value to which the hand-arm system is subjected, measured in accordance with this document, if the vibration total value exceeds 2,5 m/s^2. Where this value does not exceed 2,5 m/s^2, this fact may be stated in place of the emission value and uncertainty, e.g., by declaring $a_h \leq 2{,}5$ m/s^2;

– the uncertainty surrounding this value in accordance with this document.

These values shall be either those actually measured for the machine in question or those established on the basis of measurements taken for a technically comparable machine which is representative of the machine being produced.

Regarding operating conditions during measurement and the methods used for measurement, the reference of the standard applied ~~(IEC 60335-2-79)~~ shall be specified.

DD.5 Characterization of vibration

DD.5.1 Direction of measurement

The vibration transmitted to the hand shall be measured for three directions of an orthogonal coordinate system. The resulting value of the three axes shall be reported. At each hand position, the vibration shall be measured simultaneously in the three directions shown in Figure DD.3 and Figure DD.4.

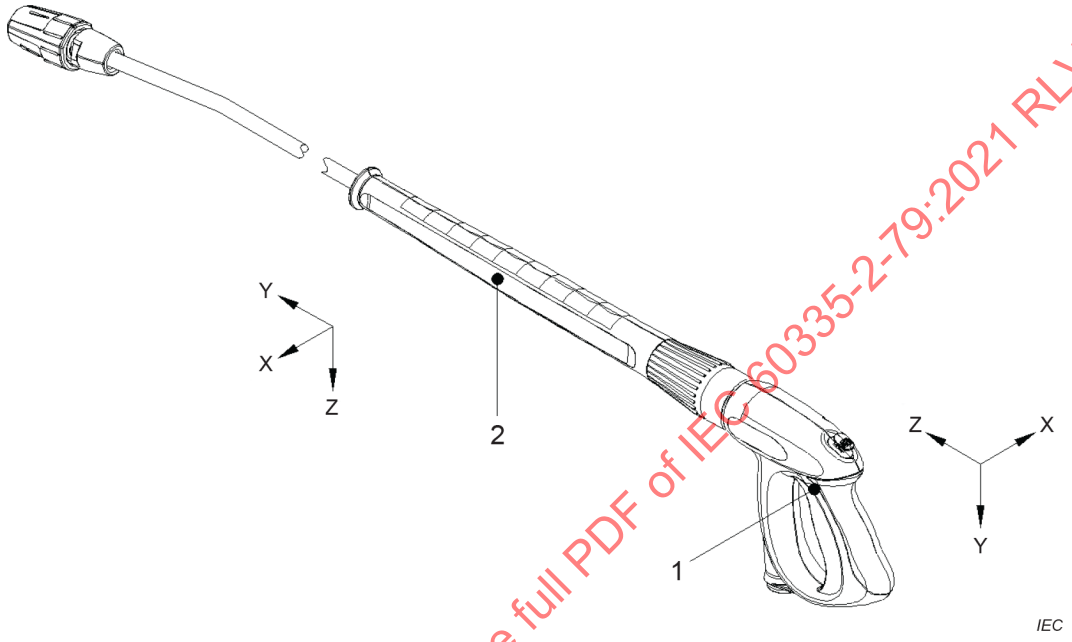
DD.5.2 Location of measurements

Measurements shall be made at the gripping zones, where the **operator** normally holds the machine and applies the **reaction force**.

The prescribed transducer location for the main measuring point shall be as close as possible to the hand between the thumb and index finger, with the **trigger gun** held as in **normal operation**. Figure DD.3 shows this main measuring point for a **trigger gun** at the left side, which may be located also at the right side of the handle. Alternatively, the transducer may be

located at the end of the handle, between the thumb and index finger. The transducer shall be attached to the lance with a maximum distance from the gripping area of 10 mm.

A secondary measuring point is defined as being on the second handle, in the middle of the gripping area (see Figure DD.3). For adjustable second handles (see Figure DD.4), or for **trigger guns** without a certain second handle, the distance between the main measuring point and the second measuring point shall be l = 50 cm ± 5 cm, if applicable. Where not applicable, the maximum distance between transducer one and transducer two has to be chosen.

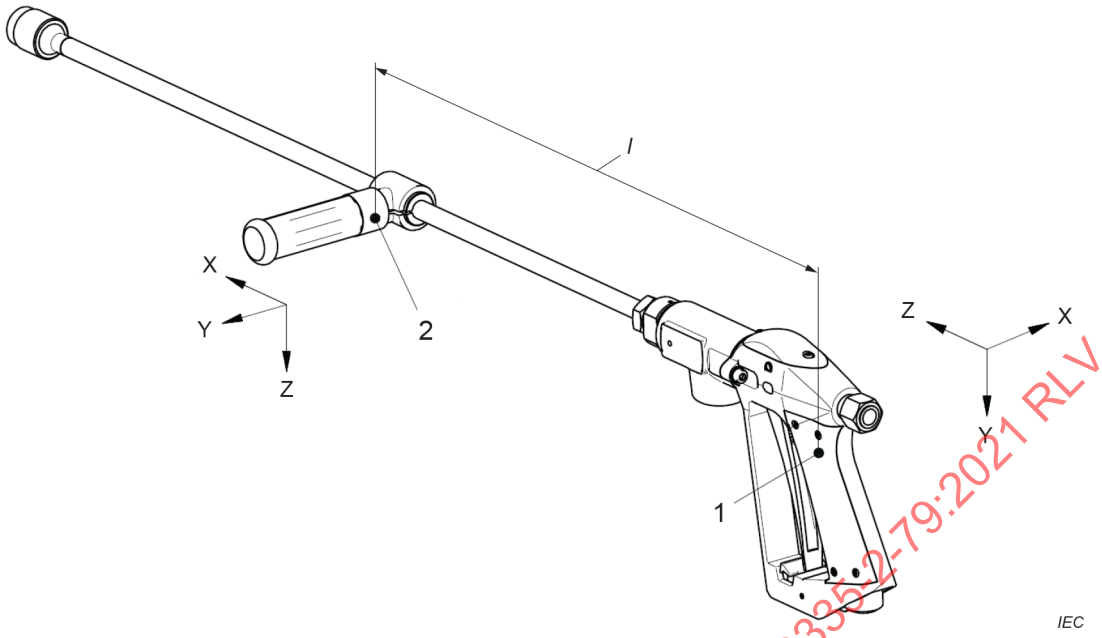


Key

1 main measuring point

2 secondary measuring point

Figure DD.3 – Measurement locations: Trigger gun, main and secondary measuring point



Key

1 main measuring point

2 secondary measuring point

Figure DD.4 – Measurement locations: Trigger gun with additional side handle, main and secondary measuring point

DD.5.3 Magnitude of vibration

The definitions for the magnitude of vibration given in 6.3 of ISO 20643:2005 apply.

DD.5.4 Combination of vibration directions

The vibration total value as defined in 6.4 of ISO 20643:2005 shall be reported for both hand positions. It is acceptable to report on and carry out tests on the hand position having the highest reading, if the vibration total value at that hand position ~~shall be~~ is at least 30 % higher than the other. ~~This~~ A provisional result may be obtained during a ~~preliminary~~ test carried out by a single **operator** during five test runs. This result shall not be used for the purpose of declaring vibration total values.

This result may also be obtained due to experience with comparable machines and nozzles. For machines with rotary nozzles, the test shall be carried out for both hand positions.

NOTE Experience has shown that the vibration value at the main measuring point is typically higher than at the secondary measuring point.

To obtain the vibration total value, a_{hv}, for each test run, the results in each direction shall be combined using Formula (D.1):

$$a_{hv} = \sqrt{a_{hwx}^2 + a_{hwy}^2 + a_{hwz}^2} \quad \text{(D.1)}$$

DD.6 Instrumentation requirements

DD.6.1 General

The instrumentation shall be in accordance with 7.1 of ISO 20643:2005.

DD.6.2 Mounting of transducers

DD.6.2.1 Specification of transducer

The specification of the transducer given in 7.2.1 of ISO 20643:2005 applies. Triaxial transducers shall be used for measurement as far as possible.

DD.6.2.2 Fastening of transducers

The transducer or the mounting block used shall be rigidly attached to the surface of the handle, if applicable.

For the two axes aligned parallel to the vibrating surface, the measurement axes of the two transducer elements in a triaxial transducer shall be at a maximum of 10 mm from the surface.

DD.6.3 Frequency weighting filter

Frequency-weighting shall be in accordance with ISO 5349-1.

DD.6.4 Integration time

The integration time shall be in accordance with 7.4 of ISO 20643:2005. The integration time for each test run shall be at least 16 s, initiating after the starting period.

NOTE The starting period itself is considered to be negligible due to the relation of the duration of the starting and working period.

DD.6.5 Calibration

The specifications for calibration given in 7.6 of ISO 20643:2005 apply.

DD.7 Testing and operating conditions of the machinery

DD.7.1 General

During testing, the machine shall be equipped and held in a manner similar to that when performing a normal work task. A reasonable warming-up period shall be undertaken prior to the start of the test.

DD.7.2 Operating conditions

During testing, the machine shall be operated at **rated voltage**, and shall be used in accordance with **normal operation** as defined in this standard and with the manufacturer's specifications, as far as not otherwise specified in DD.7.2. The operation shall be stable and smooth. In particular, the following conditions shall apply:

NOTE 1 Further requirements are given in DD.8.1 (3 test persons, five test runs) and DD.6.4 (16 s test duration).

– The tests shall be carried out at **normal operation**.

– The **trigger gun** shall be held stationary without any side-to-side motion, without tension, with the axis of the **trigger gun** at a downwards angle of 45° ± 5°, spraying the water jet to the atmosphere ~~without working towards any barrier~~ (see Figure DD.5). Gloves shall not be used unless required as PPE due to manufacturer's instructions.

– The hand position of the second hand (support hand) shall be as shown in Figure DD.5. The hand shall be placed as close as possible next to the transducer. The second hand shall support the **trigger gun** from underneath. If the gripping area is too small to place the transducer in the middle of the gripping area and simultaneously between the thumb and index finger, the transducer shall be placed in the middle of the gripping area, whilst the second hand shall be shifted towards the nozzle. A removable pulsation dampener, if any, shall not be used. If a pulsation dampener is permanently fixed to the machine, this

fact shall be reported. It is recommended that for the test the length of the **hose line** ~~shall be~~ is not be more than 10 m. If the standard length according to the manufacturer's instructions is more than 10 m, the standard hose may be used; in this case the length shall be reported. The type of the **hose line** shall be reported.

– The nominal diameter shall be not more than DN 12. If the standard nominal diameter according to the manufacturer's instructions is more than DN 12, the standard hose may be used; in this case the nominal diameter shall be reported.

NOTE 2 DN 12 is the inner diameter nominal expressed in mm.

– During measurement, the **hose line** shall lie without interference and in particular without touching the **operator**.

Figure DD.5 – Operating conditions – Position of spraying device

DD.7.3 Operators

Three different **operators** shall operate the machine during testing. The vibration measurements are influenced by the **operator**. They should therefore be skilled and able to operate the machine properly i.e. the **operator** shall be experienced in the use of the machine. The gripping force shall be as under long term working conditions and not be excessive.

The **hose line** shall hang loose from the lance with minimum bending forces transferred into the lance.

DD.8 Measurement procedure and validity

DD.8.1 Reported vibration values

Three series of five consecutive tests shall be carried out on each machine tested, using a different **operator** for each series. The values should be reported as in informative Annex EE.

The test shall be carried out for the machine as described in Clause DD.7 and reported for a standard nozzle. If it is necessary to report alternative vibration values, the tests shall be carried out as described in DD.8.2. For nozzles which cause significantly higher vibration

values (e.g. rotary nozzles with a single water jet), these values shall be reported also. If only one value is to be reported, this shall be the higher one.

The coefficient of variation, C_v, and the standard deviation, s_{n-1}, shall be calculated for each hand position for each of the three **operators**. The C_v of a test series is defined as the ratio of s_{n-1} to the mean value of the series:

$$C_v = \frac{s_{n-1}}{a_{hv}} \tag{D.2}$$

with s_{n-1} identical to s_{rec} (see Clause DD.~~10~~9) and where the standard deviation of the ith value, a_{hvi}, is:

$$s_{n-1} = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(a_{hvi} - \overline{a_{hv}})^2} \tag{D.3}$$

where

$\overline{a_{hv}}$ is the mean value of the series in m/s^2;

n is equal to 5, the number of measured values.

If C_v is greater than 0,15 or s_{n-1} is greater than 0,3 m/s^2, then the measurements shall be checked for error before data are accepted.

DD.8.2 Declaration and verification of the vibration emission value

The $\overline{a_{hv}}$ value for each **operator** shall be calculated as the arithmetic mean of a_{hv} values for the five test runs. For each hand position, the result from the three **operators** shall be combined into one value, a_h, using the arithmetic mean of the three $\overline{a_{hv}}$ values.

For tests using only one machine, the declared value, a_{hd}, is the highest of the a_h values reported for the two hand positions.

For tests using three or more machines, $\overline{a_h}$ values for each hand position shall be calculated as the arithmetic mean of the a_h values for the different machines on that hand position. The declared value, a_{hd}, is the highest of the $\overline{a_h}$ values reported for the two hand positions.

Both a_{hd} and the uncertainty, K, shall be presented with a precision determined in accordance with EN 12096. The value of a_{hd} is to be given in m/s^2 and presented by using two and a half significant digits for numbers starting with 1 (e.g., 1,20 m/s^2, 14,5 m/s^2); otherwise, two significant digits are sufficient (e.g., 0,93 m/s^2, 8,9 m/s^2). The value of K shall be presented with the same number of decimals as a_{hd}.

K shall be determined in accordance with EN 12096, based on the standard deviation of reproducibility, σ_R. The value of K shall be calculated in accordance with Clause DD.~~10~~9.

DD.9 Determination of uncertainty

DD.9.1 General

The uncertainty value, *K*, represents the uncertainty of the declared vibration emission value, a_{hd}, and, in the case of batches, production variations of machinery. It is expressed in m/s^2. The sum of a_{hd} and *K* indicates the limit below which the vibration emission value of a single machine, and/or a specified large proportion of the vibration emission values of a batch of machines, are stated to lie when the machines are new.

DD.9.2 Tests on single machines

For tests made on only a single machine, *K* shall be given as

$$K = 1{,}65\sigma_R$$

where σ_R is the standard deviation of reproducibility, estimated by the value s_R, given by

a) $s_R = \sqrt{\overline{s_{rec}}^2 + s_{op}^2}$

or

b) $s_R = 0{,}06\ a_{hd} + 0{,}3$,

whichever is the greater.

NOTE 1 The uncertainty is expected to be at least 0,5 m/s².

NOTE 2 Formula b) is empirical, based on experience giving a lower limit for s_R.

The calculations are performed on the hand position giving the highest value of a_h, where

$\overline{s_{rec}}^2$ is the arithmetic mean value of the standard deviation from the results of five tests, s_{reci}, for **operator** *j*, identical to s_{n-1} according to DD.8.1, and with the $\overline{s_{rec}}^2$ value for each **operator** calculated using

$$s_{rec\,j}^2 = \frac{1}{n-1}\sum_{i=1}^{n}(a_{hvij} - \overline{a_{hvj}})^2$$

where

n is 5, the number of measured values;

a_{hvij} is the vibration total value for the i^{th} test with the j^{th} **operator**;

$\overline{a_{hvj}}$ is the average vibration total value of measurements on the j^{th} **operator**;

s_{op} is the standard deviation of the results from the three **operators**, i.e.

$$s_{op}^2 = \frac{1}{m-1}\sum_{j=1}^{m}(\overline{a_{hvj}} - a_h)^2$$

where

m is three (i.e. the number of **operators**);

$\overline{a_{hvj}}$ is the average vibration value from the j^{th} **operator** (average of five tests);

a_h is the average vibration value from all three **operators**.

NOTE 3 The value of s_R is an estimate of the standard deviation of reproducibility of testing performed at different test centres. Since there is currently no information on reproducibility for the tests defined in this document, the value for s_R is based on the repeatability of the test for individual test subjects and across the different test subjects, according to EN 12096.

DD.9.3 Tests on batches of machines

For tests on three or more machines, the *K* value shall be given as

$$K = 1{,}5\,\sigma_t$$

where σ_t is estimated by the value s_t, given by

$$s_t = \sqrt{\overline{s_R^2} + s_b^2}$$

or

$s_t = 0{,}06 a_{hd} + 0{,}3$,

whichever is the greater.

The calculations are performed on the hand position giving the highest value of $\overline{a_h}$ and where

$\overline{s_R^2}$ is the mean value of s_R^2 for the different machines in the batch, where the s_R value for each machine is calculated using DD.9.2 a), above;

s_b is the standard deviation of the test results for individual machines, i.e.

$$s_b^2 = \frac{1}{p-1}\sum_{l=1}^{p}(a_{hl} - \overline{a_h})^2$$

where

a_{hl} is the single-machine emission for one hand position on the *l*th machine;

$\overline{a_h}$ is the mean value of the single-machine emissions for one hand position;

a_{hd} is the highest of the $\overline{a_h}$ values reported for the two hand positions;

p is the number of machines tested ~~(W 3)~~.

DD.10 Measurement report

The following information shall be given in the test report:

– reference to this document;
– name of the measuring laboratory;
– date of measurement and name of the person responsible for the test;
– specification of the machine (manufacturer, type, serial number, etc.);
– declared emission value a_{hd} and uncertainty *K*;
– type of nozzle, **trigger gun**, and the type, length and nominal bore diameter of the **hose line**;

– energy supply (input voltage etc., as applicable);
– instrumentation (accelerometer, recording system, hardware, software, etc.);
– position and fastening of transducers, measuring directions and individual vibration values;
– operating conditions, and other quantities to be specified according to Clause DD.7;
– detailed results of the test (see informative Annex EE);
– the names of the **operators** together with their height.

If transducer positions or measurements other than those specified in this document are used, they shall be clearly defined and an explanation of the reason for the change in the position of the transducer shall be inserted in the test report.

Annex EE
(informative)

Model test report for vibration emission at handles of high-pressure cleaners

See Table EE.1 and Table EE.2.

Table EE.1 – General information and reported results

The test has been carried out in accordance with …	
Tester:	
Measured by (company/laboratory):	Tested by: Reported by: Date:
Test object and declared value:	
Machine tested (power supply and machine type, type of material used, manufacturer, machine model and name, the type, length and nominal bore diameter of the **hose line**):	Declared vibration emission value a_{hd} and uncertainty K:
Measuring equipment:	
Transducers (manufacturer, type, positioning, fastening method, photos, mechanical filters if used):	
Vibration instrumentation:	Auxiliary equipment:
Operating and test conditions and results:	
Test conditions (test method used, material used for test, type of inserted tool used, operator posture, hand position, photos):	
Power supply (air pressure, hydraulic flow, voltage):	Measured feed force:
Any other quantities to report:	

Table EE.2 – Measurement results for one machine

Date:			Machine type:				Serial number:			
			Main handle (hand position 1)				Support handle (hand position 2)			
Test	Operator	Test run	a_{hv}	Statistics for operator			a_{hv}	Statistics for operator		
				$\overline{a_{hv}}$	s_{n-1}	C_v		$\overline{a_{hv}}$	s_{n-1}	C_v
1	1	1								
2	1	2								
3	1	3								
4	1	4								
5	1	5								
6	2	1								
7	2	2								
8	2	3								
9	2	4								
10	2	5								
11	3	1								
12	3	2								
13	3	3								
14	3	4								
15	3	5								
			a_h for hand position 1:				a_h for hand position 2:			
			s_R for hand position 1:				s_R for hand position 2:			

NOTE The a_{hv} and $\overline{a_{hv}}$ values are calculated according to DD.5.4 and DD.8.2, s_{n-1} and C_v are calculated according to DD.8.1, and s_R is calculated according to Clause DD.9.

Bibliography

The bibliography of Part 1 is applicable except as follows.

Addition:

~~IEC 62841 (all parts), *Electric motor-operated hand-held, transportable tools and lawn and garden machinery – Safety*~~

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 3743-1, *Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for small movable sources in reverberant fields – Part 1: Comparison method for hard-walled test rooms*

ISO 3744, *Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for an essentially free field over a reflecting plane*

ISO 3864-1, *Graphical symbols – Safety colours and safety signs – Part 1: Design principles for safety signs and safety markings*

ISO 4871, *Acoustics – Declaration and verification of noise emission values of machinery and equipment*

ISO 5349-1, *Mechanical vibration – Measurement and evaluation of human exposure to hand-transmitted vibration – Part 1: General requirements*

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

ISO 11203, *Acoustics – Noise emitted by machinery and equipment – Determination of emission sound pressure levels at a work station and at other specified positions from the sound power level*

ISO/TR 11688-1, *Acoustics – Recommended practice for the design of low-noise machinery and equipment – Part 1: Planning*

ISO 80000-1, *Quantities and units – Part 1: General*

ISO 15230, *Mechanical vibration and shock – Coupling forces at the man-machine interface for hand-transmitted vibration*

ISO 20643:2005, *Mechanical vibration – Hand-held or hand-guided machinery – Principles for evaluation of vibration emission*

ISO 28927 (all parts), *Hand-held portable power tools – Test methods for evaluation of vibration emission*

ISO 4254-6, *Agricultural machinery – Safety – Part 6: Sprayers and liquid fertilizer distributors*

EN 1829-1, *High pressure water jet machines – Safety requirements – Part 1: Machines*

EN 12096:1997, *Mechanical vibration – Declaration and verification of vibration emission values*

Index of defined terms

IEC 60335-2-79

Edition 5.0 2021-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

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

Appareils électrodomestiques et analogues – Sécurité – Partie 2-79: Exigences particulières pour les appareils de nettoyage à haute pression et les appareils de nettoyage à vapeur

IEC 60335-2-79:2021-06(en-fr)

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

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

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 60335-2-79 has been prepared by subcommittee 61J: Electrical motor-operated cleaning appliances for commercial use, of IEC technical committee 61: Safety of household and similar electrical appliances. It is an International Standard.

This fifth edition cancels and replaces the fourth edition published in 2016. It constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition (minor changes are not listed):

– editorial and technical alignment with IEC 60335-1:2020;
– clarification on hand-held and battery-operated high pressure cleaners;
– general editorial improvements.

The text of this International Standard is based on the following documents:

Draft	Report on voting
61J/739/CDV	61J/746A/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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 sixth edition (2020) 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: Particular requirements for high pressure cleaners and steam cleaners.

When a particular sub clause of Part 1 is not mentioned in this part 2, that sub clause 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 sub clause 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.

NOTE 4 The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 12 months or later than 36 months from the date of publication.

A list of all parts of the IEC 60335 series, under the general title: *Household and similar electrical appliances – Safety* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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 and takes into account the way in which electromagnetic phenomena can affect the safe operation of appliances.

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.

When a part 2 standard does not include additional requirements to cover hazards dealt with in Part 1, Part 1 applies.

NOTE 1 This means that the technical committees responsible for the part 2 standards have determined that it is not necessary to specify particular requirements for the appliance in question over and above the general requirements.

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.

NOTE 2 Horizontal and generic standards covering a hazard are not applicable since they have been taken into consideration when developing the general and particular requirements for the IEC 60335 series of standards. For example, in the case of temperature requirements for surfaces on many appliances, generic standards, such as ISO 13732-1 for hot surfaces, are not applicable in addition to Part 1 or part 2 standards.

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.

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 part of IEC 60335 deals with the safety of high-pressure cleaners without traction drive, intended for household and commercial indoor or outdoor use, having a **rated pressure** not less than 2,5 MPa and not exceeding 35 MPa.

It also applies to steam cleaners and those parts of hot water high pressure cleaners incorporating a steam stage which have a capacity not exceeding 100 l, a **rated pressure** not exceeding 2,5 MPa and a product of capacity and **rated pressure** not exceeding 5 MPa·l.

They are not equipped with a traction drive. The following power systems of the drive for the high pressure pump are covered:

– mains powered motors up to a **rated voltage** of 250 V for single-phase machines and 480 V for other machines,
– battery-operated motors,
– internal combustion engines,
– hydraulic or pneumatic motors.

This standard does not apply to

– high pressure water jet machines having a **rated pressure** exceeding 35 MPa;

NOTE 101 In Europe, those machines are covered by EN 1829-1.

– liquid or steam cleaners intended for domestic use (IEC 60335-2-54);
– hand-held and transportable motor-operated electric tools (IEC 60745 series, IEC 61029 series, IEC 62841 series);
– appliances for medical purposes (IEC 60601);
– agricultural sprayers (ISO 4254-6);
– non-liquid, solid abrasive cleaners;
– machines designed to be part of a production process;
– machines designed for use in corrosive or explosive environments (dust, vapour or gas);
– machines designed for use in vehicles or on board of ships or aircraft.

NOTE 102 Attention is drawn to the fact that in many countries additional requirements on the safe use of the equipment covered can be specified by the national health authorities, the national authorities responsible for the protection of labour, the national water supply authorities and similar authorities.

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

IEC 60364-1, *Low-voltage electrical installations – Part 1: Fundamental principles, assessment of general characteristics, definitions*

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

Replacement:

IEC 61770:2008, *Electric appliances connected to the water mains – Avoidance of backsiphonage and failure of hose-sets*

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1.9 *Addition:*
normal operation
conditions under which the machine is operated in normal use

It denotes the operation at **rated flow** and **rated pressure** with the appropriate nozzle and **hose line** fitted, all strainers and filters in a clean operating condition and the **unloader valve** set to the **rated pressure**. The **water heater**, if fitted, is operated at maximum power. Electric motor driven machines are supplied at **rated voltage**.

The burner is operated at rated power. Machines designed for operation at more than one rated power setting are additionally tested at the most disadvantageous power.

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

The draught is adjusted as recommended in the instructions.

3.1.12 *Addition:*
Functions not controlling the starting and stopping of the high pressure jet exiting the nozzle are not regarded as remote operation. Functions for other purposes e.g. detergent or water flow control are not considered to be remote operation.

3.5.2 *Addition:*

NOTE 101 to entry: High pressure cleaners are regarded as **hand-held**, if the motor/pump unit and the **trigger gun**/spray lance/nozzle element form a single unit while in operation and being held by hand. High pressure cleaners where the motor/pump unit and the **trigger gun** are separated and connected to each other through a high pressure **hose line** are not regarded as **hand-held**.

3.101
unloader valve
pressure operated device which, when the pump pressure exceeds a preset value, releases the pressure and leads the excess fluid into 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 device which, when the pump or steam cleaner pressure exceeds a preset value, releases the pressure and which may return the excess fluid or steam either to the inlet system or into the atmosphere

3.103
rated pressure
maximum working pressure at the pressure generator during **normal operation**

3.104
allowable pressure
maximum pressure up to which a machine and/or parts of the machine may be subjected without impairing its safety

3.105
rated flow
maximum flow at **rated pressure** at the nozzle during **normal operation**

3.106
maximum flow rate
highest possible flow rate at the nozzle

Note 1 to entry: Typically, the **maximum flow rate** occurs at working pressures lower than **rated pressure** and with a nozzle designed for spraying of **cleaning agents**.

3.107
rated temperature
maximum temperature of the **cleaning agent** during **normal operation**

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
trigger gun
hand-held spraying device where the flow of the **cleaning agent** is regulated by an integrated manually operated control device

3.111
pencil jet nozzle
nozzle that gives a concentrated, parallel water jet

Note 1 to entry: **Pencil jet nozzles** are also known as needle jet nozzles, solid jet nozzles or zero degree jet nozzles.

3.112
water jetter
pipe-cleaning device, connected to and controlled by a **trigger gun**, consisting of a high pressure hose and a cleaning head with nozzles

3.113
cleaning agent
water with or without the addition of gaseous, soluble or miscible detergent or solid abrasive

3.114
water heater
device for heating the **cleaning agent** by means of electricity, gas, liquid fuel or heat exchange

3.115
continuous ignition
ignition of an oil or gas fired burner that is continuously maintained throughout the time the burner is operational, whether the burner is firing or not

3.116
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 1 to entry: **Primary safety controls** are also known as flame failure devices or flame safety controls.

3.117
motorized cleaning head
hand-held or hand-guided cleaning device connected to the machine, with an integrated electrical motor

3.118
low pressure accessory
device, connected to and controlled by a **trigger gun**, with large nozzle openings generating a pressure below **rated pressure**

Note 1 to entry: Typical examples of **low pressure accessories** are washing brushes, foam nozzles, washing sponges.

3.119
hand-guided machine
machine that needs to be moved on the floor

3.120
hose line
assembly of high pressure hoses mounted with appropriate fittings

3.121
guard
part of the machine specifically designed to provide protection by means of a physical barrier, such as a casing, a shield, a cover, a screen, a door, an enclosure or a fence; other parts of the machine that fulfil a primarily operational function, for example, the frame of the machine, may also fulfil a protective function but are not referred to as **guards**

Note 1 to entry: Three main kinds of **guards** can be distinguished: fixed **guards**, interlocking moveable **guards** and adjustable **guards**. Interlocking movable **guards** are required where frequent access is envisaged, while fixed **guards** can be used where frequent access is not envisaged.

3.122
operator
person installing, operating, adjusting, cleaning, moving, or performing **user maintenance** on the machine

3.123
test solution
a solution which 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

Note 1 to entry: The chemical designation of dodecyl sodium sulphate is $C_{12}H_{25}NaSO_4$.

3.124
reaction force
force which reacts on the spraying device (and thereby on the **operator**) as a result of the action force by the water jet leaving the nozzle

Note 1 to entry: The **reaction force** can also be called recoil force. For other standards with regard to hand-arm-vibration, the technical term is feed force (e.g. ISO 28927 series) or push force (e.g. ISO 15230) what describes another force. For high-pressure cleaners, the **reaction force** is the relevant physical dimension.

3.125
commercial use
intended use of machines covered by this standard, i.e. not intended for normal housekeeping purposes by private persons but which may be a source of danger to the public

I.e. in particular that

– the machines may be used by cleaning contractors, cleaning staff, etc.;
– they are used in commercial or public premises (i.e. offices, shops, hotels, hospitals, schools, etc.) or in industrial (plants, etc.) and light industrial (workshops, etc.) environments.

Note 1 to entry: **Commercial use** is also called professional use.

3.126
typical operational mass
mass of the most usual configuration of a machine ready for use including the following, if applicable:

– hose,
– spraying device (lance and gun),
– standard nozzle,
– fuel tank filled to max level, and
– tank for descaling filled to max level,

excluding the following:

– any contents of the hydraulic system (supply- and high pressure hoses, pump, tank for **cleaning agent**),
– any accessory, not required for normal operation (e.g., additional nozzles, foam bottle), and
– **supply cord** with plug

NOTE 1 to entry: **typical operational mass** is also known as **ToM**

4 General requirement

This clause of Part 1 is applicable except as follows.

Replacement of the first paragraph by the following:

Machines shall be constructed so that they function safely so as to cause no danger to persons or surroundings during normal use, even in the event of carelessness, and during installation, adjusting, maintenance, cleaning, repairing or transportation.

Addition:

For the purposes of this standard, the term ‘appliance’ as used in Part 1 is to be read as ‘machine’.

5 General conditions for the tests

This clause of Part 1 is applicable except as follows.

5.101 *The **test solution** shall be stored in a sealed container, in an ambient between 3 °C and 8 °C and used within seven days after its preparation.*

5.102 ***Protective devices** and **safety valves** shall remain fully functional but shall not operate under **normal operation**.*

5.103 *If a requirement is based upon the mass of the appliance, the **typical operational mass** shall be applied.*

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 *Replacement:*

Machines shall be one of the following classes with respect to the protection against electric shock:

– **class I**,
– **class II**, or
– **class III**.

However, **hand-held appliances** and hand-held parts containing electrical components 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 machines shall have a degree of protection against harmful ingress of water according to Table 101:

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	IPX5
	Hand-held parts	II	IPX7
		III	IPX3
High pressure cleaners	**Hand-held appliances**	II-III	IPX7
	Other types of machines	I-II-III	IPX5
	Hand-held parts	II-III	IPX7

However, **fixed appliances** that are specified for installation in a separate 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 *Modification:*

Replace the fourth dashed item as follows:

– the business name and address of the manufacturer and, if applicable, his authorized representative; any address shall be sufficient to ensure postal contact;

Addition:

Machines shall be marked in addition with the following:

– serial number, if any;

– designation of the machine and series or type, allowing the technical identification of the product. This may be achieved by a combination of letters and/or numbers;

NOTE 101 Designation of machine, series or type includes the model or type reference as required in Part 1.

NOTE 102 Prefixes for pressure values according ISO 80000-1, such as MPa, are allowed.

– year of construction, i.e. the year in which the manufacturing process is completed;

– **rated pressure** in pascals;

– **allowable pressure** in pascals;

– **rated flow** in litres per minute;

– **maximum flow rate** in litres per minute, if necessary. The number of flow rate markings is limited to two;

– maximum **rated temperature** where this is above 50 °C;

– maximum power of the **water heater** in kW, if applicable (for electric heaters, the input power, for gas-fired or oil-fired heaters the output power).

Machines equipped with wheels and other mobile machinery shall be marked with the **ToM** in kg.

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

Machines shall be marked in addition with the following, if applicable:

– 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.

The height of the lettering shall be not less than 4 mm. This wording may be replaced by symbol IEC 60417-5041 (2002-10).

– Steam cleaners shall be marked with symbol IEC 60417-5597 (2014-06).

– Machines not intended to be connected to the potable water mains shall be marked with the symbol according to Figure 104 , coloured as shown or in monochrome colour.

– Machines intended to be used indoors and 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.

7.1.101 All high pressure hoses shall be marked with the following:

– with a pressure of at least the **allowable pressure** in pascals;

NOTE Prefixes for pressure values according ISO 80000-1, such as MPa, are allowed.

– maximum temperature in degrees Celsius;
– business name of the manufacturer of the hose and the date of production. These data may be coded.

Compliance is checked by inspection.

7.1.102 All high pressure accessories (e.g. **trigger gun**, spray lance) shall be marked with the following:

– a pressure of at least the **allowable pressure** in pascals;

NOTE Prefixes for pressure values according ISO 80000-1, such as MPa, are allowed.

– maximum temperature in degrees Celsius.

Compliance is checked by inspection.

7.1.103 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;
– year of construction, i.e. the year in which the manufacturing process is completed;
– mass of the most usual configuration in kg.

Motorized cleaning heads for water-suction cleaning appliances, except those of **class III construction** having a **working voltage** up to 24 V shall be marked with symbol IEC 60417-5935 (2012-09).

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

Compliance is checked by inspection.

7.6 *Addition:*

[symbol IEC 60417-5597 (2014-06)] steam, low jet

[symbol IEC 60417-5041 (2002-10)] caution, hot surface

7.12 *Modification:*

Replace the fourth paragraph by the following text.

This machine is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge.

Addition:

The front cover of the instructions shall include the substance of the following warning:

CAUTION Read the instructions before using the machine.

This wording may be replaced by symbols ISO 7000-0434A (2004-01) and ISO 7000-0790 (2004-01).

The instructions shall contain at least the following:

– the business name and full address of the manufacturer and, if applicable, his authorized representative;
– designation of the machine and series or type, except for the serial number, allowing the technical identification of the product. This may be achieved by a combination of letters and/or numbers;

NOTE 101 The designation of series or type can be abstracted, as long as the identification of the product is ensured.

– the general description of the machine;
– the intended use of the machine and the auxiliary equipment as covered by the scope of this standard;

NOTE 102 Examples of auxiliary equipment are such as, but not limited to, lights and powered brushes as required by this standard.

NOTE 103 Alternative requirements for instructions in hard copy form are available in 7.12.9.

– the meaning of the symbols used on the machine and in the instructions as required by this standard;
– drawings, diagrams, descriptions and explanations necessary for the safe use, maintenance and repair of the machine and for checking its correct functioning;
– information regarding putting into service, safe operation, handling, transportation, and storage of the machine taking into account its mass;
– instructions to enable adjustment and maintenance to be carried out safely, including the protective measures that should be taken during these operations;
– the conditions in which the machine meets the requirement of stability during use, transportation, assembly, dismantling when out of service, testing or foreseeable breakdowns;
– the procedure to be followed to prevent unsafe situations in the event of accident (e.g. contact with or spillage of detergents, battery acid, fuel or oil) or equipment breakdown (such as flat tire or component failure).

The instructions shall indicate the type and frequency of inspections and maintenance required for safe operation, including the preventive maintenance measures. They shall, if applicable, give the specifications of the spare parts if they affect the health and safety of the **operator**.

In addition, the instructions shall give the following information, if applicable:

– information about appropriate personnel protection equipment (PPE) for high pressure cleaners in operation, e.g. safety boots, safety gloves, safety helmets with visors, hearing protection etc. which shall be worn while operating the equipment;

– instructions for **water jetters** shall be given, such as “Insert hose beyond the red mark before turning on the machine to prevent the **operator** being hit by the water jet or debris/sewage”;

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

– adequate information about the nozzles to be used, the danger of the **reaction force** and the sudden torque on the spray assembly when operating the **trigger gun**;

– the **reaction forces** if they exceed 20 N;

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

– for battery-operated machines, the precautions to be taken for safe charging;

– information regarding safe disposal of batteries;

– if split rims are used for pneumatic tyres, instructions shall be given for the safe change of tyres;

– for mains operated machines, the substance of the following:

  The electric supply connection shall be made by a qualified electrician and comply with IEC 60364-1. It is recommended that the electric supply to this machine 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.

– for oil fired machines without a **primary safety control**, the substance of the following:

  This machine must be attended during operation.

– for **fixed appliances** intended to be used in a dry independent room, and for steam cleaners intended for indoor use only, the substance of the following:

  Do not splash or wash down.

For machines intended to be connected to the potable water mains, the instructions shall give the following information, 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 supply from the potable water mains to supply from other water sources.

For machines not intended to be connected to the potable water mains, the instructions shall give the following information, 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.

7.12.9 *Add the following text after the second paragraph:*

Instead of hard copy, electronic form can be used if the following conditions are met:

– instructions for unpacking, installation and enabling access to the complete safety instructions on a suitable reading device shall be provided on paper or marked on the machine,

– the suitable reading device shall be provided with the machine or be necessary to operate the machine, and

– the content of the electronic instructions shall be provided with the machine.

For non-safety related functional use, the operational manual may be provided in electronic form either:

– on a suitable electronic display incorporated in the appliance, or

– on a separate electronic device provided with the appliance, or

from a provided link to a website, where they may be viewed and/or downloaded.

7.12.101 The instructions shall include warnings concerning ways in which the machine shall not be used, which in the experience of the manufacturer are likely to occur. At least, they shall include the substance of the following warnings, if applicable.

– WARNING This machine 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 machine.

– WARNING During use of high pressure cleaners, aerosols may be formed. Inhalation of aerosols can be hazardous to health.

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

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

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

– WARNING Risk of explosion – Do not spray flammable liquids.

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

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

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

– WARNING Water that has flowed through backflow preventers is considered to be non-potable.

– A warning that the machine shall be disconnected from its power source during cleaning or maintenance and when replacing parts or converting the machine to another function:

  - for mains operated machines, by removing the plug from the socket-outlet;
  - for battery-operated machines, by safely disconnecting at least the positive or negative terminal of the battery or by an equivalent method (disconnecting device; for non-**SELV** both terminals must be disconnected);
  - for internal combustion engine powered machines, by removing the ignition key and by disconnecting the battery.

NOTE 1 Where no ignition key and no battery exist, the disconnection can be achieved by equivalent means.

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

– WARNING Inadequate extension cords can be dangerous. If an extension cord is used, it shall be suitable for outdoor use, and the connection has to be kept dry and off the ground. It is recommended that this is accomplished by means of a cord reel which keeps the socket at least 60 mm above the ground.

NOTE 2 Extension cords are also called extension cables

– WARNING Do not use combustion engine powered machines indoors unless adequate ventilation is assessed by a competent person or labour authorities.

– WARNING Ensure that any exhaust emissions are not in the vicinity of air intakes.

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

– WARNING Always switch off the mains disconnecting switch when leaving the machine unattended.

Instructions for machines where gas or liquid fuel are used shall also include the specification of the correct fuel and the substance of the following:

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

Instructions for machines having a current-carrying hose, operating at other **than safety extra-low voltage**, shall also include the substance of the following:

– WARNING This hose contains electrical connections: do not use it to collect water and do not immerse in water for cleaning.

The instructions for machines not intended for commercial use shall include the substance of the following:

– WARNING Depending on the application, shielded nozzles can be used for high pressure cleaning, which will reduce the emission of hydrous aerosols dramatically. However, not all applications allow the use of such a device. If shielded nozzles are not applicable for the protection against aerosols, a respiratory mask of class FFP 2 or equivalent may be needed, depending on the cleaning environment.

The instructions for machines intended for commercial use shall include the substance of the following:

– WARNING The employer shall perform a risk assessment in order to specify the necessary protective measures regarding aerosols, depending on the surface to be cleaned and its environment. Respiratory masks of class FFP 2, an equivalent or higher are suitable for the protection against hydrous aerosols.

7.12.102 Information on noise

NOTE The instructions can include information on airborne noise emission as indicated in CC.2.7.

7.12.103 Information on vibration

NOTE The instructions can include information on vibration emission as indicated in Clause DD.2.

7.13 *Addition:*

The words “Original instructions” shall appear on the language version(s) verified by the manufacturer.

7.14 *Addition:*

The height of symbol IEC 60417-5935 (2012-09) shall be at least 15 mm.

Compliance is checked by measurement.

8 Protection against access to live parts

This clause of Part 1 is applicable except as follows.

8.1 *Addition:*

Water and water-borne **cleaning agents** are considered conductive.

8.1.1 *Modification:*

Replace, in the second paragraph, "mass" *by* "**ToM**".

Add the following text after the sixth paragraph:

NOTE Appliances that are for **commercial use** in accordance with this standard are considered not to be installed in an area open to the public.

9 Starting of motor-operated appliances

This clause of Part 1 is replaced by the following.

It shall only be possible to start the machine by intended actuation of a control device provided for the purpose. The same requirement applies when restarting the machine after a stoppage, whatever the cause.

Compliance is checked by inspection and test.

10 Power input and current

This clause of Part 1 is applicable except as follows.

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

Compliance is checked by measurement. During measurement, the heat exchanger, if any, is adjusted to the highest water temperature during high pressure cleaning mode.

NOTE Pressure peaks, detected by a pressure gauge with high sampling rate are being averaged to yield the pressure.

11 Heating

This clause of Part 1 is applicable except as follows.

11.4 *Modification:*

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

11.7 *Addition:*

Machines are operated until steady conditions are established.

11.8 *Addition to Table 3, at the end of footnote a:*

Motors which are hermetically sealed are considered to be airtight.

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

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, taking into account the following:

The required test observations are recorded for any test input for the machine. After 15 min of operation, samples of the flue gas are 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.

11.102 Hoses, spray lances and fittings containing the **cleaning agent** shall withstand at least the **rated temperature**.

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

11.103 Adequate protection against unintentional contact with hot metal parts by the user shall be ensured. The protection means shall be considered as an external enclosure.

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 not exceed a temperature of 10 °C 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 Charging of metal-ion batteries

This clause of Part 1 is applicable.

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable.

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:*

All machines shall be constructed so that

– spillage of liquid due to **normal operation**,
– filling including overfilling, and
– overturning of **hand-guided machines**, **hand-held appliances** and unstable machines

does not affect their electrical insulation.

Tanks for the following liquids are excluded from the tests:
– hydraulic oil,
– coolant,
– fuel (diesel, gasoline, LPG).

Compliance is checked by the following test.

The machine is placed on a support inclined at an angle of 10° to the horizontal, the liquid container, if any, is filled to half the level indicated in the instructions. A machine is considered to be unstable if it overturns when a force of 180 N is applied to the top of the machine in the most unfavourable horizontal direction.

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

Liquid containers that are filled by hand are completely filled with a saline solution of water containing approximately 1 % NaCl and 0,6 % rinsing agent 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.

Any commercially available non-ionic rinsing agent may be used, but if there is any doubt with regards to the test results, the rinsing agent shall have the following properties:

– viscosity, 17 mPa s;
– pH 2,2 (1 % in water)
– and its composition shall comprise the following substances

– Plurafac ® LF 221[1]	15,0 % parts by mass
– Cumene sulfonate (40 % solution)	11,5 % parts by mass
– Citric acid (anhydrous)	3,0 % parts by mass
– Deionized water	70,5 % parts by mass

***Hand-held appliances** and machines that are unstable are then, with the containers completely filled for the float tank, if any, and with the most conductive detergent 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 machine returns automatically to its normal position of use.*

[1] Plurafac ® LF 221 is the trade name of a product supplied by BASF. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named.

__Motorized cleaning heads__ are placed in a tray, the base of which is level with the surface supporting the machine. The tray is filled with the __test solution__ to a level of 5 mm above its base, this level being maintained throughout the test. The machine including the __motorized cleaning head__ is operated until its liquid container is completely full and afterwards for a further 5 min.

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

There shall be no trace of liquid on insulation that reduces the __clearances__ or __creepage distances__ below the values specified in Clause 29.

15.3 *Modification:*

The relative humidity shall be (93 ± 6) %.

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

The following test is not applicable to **motorized cleaning heads** of **class III construction** having a **working voltage** up to 24 V.

Compliance is checked by the following four 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 60068-2-31. 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

- *1 000 times on its right side;*
- *1 000 times on its left side;*
- *1 000 times on its front face;*
- *1 000 times on its cleaning surface.*

The __motorized cleaning head__ is then subjected to the test described in IEC 60529:1989, 14.2.4, as amended by IEC 60529:1989/AMD2:2013 using the __test solution__.

The __motorized cleaning head__ shall be operated in a flat-bottomed vessel filled with a saline solution of water containing approximately 1 % NaCl so that a depth of 3,0 mm of water is maintained. The vessel is to be a size such that the __motorized cleaning head__ moves about freely and is to be operated with or without connection to the high pressure cleaner for 15 min whichever applicable. The __motorized cleaning head__ shall then withstand the electric strength test of 16.3, the voltage being applied between the __live parts__ and the __test solution__. There shall be no trace of saline solution on insulation that reduces __clearances__ or __creepage distances__ below the values specified in Clause 29.

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 a saline solution of 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.

18.101 The insulation, contacts and connections shall not be damaged and shall not work loose, as result of heating, vibration, etc.

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

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

18.102 *The machine 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.*

The machine is 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 machine 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 **hose lines** are coiled on concrete during this test.*

18.103 *Machines 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 *Machines 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 the **rated voltage**, the operating cycle being that specified in 18.103.*

If the temperature rise of any part of the machine exceeds the temperature rise determined during the test of 11.8, forced cooling or rest periods may be applied, the rest periods being excluded from the specified operating time. If forced cooling is applied, it shall not alter the air flow of the machine or redistribute carbon deposits.

18.105 *Machines provided with **self-resetting thermal cut-outs** shall work reliably under overvoltage conditions.*

Compliance is checked by the following test.

The machine is supplied at a voltage equal to 1,1 times the ***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 *After the tests of 18.102 to 18.105, the machine 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.*

19 Abnormal operation

This clause of Part 1 is applicable except as follows.

19.1 *Addition:*

The test of 19.7 is not applicable to the pump motor of three-phase machines. Machines with appliance outlets complying with the standard sheets in IEC 60320-3 and socket outlets are subjected to the test of 19.104.

19.5 *Modification:*

In the fourth paragraph, delete the following text: "used in a system with polarized plugs intended for connection to polarized socket outlets".

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 shall not be open-circuited or short-circuited, provided the appropriate standard covers the conditions that occur with the machine. 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 machine 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 machines, the following applies.

When the combustion air supply to a machine having fan-assisted draught is partially or completely blocked, the machine shall either continue to operate safely or the fuel supply shall be shut off.

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 machine 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 a force not exceeding 1 N.*

19.102 For atmospheric gas-fired machines, 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 %.

Compliance is checked by inspection and by the following test.

The machine is tested in an atmosphere having a normal oxygen supply. The machine 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 amount of CO in the flue gases shall not exceed 0,04 % (volume) on an air-free and dry basis.

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 machine, nor produce a concentration of carbon monoxide in an air-free sample of the flue gases in excess of 0,04 %.

Compliance is checked by inspection and by the following test.

The machine is tested in an atmosphere having a normal oxygen supply. The machine 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 a machine 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.

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 %.

Compliance is checked by inspection and by the following test.

The machine is tested in an atmosphere having a normal oxygen supply.

The machine is operated for at least 15 min at normal test pressure. When the machine 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.

In case outage occurs, raw gas shall not be forced into the combustion chamber on reopening of the flue outlet.

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 machine, nor produce a concentration of carbon monoxide in an air-free sample of the flue gases in excess of 0,04 %.

Compliance is checked by inspection and by the following test.

The machine is tested in an atmosphere having a normal oxygen supply.

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 machine 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.

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

19.103 The machine shall be able to start with a successful ignition even under undervoltage condition, if applicable.

Compliance is checked by the following test.

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

19.104 *Machines with appliance outlets, complying with the standard sheets in IEC 60320-3 and socket outlets shall be operated under conditions of **normal operation**, except the appliance outlet or socket outlet is loaded with the maximum load corresponding to its configuration in accordance with IEC 60320-3 or IEC TR 60083, respectively. Machines with more than one appliance outlet or socket outlet are tested with each outlet loaded one at the time.*

However, this test is not applied for appliances with appliance outlets or socket outlets

– *intended only to supply accessories supplied with the machine,*
– *inaccessible to the user, or*
– *provided with a **protective device** as specified in 22.61.*

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.1 *Replacement of the first sentence by the following:*

Machines, other than **fixed appliances**, **hand-held appliances** and **hand-guided machines** without a fixed upright parking position of the handle, intended to be used on a surface such as the floor or a table, shall have adequate stability.

20.2 *Add the following text after the second paragraph of the test specification:*

NOTE 101 Appliances according to this standard are not regarded as being intended to be installed in an area open to the public.

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 by the following tests.

*Hoses, when tested at 45 °C for 7 days with the normally diluted **cleaning agent**, shall not be damaged. Seals used in the construction of the machine shall not differ from untested seals when immersed in the normally diluted cleaning liquid at 45 °C for 7 days and then rinsed in water.*

Metal used in the construction of the parts of the machine 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 × 200 mm × 2 mm) shall have its surface area recorded as dm^2 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 45 °C 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/dm^2. There shall be no significant signs of corrosion present on the test piece and the mass change shall be within 40 mg/dm^2.

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

Compliance is checked by inspection and by measurement.

20.103 Oil-heated or gas-heated machines 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 The unintentional closing and lowering of doors, lids, covers etc., which could cause injury, shall be prevented.

Wheels or rollers for the transport of machines 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.

21.1 *Replacement of the first paragraph by the following:*

The machine and its components and fittings shall have adequate mechanical strength and be constructed to withstand such rough handling that may be expected in normal use, during transportation, assembly, dismantling, scrapping and any other action involving the machine.

Modification in the third paragraph:

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

21.101 Parts subjected to the hydraulic pressure shall be of sufficient mechanical strength.

Compliance is checked by the following tests in 21.101.1, 21.101.2, and 21.101.3.

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 used externally outside of the high pressure cleaner to connect the ***trigger gun*** *with the high pressure cleaner 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 s and 30 s after starting at zero pressure.*

NOTE 1 It will be necessary to render the pressure relief valve and/or alternative sensing device inoperative.

NOTE 2 This test is related to the high pressure hose, not the high pressure **hose line**. Effects of the fittings can be ignored.

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****, if any, 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****.*

During this test, there shall be no rupture.

21.102 Pressure safety devices shall operate reliably.

Compliance is checked by the following test.

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

21.103 **Hand-held appliances**, **hand-guided machines** and machines 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 machine 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 machine 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 machine or spray gun is then dropped five times, with its major axis vertical, and with the nozzle pointing downwards.

*After this test, the machine 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.*

21.104 During **normal operation**, the **allowable pressure** shall not be exceeded.

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

Equipped with the nozzle for highest flow assigned by the manufacturer, the flow rate shall not deviate more than ± 10 % from the **maximum flow rate**.

Compliance is checked by measurement.

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 *Addition:*

The parts are subject to the hammer test of 21.1. 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.

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 during **normal operation**, 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 Not applicable.

22.48 *Replacement of the compliance paragraph by the following:*

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

22.61 *Add the following at the end:*

The **protective device** is not necessary for appliances for which 30.2.2 is applicable, fitted with a supply cord or cord set, having a plug of the identical maximum current rating as the socket-outlet or appliance outlet integrated into the appliance.

22.101 The machine shall be constructed so as to prevent the penetration of objects from the floor, which may impair the safety of the machine.

NOTE This requirement is not applicable to **hand-held appliances** or hand-held accessories (e.g. **trigger guns**).

The machine, placed in the intended operation position according the user instructions shall have no **live parts** less than 60 mm from the floor that could come to contact with liquid.

Portable appliances having a **ToM** not exceeding 40 kg shall also be positioned in all stable positions as defined by the manufacturer with all necessary hoses and supply cords connected and shall have no **live parts** less than 30 mm from the floor that could come to contact with liquid.

Compliance is checked by inspection and 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^2, the width not being less than 3 mm.

Compliance is checked by measurement.

22.103 The machine 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. It shall not be possible to supply the nozzle with high pressure fluid without having the **trigger gun** or equivalent means in the high pressure system.

NOTE Requirements for electronic devices to control the liquid flow are under consideration.

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 is locked in the non-operating condition. The pressure in the fluid system is adjusted to 2,5 MPa. The actuator of the operating means is then 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.*

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

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

22.104 Machines, 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 The machine and its parts shall not have uncontrolled movement to a hazardous degree when used in accordance with the manufacturer's instructions.

Portable appliances with wheels and having a **ToM** 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.

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

where

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

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 Except for battery-operated appliances, high pressure cleaners shall be fitted with a switch or contactor in their supply circuit that ensures **all-pole disconnection**. Except for stationary appliances and for battery-operated appliances, circuits not controlling the motor driving the high pressure pump are acceptable to be directly connected to the supply mains without this switch.

Compliance is checked by inspection.

22.110 The equivalent nozzle diameter of **low pressure accessories** shall not be less than 2 mm.

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

Compliance is checked by inspection and measurement.

22.111 Guards

Fixed **guards** shall be secured by systems that can be opened or removed only with **tools**, and shall be incapable of remaining in place without their fixings, if applicable.

Their fixing systems shall remain attached to the **guards** or to the machine when the **guards** are removed, with the exception of fixing systems that can remain detachable without impairing safety. This does also not apply if, after removal of the fixing systems, or if the component is incorrectly repositioned, the machine becomes inoperative or is obviously incomplete.

NOTE This requirement does not necessarily apply to fixed **guards** that are only liable to be removed, for example, when the machine is completely overhauled, is subject to major repairs or is dismantled for transfer to another site. For the same reason, it is not be necessary to apply the requirement to the casings of machinery intended for use by laymen, where the manufacturer's instructions specify that the repairs requiring removal of these casings are only to be carried out in a specialist repair workshop. In that case, fixing systems can be used that are not easy to remove.

If movable **guards** are interlocked, the interlocking devices shall prevent the start of hazardous machine functions until the **guards** are fixed in their position, and give a stop command whenever they are no longer closed.

Interlocking movable **guards** shall, as far as possible, remain attached to the appliance when open and they shall be designed and constructed in such a way that they can be adjusted only by means of an intentional action.

Interlocking movable **guards** shall be designed in such a way that the absence or failure of one of their components prevents starting or stops the hazardous functions of the appliance.

Adjustable **guards** may be used only to restrict access to those areas of the moving parts strictly necessary for the work. They shall be manually or automatically adjustable based on the type of work involved and shall be adjustable without use of **tools**.

Compliance is checked by inspection.

22.112 The machine shall be designed in such a way as to avoid incorrect mounting, if this can lead to an unsafe situation. If this is not possible, information on the correct mounting shall be given directly on the part and/or the enclosure.

Compliance is checked by inspection.

22.113 For machines where the **operator** is required to use personal protective equipment (PPE), controls shall be designed in such a way that they can be operated safely.

Compliance is checked by inspection and by functional test.

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 cycles of operations.

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

After the test, the device should stop the liquid flow to the nozzle immediately. Small leakages are allowed (e.g. for frost protection purposes).

24.1.4 *Replacement of the last paragraph:*

Thermal cut-outs *of the capillary type shall comply with the requirements of IEC 60730-2-9:2015 including IEC 60730-2-9:2015/AMD1:2018.*

24.7 Not applicable.

25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows:

25.1 *Addition:*

Three-phase machines are not required to be provided with a plug.

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

Machines 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 machine 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 machine when coupled.

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

25.7 *Addition:*

Supply cords of machines other than **stationary machines** shall not be less than 5 m in length, except that for **hand-held machines** and machines 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 machine 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:*

Replacement of Table 12 by the following:

Table 12 – Pull force and torque

ToM *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 machines 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.

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. The requirement is not applicable to the distance between high voltage spark electrodes and PE for appliances using galvanic isolated sparking transformers with common earth for generating the sparking voltage.

This requirement is not applicable to the air gap between the 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 machine.

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.

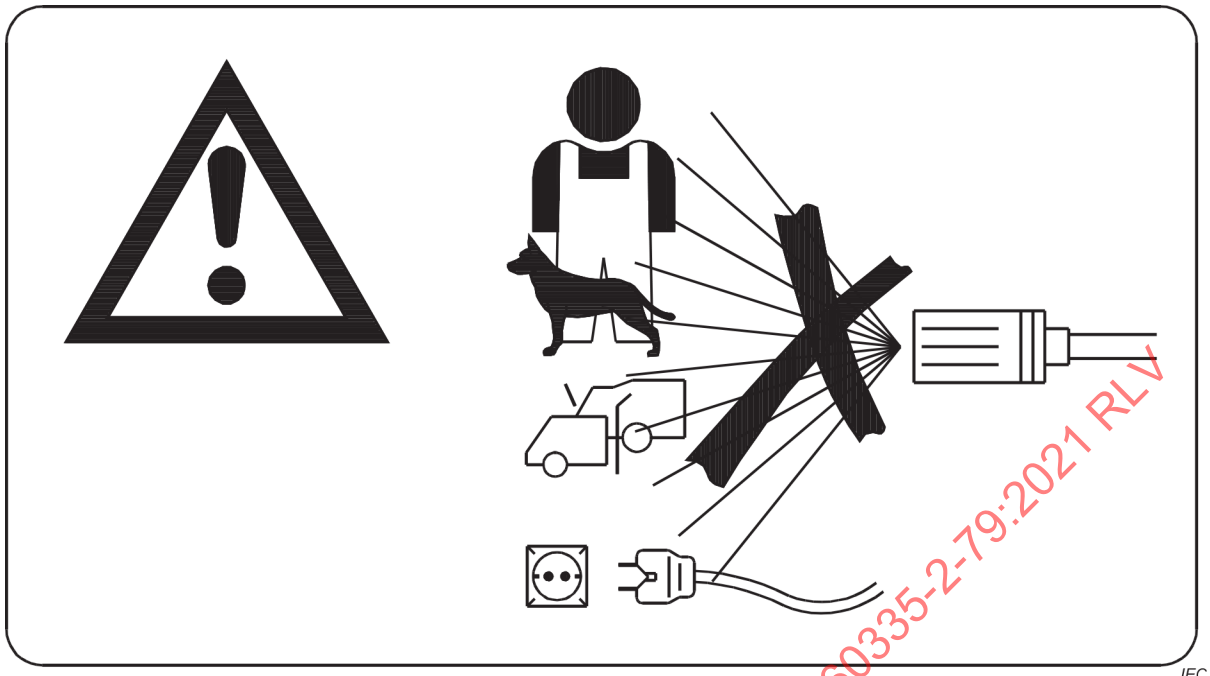
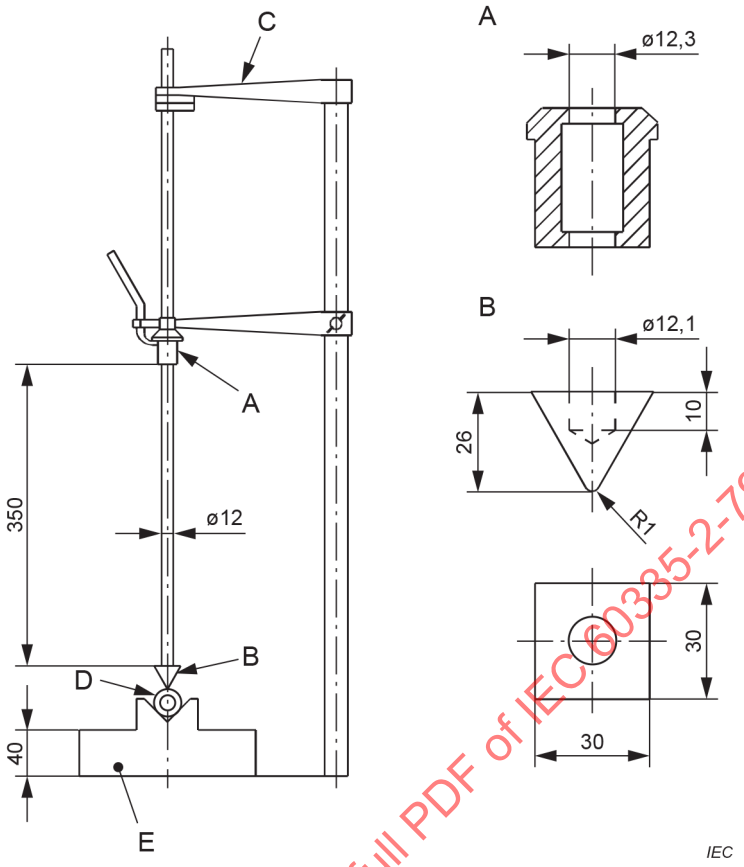


Figure 101 – Warning symbol

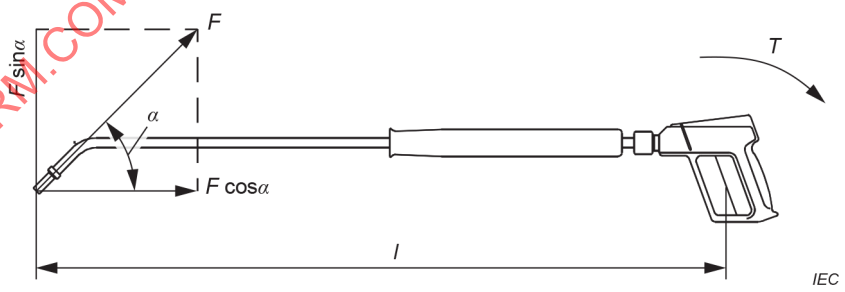
Dimensions in millimetres



Key

A weight
B chisel
C fixing arm
D sample
E base having a mass of 10 kg

Figure 102 – Impact test apparatus



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

Figure 103 – Reactions on handle

IEC

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

IEC

Figure 105 – Warning symbol: Do not inhale fumes

Annexes

The annexes of Part 1 are applicable, except as follows.

Annex B
(normative)

Battery-operated appliances, separable batteries and detachable batteries for battery-operated appliances

Annex B of Part 1 is applicable except as follows:

6 Classification

Addition:

6.2 **Battery-operated** high pressure cleaners shall be IPX5.

7 Markings and instructions

7.1 *Modification:*

Add at the end of the fourth paragraph (“If appliances use more than one battery,”): "except for machines with hardwired **battery** sets."

19 Abnormal operation

B.19.2 *Addition:*

This subclause is not applicable for machines with hardwired **battery** sets.

22 Construction

B.22.3 *Modification:*

Add the following text after the sixth paragraph of the test specification:

NOTE 101 Appliances according to this standard are not regarded as being intended to be installed in an area open to the public.

NOTE 102 During this test two test probes are applied simultaneously.

B.22.4 *Modification:*

Add the following text after the fifth paragraph of the test specification:

NOTE 101 Appliances according to this standard are not regarded as being intended to be installed in an area open to the public.

NOTE 102 During this test two test probes are applied simultaneously.

Annex AA
(normative)

Requirements to avoid backsiphonage

The requirements of IEC 61770:2008 are applicable except as follows:

1 Scope

Replace the text of this clause by the following:

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.

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

3 Terms and definitions

3.3 *Replace the Note by:*

NOTE Examples are air gaps 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 1 to entry: For three-phase machines 5 s and for single phase machines, 2 s can be appropriate.

Add the following new definitions:

3.12
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

3.13
protection point
location in a hydraulic circuit where a safety device is installed

4 General requirements

4.2 *Replace the existing text by the following:*

Backflow prevention devices shall be incorporated in, or fixed to, the machine or 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 normative Annex BB.

4.3 Not applicable.

4.4 Not applicable.

5 General conditions for the tests

5.4 *Replace the text by the following:*

Tests, except the functional and endurance tests on airgaps and backflow preventers with reduced pressure zone, are made on the machine, unless this is impracticable. The compliance is then checked by the tests according to Annex A of IEC 61770:2008.

NOTE During the functional and endurance tests, additional samples can 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 General requirements

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.

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.

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.*

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;

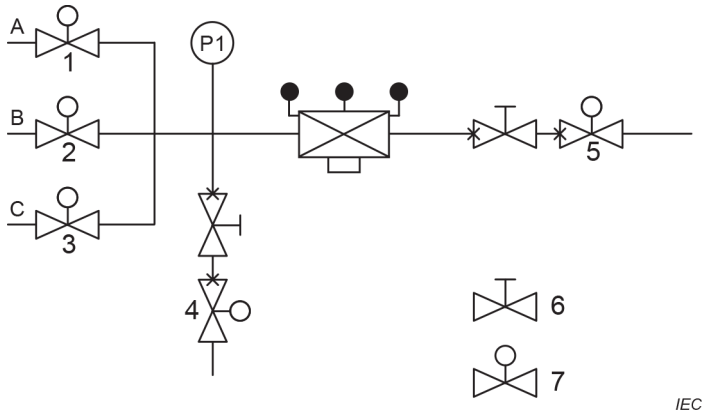
– after this test cycle, the device is submitted for 14 h to an upstream pressure of 0,3 MPa (3 bar) and to a downstream pressure of 1 MPa (10 bar) at **room temperature**;

– 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 10.2 to 10.5.



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

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 machine 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).

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 machine, locate the desired or existing **protection point**(s) to be protected, or, failing this, the point of connection of the machine to the potable water main.

Determine the maximum water level.

Define whether the **protection point** or, failing this, the point of connection of the machine 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 machine 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 machine 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					

BB.5 Air break to drain

All machines 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 realized by a full disconnection or by air inlets.

Requirements on air breaks to drain:

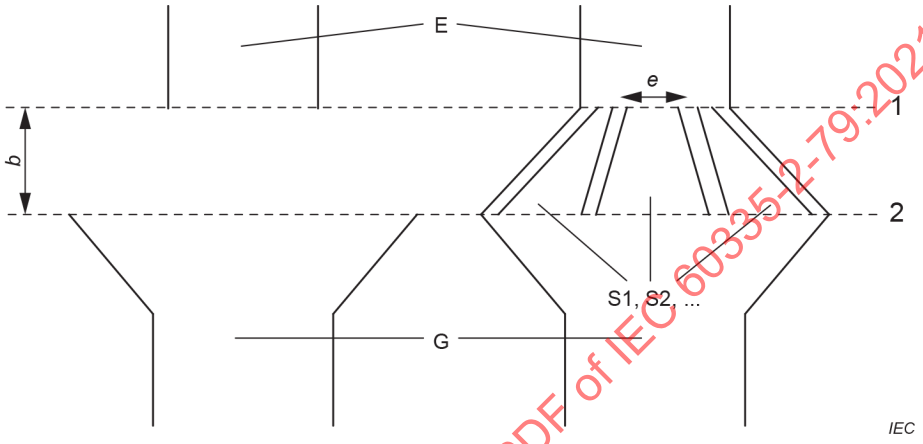
b ≥ G;

b ≥ 20 mm;

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

e ≥ 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:	S1, S2, cross-sections for air passage
e	smallest dimension for calculation of a cross-section
b	air gap height

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

Annex CC
(informative)

Emission of acoustical noise

CC.1 Noise reduction

Noise reduction at high pressure cleaners is an integral part of the design process and shall be achieved by applying measures at source to control noise, see for example ISO/TR 11688-1. The success of the applied noise reduction measures is assessed on the basis of the actual noise emission values in relation to other machines of the same type with comparable non-acoustical technical data. The major sound sources of high pressure cleaners are pumps and burners.

CC.2 Noise test code

CC.2.1 Emission sound pressure level determination

The emission sound pressure level is determined in accordance with ISO 11203, using the method with Q calculated for machines without a specified work station, with the measurement distance d = 1 m.

NOTE In this case, the emission sound pressure level is equal to the surface sound pressure level used for calculating the sound power level according to ISO 3744 when applying a rectangular parallelepiped measurement surface at a distance of 1 m from the reference box.

CC.2.2 Sound power level determination

The sound power level is measured in accordance with ISO 3744, or with ISO 3743-1 if a suitable hard-walled test room is available.

CC.2.3 Operating and mounting conditions

The operating conditions shall be identical for the determination for both sound power and emission sound pressure level at the specified positions.

In addition to **normal operation** in accordance with 3.1.9, the following requirements shall be taken into account.

The high pressure cleaner shall be installed on the reflecting plane; skid-mounted machines shall be placed on a support 0,40 m high, unless otherwise required by the manufacturer's conditions of installation.

The high pressure cleaner is operated under **normal operation**. Immediately before each series of measurement, the machine shall be operated for at least 10 min. The noise emitted by the nozzle and the emission of the water jet hitting any surfaces shall be excluded from measurement.

The period of observation shall be at least 15 s.

CC.2.4 Measurement uncertainties

A standard deviation of reproducibility σ_{RO} of less than 1,5 dB is expected for both the A-weighted emission sound pressure level according to ISO 11203 and the A-weighted sound power level determined according to ISO 3744 or ISO 3743-1.

CC.2.5 Information to be recorded

The information to be recorded covers all of the technical requirements of this noise test code. Any deviations from this noise test code or from the basic standards upon which it is based are to be recorded together with the technical justification for such deviations.

CC.2.6 Information to be reported

The information to be included in the test report is at least that which the manufacturer requires for a noise emission declaration or the user requires to verify the declared values.

CC.2.7 Declaration and verification of noise emission values

The declaration of the emission sound pressure level shall be made as a dual-number noise emission declaration according to ISO 4871, where it exceeds 70 dB(A). Where the emission sound pressure level does not exceed 70 dB(A), this fact may be stated in place of the emission value and uncertainty, e.g. by declaring $L_{pA} \leq 70$ dB(A).

It shall declare the noise emission value L_{pA} and separately the respective uncertainty K_{pA}.

The sound power level shall be given as a single value declaration according to ISO 4871 declaring the sum of L_{WA} and the respective uncertainty K_{WA}, where the emission sound pressure level exceeds 80 dB(A).

NOTE K_{pA} and K_{WA} are expected to be 3 dB.

The noise declaration shall state that the noise emission values have been obtained according to this noise test code. If this statement is not applicable, the noise declaration shall indicate clearly what the deviations from this standard, and from the basic standards, are.

If undertaken, verification shall be conducted according to ISO 4871 by using the same mounting, installation and operating conditions as those used for the initial determination of the noise emission values.

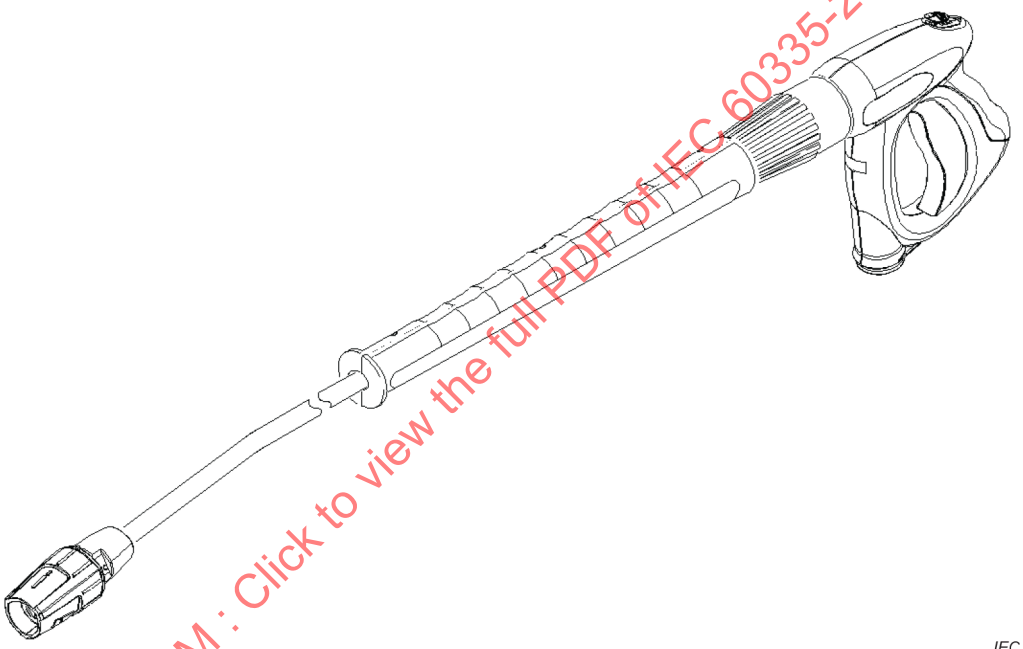
Annex DD
(informative)

Emission of vibration

DD.1 General

Informative Annex DD specifies a laboratory method for measuring hand-transmitted vibration emission at the handles of high-pressure cleaners. It is a type-test procedure for establishing the magnitude of vibration in the gripping areas of a machine run under specified test conditions. It is intended that the results be used to compare different models of the same type of machine.

Figure DD.1 and Figure DD.2 show an example of a typical **trigger gun** (spraying device) covered by this document.



IEC

Figure DD.1 – Trigger gun

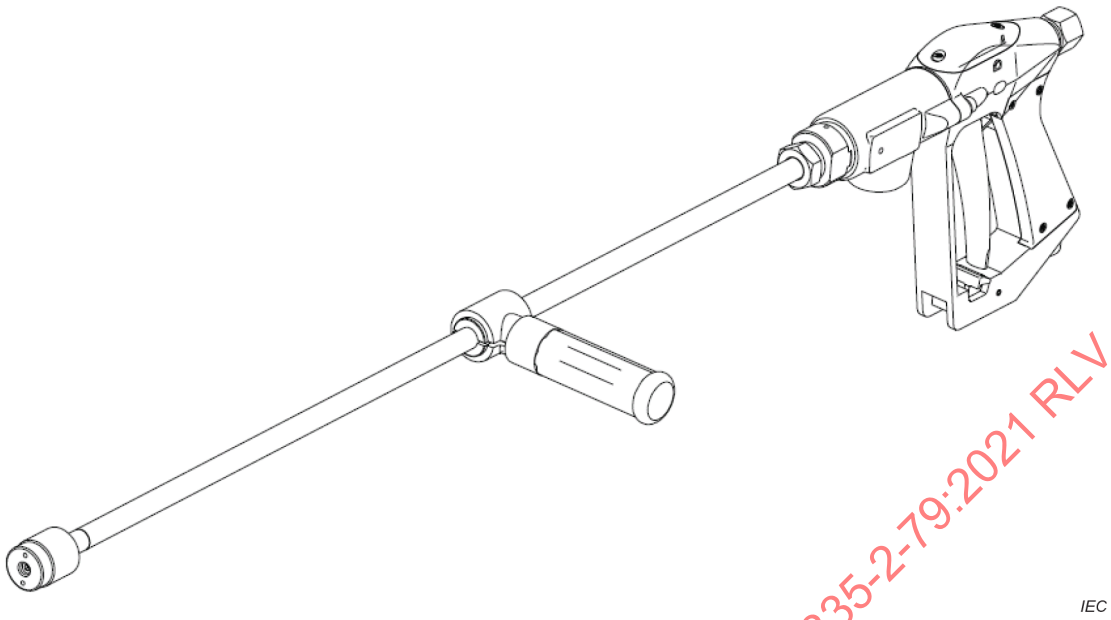


Figure DD.2 – Trigger gun with additional side handle

DD.2 Reduction of vibration

The machine shall be designed and constructed in such a way that risks resulting from vibrations produced by the machine are reduced to the lowest level, taking account of technical progress and the availability of means of reducing vibration, in particular at source.

The handles shall be designed and constructed in such a way as to reduce the vibrations transmitted to the upper limbs of the **operator** to the lowest level that is reasonably possible.

DD.3 Terms, definitions and symbols

For the purposes of this document, the terms and definitions given in ISO 20643 and the symbols given in Table DD.1 apply.

Table DD.1 – Description and units of the symbols used

Symbol	Description	Unit
a_{hw}	root-mean-square (RMS) single-axis acceleration value of the frequency-weighted hand-transmitted vibration	m/s^2
a_{hv}	vibration total value of frequency-weighted RMS acceleration; root sum of squares of a_{hw} values for the three measured axes of vibration	m/s^2
$\overline{a_{hv}}$	arithmetic mean value of a_{hv} values of runs for single **operator** using one hand position	m/s^2
a_h	arithmetic mean value of $\overline{a_{hv}}$ values for all **operators** for one hand position	m/s^2
$\overline{a_h}$	arithmetic mean value of a_h values for one hand position on several machines	m/s^2
a_{hd}	declared vibration emission value	m/s^2
s_{n-1}	standard deviation for a test series (for a sample, *s*)	m/s^2
σ_R	standard deviation of reproducibility (for a population, σ)	m/s^2
C_v	coefficient of variation for a test series	
K	uncertainty	m/s^2

DD.4 Information on vibration emission

The instructions shall give the following information:

– the vibration total value to which the hand-arm system is subjected, measured in accordance with this document, if the vibration total value exceeds 2,5 m/s^2. Where this value does not exceed 2,5 m/s^2, this fact may be stated in place of the emission value and uncertainty, e.g., by declaring $a_h \leq 2{,}5$ m/s^2;

– the uncertainty surrounding this value in accordance with this document.

These values shall be either those actually measured for the machine in question or those established on the basis of measurements taken for a technically comparable machine which is representative of the machine being produced.

Regarding operating conditions during measurement and the methods used for measurement, the reference of the standard applied shall be specified.

DD.5 Characterization of vibration

DD.5.1 Direction of measurement

The vibration transmitted to the hand shall be measured for three directions of an orthogonal coordinate system. The resulting value of the three axes shall be reported. At each hand position, the vibration shall be measured simultaneously in the three directions shown in Figure DD.3 and Figure DD.4.

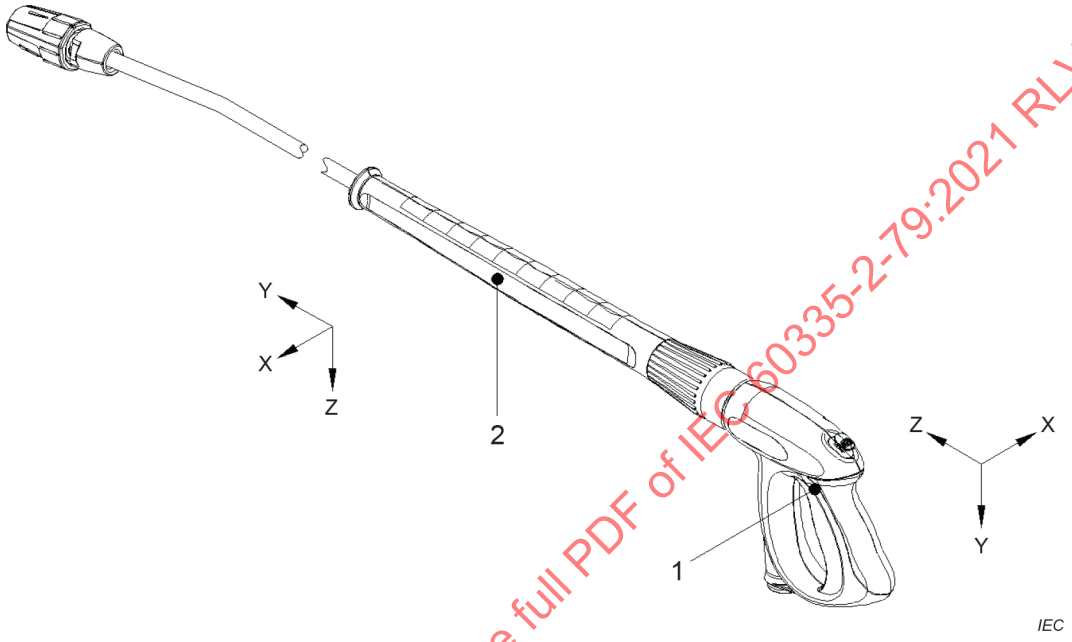
DD.5.2 Location of measurements

Measurements shall be made at the gripping zones, where the **operator** normally holds the machine and applies the **reaction force**.

The prescribed transducer location for the main measuring point shall be as close as possible to the hand between the thumb and index finger, with the **trigger gun** held as in **normal operation**. Figure DD.3 shows this main measuring point for a **trigger gun** at the left side, which may be located also at the right side of the handle. Alternatively, the transducer may be

located at the end of the handle, between the thumb and index finger. The transducer shall be attached to the lance with a maximum distance from the gripping area of 10 mm.

A secondary measuring point is defined as being on the second handle, in the middle of the gripping area (see Figure DD.3). For adjustable second handles (see Figure DD.4), or for **trigger guns** without a certain second handle, the distance between the main measuring point and the second measuring point shall be l = 50 cm ± 5 cm, if applicable. Where not applicable, the maximum distance between transducer one and transducer two has to be chosen.

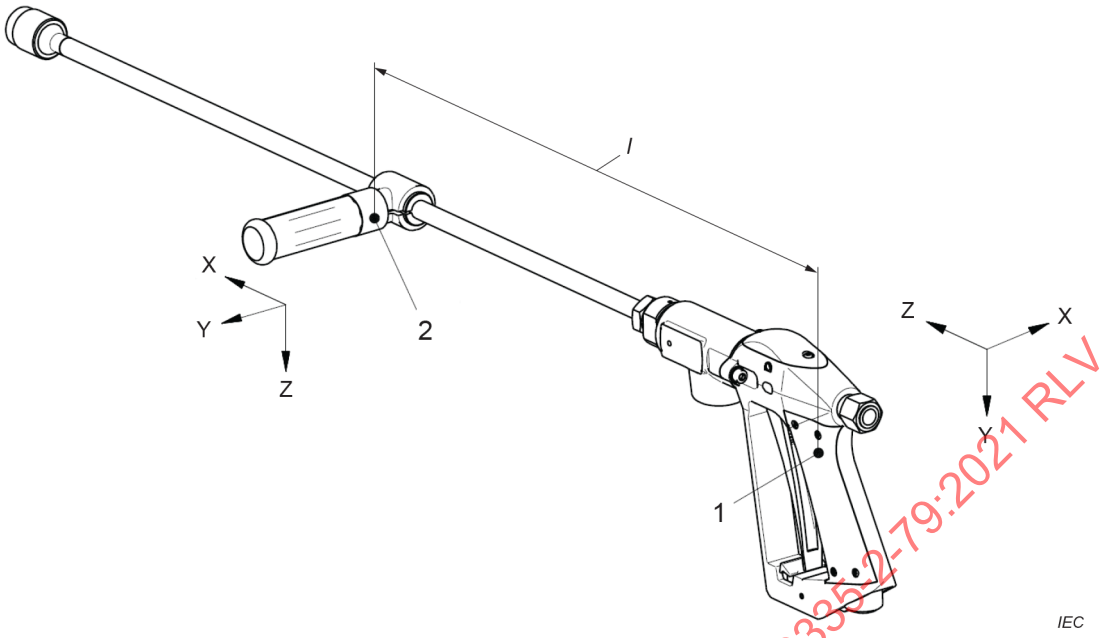


Key

1 main measuring point

2 secondary measuring point

Figure DD.3 – Measurement locations: Trigger gun, main and secondary measuring point



Key

1 main measuring point

2 secondary measuring point

Figure DD.4 – Measurement locations: Trigger gun with additional side handle, main and secondary measuring point

DD.5.3 Magnitude of vibration

The definitions for the magnitude of vibration given in 6.3 of ISO 20643:2005 apply.

DD.5.4 Combination of vibration directions

The vibration total value as defined in 6.4 of ISO 20643:2005 shall be reported for both hand positions. It is acceptable to report on and carry out tests on the hand position having the highest reading, if the vibration total value at that hand position is at least 30 % higher than the other. A provisional result may be obtained during a test carried out by a single **operator** during five test runs. This result shall not be used for the purpose of declaring vibration total values.

This result may also be obtained due to experience with comparable machines and nozzles. For machines with rotary nozzles, the test shall be carried out for both hand positions.

NOTE Experience has shown that the vibration value at the main measuring point is typically higher than at the secondary measuring point.

To obtain the vibration total value, a_{hv}, for each test run, the results in each direction shall be combined using Formula (D.1):

$$a_{hv} = \sqrt{a_{hwx}^2 + a_{hwy}^2 + a_{hwz}^2} \quad \text{(D.1)}$$

DD.6 Instrumentation requirements

DD.6.1 General

The instrumentation shall be in accordance with 7.1 of ISO 20643:2005.

DD.6.2 Mounting of transducers

DD.6.2.1 Specification of transducer

The specification of the transducer given in 7.2.1 of ISO 20643:2005 applies. Triaxial transducers shall be used for measurement as far as possible.

DD.6.2.2 Fastening of transducers

The transducer or the mounting block used shall be rigidly attached to the surface of the handle, if applicable.

For the two axes aligned parallel to the vibrating surface, the measurement axes of the two transducer elements in a triaxial transducer shall be at a maximum of 10 mm from the surface.

DD.6.3 Frequency weighting filter

Frequency-weighting shall be in accordance with ISO 5349-1.

DD.6.4 Integration time

The integration time shall be in accordance with 7.4 of ISO 20643:2005. The integration time for each test run shall be at least 16 s, initiating after the starting period.

NOTE The starting period itself is considered to be negligible due to the relation of the duration of the starting and working period.

DD.6.5 Calibration

The specifications for calibration given in 7.6 of ISO 20643:2005 apply.

DD.7 Testing and operating conditions of the machinery

DD.7.1 General

During testing, the machine shall be equipped and held in a manner similar to that when performing a normal work task. A reasonable warming-up period shall be undertaken prior to the start of the test.

DD.7.2 Operating conditions

During testing, the machine shall be operated at **rated voltage**, and shall be used in accordance with **normal operation** as defined in this standard and with the manufacturer's specifications, as far as not otherwise specified in DD.7.2. The operation shall be stable and smooth. In particular, the following conditions shall apply:

NOTE 1 Further requirements are given in DD.8.1 (3 test persons, five test runs) and DD.6.4 (16 s test duration).

– The tests shall be carried out at **normal operation**.

– The **trigger gun** shall be held stationary without any side-to-side motion, without tension, with the axis of the **trigger gun** at a downwards angle of 45° ± 5°, spraying the water jet to the atmosphere (see Figure DD.5). Gloves shall not be used unless required as PPE due to manufacturer's instructions.

– The hand position of the second hand (support hand) shall be as shown in Figure DD.5. The hand shall be placed as close as possible next to the transducer. The second hand shall support the **trigger gun** from underneath. If the gripping area is too small to place the transducer in the middle of the gripping area and simultaneously between the thumb and index finger, the transducer shall be placed in the middle of the gripping area, whilst the second hand shall be shifted towards the nozzle. A removable pulsation dampener, if any, shall not be used. If a pulsation dampener is permanently fixed to the machine, this

fact shall be reported. It is recommended that for the test the length of the **hose line** is not be more than 10 m. If the standard length according to the manufacturer's instructions is more than 10 m, the standard hose may be used; in this case the length shall be reported. The type of the **hose line** shall be reported.

– The nominal diameter shall be not more than DN 12. If the standard nominal diameter according to the manufacturer's instructions is more than DN 12, the standard hose may be used; in this case the nominal diameter shall be reported.

NOTE 2 DN 12 is the inner diameter nominal expressed in mm.

– During measurement, the **hose line** shall lie without interference and in particular without touching the **operator**.

Figure DD.5 – Operating conditions – Position of spraying device

DD.7.3 Operators

Three different **operators** shall operate the machine during testing. The vibration measurements are influenced by the **operator**. They should therefore be skilled and able to operate the machine properly i.e. the **operator** shall be experienced in the use of the machine. The gripping force shall be as under long term working conditions and not be excessive.

The **hose line** shall hang loose from the lance with minimum bending forces transferred into the lance.

DD.8 Measurement procedure and validity

DD.8.1 Reported vibration values

Three series of five consecutive tests shall be carried out on each machine tested, using a different **operator** for each series. The values should be reported as in informative Annex EE.

The test shall be carried out for the machine as described in Clause DD.7 and reported for a standard nozzle. If it is necessary to report alternative vibration values, the tests shall be carried out as described in DD.8.2. For nozzles which cause significantly higher vibration

values (e.g. rotary nozzles with a single water jet), these values shall be reported also. If only one value is to be reported, this shall be the higher one.

The coefficient of variation, C_v, and the standard deviation, s_{n-1}, shall be calculated for each hand position for each of the three **operators**. The C_v of a test series is defined as the ratio of s_{n-1} to the mean value of the series:

$$C_v = \frac{s_{n-1}}{a_{hv}} \tag{D.2}$$

with s_{n-1} identical to s_{rec} (see Clause DD.9) and where the standard deviation of the *i*th value, a_{hvi}, is:

$$s_{n-1} = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(a_{hvi} - \overline{a_{hv}})^2} \tag{D.3}$$

where

$\overline{a_{hv}}$ is the mean value of the series in m/s^2;

n is equal to 5, the number of measured values.

If C_v is greater than 0,15 or s_{n-1} is greater than 0,3 m/s^2, then the measurements shall be checked for error before data are accepted.

DD.8.2 Declaration and verification of the vibration emission value

The $\overline{a_{hv}}$ value for each **operator** shall be calculated as the arithmetic mean of a_{hv} values for the five test runs. For each hand position, the result from the three **operators** shall be combined into one value, a_h, using the arithmetic mean of the three $\overline{a_{hv}}$ values.

For tests using only one machine, the declared value, a_{hd}, is the highest of the a_h values reported for the two hand positions.

For tests using three or more machines, $\overline{a_h}$ values for each hand position shall be calculated as the arithmetic mean of the a_h values for the different machines on that hand position. The declared value, a_{hd}, is the highest of the $\overline{a_h}$ values reported for the two hand positions.

Both a_{hd} and the uncertainty, *K*, shall be presented with a precision determined in accordance with EN 12096. The value of a_{hd} is to be given in m/s^2 and presented by using two and a half significant digits for numbers starting with 1 (e.g., 1,20 m/s^2, 14,5 m/s^2); otherwise, two significant digits are sufficient (e.g., 0,93 m/s^2, 8,9 m/s^2). The value of *K* shall be presented with the same number of decimals as a_{hd}.

K shall be determined in accordance with EN 12096, based on the standard deviation of reproducibility, σ_R. The value of *K* shall be calculated in accordance with Clause DD.9.

DD.9 Determination of uncertainty

DD.9.1 General

The uncertainty value, *K*, represents the uncertainty of the declared vibration emission value, a_{hd}, and, in the case of batches, production variations of machinery. It is expressed in m/s^2. The sum of a_{hd} and *K* indicates the limit below which the vibration emission value of a single machine, and/or a specified large proportion of the vibration emission values of a batch of machines, are stated to lie when the machines are new.

DD.9.2 Tests on single machines

For tests made on only a single machine, *K* shall be given as

$$K = 1{,}65\sigma_R$$

where σ_R is the standard deviation of reproducibility, estimated by the value s_R, given by

a) $s_R = \sqrt{s_{rec}^2 + s_{op}^2}$

or

b) $s_R = 0{,}06\ a_{hd} + 0{,}3$,

whichever is the greater.

NOTE 1 The uncertainty is expected to be at least 0,5 m/s².

NOTE 2 Formula b) is empirical, based on experience giving a lower limit for s_R.

The calculations are performed on the hand position giving the highest value of a_h, where

s_{rec}^2 is the arithmetic mean value of the standard deviation from the results of five tests, s_{reci}, for **operator** *j*, identical to s_{n-1} according to DD.8.1, and with the s_{rec}^2 value for each **operator** calculated using

$$s_{rec\,j}^2 = \frac{1}{n-1}\sum_{i=1}^{n}(a_{hvij} - \overline{a_{hvj}})^2$$

where

n is 5, the number of measured values;

a_{hvij} is the vibration total value for the i^{th} test with the j^{th} **operator**;

$\overline{a_{hvj}}$ is the average vibration total value of measurements on the j^{th} **operator**;

s_{op} is the standard deviation of the results from the three **operators**, i.e.

$$s_{op}^2 = \frac{1}{m-1}\sum_{j=1}^{m}(\overline{a_{hvj}} - a_h)^2$$

where

m is three (i.e. the number of **operators**);

$\overline{a_{hvj}}$ is the average vibration value from the j^{th} **operator** (average of five tests);

a_h is the average vibration value from all three **operators**.

NOTE 3 The value of s_R is an estimate of the standard deviation of reproducibility of testing performed at different test centres. Since there is currently no information on reproducibility for the tests defined in this document, the value for s_R is based on the repeatability of the test for individual test subjects and across the different test subjects, according to EN 12096.

DD.9.3 Tests on batches of machines

For tests on three or more machines, the *K* value shall be given as

$$K = 1{,}5\,\sigma_t$$

where σ_t is estimated by the value s_t, given by

$$s_t = \sqrt{\overline{s_R^2} + s_b^2}$$

or

$s_t = 0{,}06 a_{hd} + 0{,}3$,

whichever is the greater.

The calculations are performed on the hand position giving the highest value of $\overline{a_h}$ and where

$\overline{s_R^2}$ is the mean value of s_R^2 for the different machines in the batch, where the s_R value for each machine is calculated using DD.9.2 a), above;

s_b is the standard deviation of the test results for individual machines, i.e.

$$s_b^2 = \frac{1}{p-1}\sum_{l=1}^{p}(a_{hl} - \overline{a_h})^2$$

where

a_{hl} is the single-machine emission for one hand position on the *l*th machine;

$\overline{a_h}$ is the mean value of the single-machine emissions for one hand position;

a_{hd} is the highest of the $\overline{a_h}$ values reported for the two hand positions;

p is the number of machines tested.

DD.10 Measurement report

The following information shall be given in the test report:

– reference to this document;
– name of the measuring laboratory;
– date of measurement and name of the person responsible for the test;
– specification of the machine (manufacturer, type, serial number, etc.);
– declared emission value a_{hd} and uncertainty *K*;
– type of nozzle, **trigger gun**, and the type, length and nominal bore diameter of the **hose line**;
– energy supply (input voltage etc., as applicable);

– instrumentation (accelerometer, recording system, hardware, software, etc.);
– position and fastening of transducers, measuring directions and individual vibration values;
– operating conditions, and other quantities to be specified according to Clause DD.7;
– detailed results of the test (see informative Annex EE);
– the names of the **operators** together with their height.

If transducer positions or measurements other than those specified in this document are used, they shall be clearly defined and an explanation of the reason for the change in the position of the transducer shall be inserted in the test report.

Annex EE
(informative)

Model test report for vibration emission at handles of high-pressure cleaners

See Table EE.1 and Table EE.2.

Table EE.1 – General information and reported results

The test has been carried out in accordance with …	
Tester:	
Measured by (company/laboratory):	Tested by: Reported by: Date:
Test object and declared value:	
Machine tested (power supply and machine type, type of material used, manufacturer, machine model and name, the type, length and nominal bore diameter of the **hose line**):	Declared vibration emission value a_{hd} and uncertainty K:
Measuring equipment:	
Transducers (manufacturer, type, positioning, fastening method, photos, mechanical filters if used):	
Vibration instrumentation:	Auxiliary equipment:
Operating and test conditions and results:	
Test conditions (test method used, material used for test, type of inserted tool used, operator posture, hand position, photos):	
Power supply (air pressure, hydraulic flow, voltage):	Measured feed force:
Any other quantities to report:	

Table EE.2 – Measurement results for one machine

Date:			Machine type:				Serial number:			
			Main handle (hand position 1)				Support handle (hand position 2)			
Test	Operator	Test run	a_{hv}	Statistics for operator			a_{hv}	Statistics for operator		
				$\overline{a_{hv}}$	s_{n-1}	C_v		$\overline{a_{hv}}$	s_{n-1}	C_v
1	1	1								
2	1	2								
3	1	3								
4	1	4								
5	1	5								
6	2	1								
7	2	2								
8	2	3								
9	2	4								
10	2	5								
11	3	1								
12	3	2								
13	3	3								
14	3	4								
15	3	5								
			a_h for hand position 1:				a_h for hand position 2:			
			s_R for hand position 1:				s_R for hand position 2:			

NOTE The a_{hv} and $\overline{a_{hv}}$ values are calculated according to DD.5.4 and DD.8.2, s_{n-1} and C_v are calculated according to DD.8.1, and s_R is calculated according to Clause DD.9.

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 3743-1, *Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for small movable sources in reverberant fields – Part 1: Comparison method for hard-walled test rooms*

ISO 3744, *Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for an essentially free field over a reflecting plane*

ISO 3864-1, *Graphical symbols – Safety colours and safety signs – Part 1: Design principles for safety signs and safety markings*

ISO 4871, *Acoustics – Declaration and verification of noise emission values of machinery and equipment*

ISO 5349-1, *Mechanical vibration – Measurement and evaluation of human exposure to hand-transmitted vibration – Part 1: General requirements*

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

ISO 11203, *Acoustics – Noise emitted by machinery and equipment – Determination of emission sound pressure levels at a work station and at other specified positions from the sound power level*

ISO/TR 11688-1, *Acoustics – Recommended practice for the design of low-noise machinery and equipment – Part 1: Planning*

ISO 80000-1, *Quantities and units – Part 1: General*

ISO 15230, *Mechanical vibration and shock – Coupling forces at the man-machine interface for hand-transmitted vibration*

ISO 20643:2005, *Mechanical vibration – Hand-held or hand-guided machinery – Principles for evaluation of vibration emission*

ISO 28927 (all parts), *Hand-held portable power tools – Test methods for evaluation of vibration emission*

ISO 4254-6, *Agricultural machinery – Safety – Part 6: Sprayers and liquid fertilizer distributors*

EN 1829-1, *High pressure water jet machines – Safety requirements – Part 1: Machines*

EN 12096:1997, *Mechanical vibration – Declaration and verification of vibration emission values*

Index of defined terms

SOMMAIRE

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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APPAREILS ÉLECTRODOMESTIQUES ET ANALOGUES – SÉCURITÉ –

Partie 2-79: Exigences particulières pour les appareils de nettoyage à haute pression et les appareils de nettoyage à vapeur

AVANT-PROPOS

1) La Commission Electrotechnique Internationale (IEC) est une organisation mondiale de normalisation composée de l'ensemble des comités électrotechniques nationaux (Comités nationaux de l'IEC). L'IEC a pour objet de favoriser la coopération internationale pour toutes les questions de normalisation dans les domaines de l'électricité et de l'électronique. À cet effet, l'IEC – entre autres activités – publie des Normes internationales, des Spécifications techniques, des Rapports techniques, des Spécifications accessibles au public (PAS) et des Guides (ci-après dénommés "Publication(s) de l'IEC"). Leur élaboration est confiée à des comités d'études, aux travaux desquels tout Comité national intéressé par le sujet traité peut participer. Les organisations internationales, gouvernementales et non gouvernementales, en liaison avec l'IEC, participent également aux travaux. L'IEC collabore étroitement avec l'Organisation Internationale de Normalisation (ISO), selon des conditions fixées par accord entre les deux organisations.
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8) L'attention est attirée sur les références normatives citées dans cette publication. L'utilisation de publications référencées est obligatoire pour une application correcte de la présente publication.
9) L'attention est attirée sur le fait que certains des éléments du présent document de l'IEC peuvent faire l'objet de droits de brevet. L'IEC ne saurait être tenue pour responsable de ne pas avoir identifié de tels droits de brevets.

L'IEC 60335-2-79 a été établie par le sous-comité 61J: Appareils de nettoyage à moteur électrique pour usage commercial, du comité d'études 61 de l'IEC: Sécurité des appareils électrodomestiques et analogues. Il s'agit d'une Norme internationale.

Cette cinquième édition annule et remplace la quatrième édition parue en 2016. Elle constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

– alignement rédactionnel et technique sur l'IEC 60335-1:2020;
– clarification concernant les appareils de nettoyage à haute pression portatifs et alimentés par batteries;

– améliorations rédactionnelles générales.

Le texte de cette Norme internationale est issu des documents suivants:

Projet	Rapport de vote
61J/739/CDV	61J/746A/RVC

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2, il a été développé selon les Directives ISO/IEC, Partie 1 et les Directives ISO/IEC, Supplément IEC, disponibles sous www.iec.ch/members_experts/refdocs. Les principaux types de documents développés par l'IEC sont décrits plus en détail sous www.iec.ch/standardsdev/publications.

La présente partie 2 doit être utilisée conjointement avec la dernière édition de l'IEC 60335-1 et ses amendements. Elle a été établie sur la base de la sixième édition (2020) de cette norme.

NOTE 1 L'expression "la Partie 1" utilisée dans la présente norme fait référence à l'IEC 60335-1.

La présente partie 2 complète ou modifie les articles correspondants de l'IEC 60335-1, de façon à transformer cette publication en norme IEC: Exigences particulières pour les appareils de nettoyage à haute pression et les appareils de nettoyage à vapeur

Lorsqu'un paragraphe particulier de la Partie 1 n'est pas mentionné dans cette partie 2, ce paragraphe s'applique pour autant que cela soit raisonnable. Lorsque la présente norme mentionne "addition", "modification" ou "remplacement", le texte correspondant de la Partie 1 doit être adapté en conséquence.

NOTE 2 Le système de numérotation suivant est utilisé:

– les paragraphes, tableaux et figures qui s'ajoutent à ceux de la Partie 1 sont numérotés à partir de 101;
– à l'exception de celles qui sont dans un nouveau paragraphe ou de celles qui concernent des notes de la Partie 1, les notes sont numérotées à partir de 101, y compris celles des articles ou paragraphes qui sont remplacés;
– les annexes qui sont ajoutées sont désignées AA, BB, etc.

NOTE 3 Les caractères d'imprimerie suivants sont utilisés:

– exigences: caractères romains;
– *modalités d'essais: caractères italiques;*
– notes: petits caractères romains.

Les termes en **gras** dans le texte sont définis à l'Article 3. Lorsqu'une définition concerne un adjectif, l'adjectif et le nom associé figurent également en gras.

NOTE 4 L'attention des Comités nationaux est attirée sur le fait que les fabricants d'appareils et les organismes d'essai peuvent avoir besoin d'une période transitoire après la publication d'une nouvelle publication IEC, ou d'une publication amendée ou révisée, pour fabriquer des produits conformes aux nouvelles exigences et pour adapter leurs équipements aux nouveaux essais ou aux essais révisés.

Le comité recommande que le contenu de cette publication soit entériné au niveau national au plus tôt 12 mois et au plus tard 36 mois après la date de publication.

Une liste de toutes les parties de la série IEC 60335, publiées sous le titre général *Appareils électrodomestiques et analogues – Sécurité*, se trouve sur le site web de l'IEC.

Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous webstore.iec.ch dans les données relatives au document recherché. À cette date, le document sera

- reconduit,
- supprimé,
- remplacé par une édition révisée, ou
- amendé.

IMPORTANT – Le logo "*colour inside*" qui se trouve sur la page de couverture de cette publication indique qu'elle contient des couleurs qui sont considérées comme utiles à une bonne compréhension de son contenu. Les utilisateurs devraient, par conséquent, imprimer cette publication en utilisant une imprimante couleur.

INTRODUCTION

Il a été considéré en établissant cette Norme internationale que l'exécution de ses dispositions était confiée à des personnes expérimentées et ayant une qualification appropriée.

La présente norme reconnaît le niveau de protection internationalement accepté contre les dangers électriques, mécaniques, thermiques, liés au feu et au rayonnement des appareils lorsqu'ils fonctionnent comme en usage normal en tenant compte des instructions du fabricant. Elle couvre également les situations anormales auxquelles on peut s'attendre dans la pratique et elle tient compte de la façon dont les phénomènes électromagnétiques peuvent affecter le fonctionnement sûr des appareils.

Cette norme tient compte autant que possible des exigences de l'IEC 60364, de façon à rester compatible avec les règles d'installation quand l'appareil est raccordé au réseau d'alimentation. Cependant, des règles nationales d'installation peuvent être différentes.

Si un appareil relevant du domaine d'application de la présente norme comporte également des fonctions couvertes par une autre partie 2 de l'IEC 60335, la partie 2 correspondante est appliquée à chaque fonction séparément, dans la limite du raisonnable. Si cela est applicable, on tient compte de l'influence d'une fonction sur les autres fonctions.

Lorsqu'une partie 2 ne comporte pas d'exigences complémentaires pour couvrir les risques traités dans la Partie 1, la Partie 1 s'applique.

NOTE 1 Cela signifie que les comités d'études responsables pour les parties 2 ont déterminé qu'il n'était pas nécessaire de spécifier des exigences particulières pour l'appareil en question en plus des exigences générales.

Cette norme est une norme de famille de produits traitant de la sécurité d'appareils et a préséance sur les normes horizontales et génériques couvrant le même sujet.

NOTE 2 Les normes horizontales et génériques couvrant un risque ne sont pas applicables parce qu'elles ont été prises en considération lorsque les exigences générales et particulières ont été étudiées pour la série de normes IEC 60335. Par exemple, dans le cas des exigences de température de surface pour de nombreux appareils, des normes génériques, comme l'ISO 13732-1 pour les surfaces chaudes, ne sont pas applicables en plus de la Partie 1 ou des parties 2.

Un appareil conforme au texte de la présente norme ne sera pas nécessairement jugé conforme aux principes de sécurité de la norme si, lorsqu'il est examiné et soumis aux essais, il apparaît qu'il présente d'autres caractéristiques qui compromettent le niveau de sécurité visé par ces exigences.

Un appareil utilisant des matériaux ou présentant des modes de construction différents de ceux décrits dans les exigences de cette norme peut être examiné et essayé en fonction de l'objectif poursuivi par ces exigences et, s'il est jugé pratiquement équivalent, il peut être estimé conforme aux principes de sécurité de la norme.

APPAREILS ÉLECTRODOMESTIQUES ET ANALOGUES – SÉCURITÉ –

Partie 2-79: Exigences particulières pour les appareils de nettoyage à haute pression et les appareils de nettoyage à vapeur

1 Domaine d'application

L'article de la Partie 1 est remplacé par le texte suivant.

La présente partie de l'IEC 60335 traite de la sécurité des appareils de nettoyage à haute pression sans commande de dispositif de déplacement, destinés à un usage domestique et commercial en intérieur ou en extérieur, de **pression assignée** supérieure ou égale à 2,5 MPa et inférieure ou égale à 35 MPa.

Elle s'applique également aux appareils de nettoyage à vapeur et aux parties des appareils de nettoyage à haute pression d'eau chaude qui comportent une phase vapeur dont la capacité ne dépasse pas 100 l et la **pression assignée** ne dépasse pas 2,5 MPa, le produit de la capacité et de la **pression assignée** ne dépassant pas 5 MPa·l.

Ceux-ci ne sont pas équipés d'une commande de dispositif de déplacement. Les systèmes d'alimentation suivants de la commande de la pompe à haute pression sont couverts:

– moteurs alimentés par le réseau de **tension assignée** inférieure ou égale à 250 V pour les machines monophasées et à 480 V pour les autres machines,
– moteurs alimentés par batteries,
– moteurs à combustion interne,
– moteurs hydrauliques ou pneumatiques.

La présente norme ne s'applique pas:

– aux machines à jet d'eau à haute pression dont la **pression assignée** dépasse 35 MPa;

NOTE 101 En Europe, ces machines sont couvertes par l'EN 1829-1.

– aux appareils de nettoyage à vapeur ou à liquide à usage domestique (IEC 60335-2-54);
– aux outils électroportatifs et portables à moteur (série IEC 60745, série IEC 61029, série IEC 62841);
– aux appareils à but médical (IEC 60601);
– aux pulvérisateurs agricoles (ISO 4254-6);
– aux nettoyants abrasifs solides, non liquides;
– aux machines destinées à être utilisées dans le cadre d'un processus de production;
– aux machines destinées à être utilisées dans des environnements corrosifs ou explosifs (poussière, vapeur ou gaz);
– aux machines destinées à être utilisées dans des véhicules ou à bord de navires ou d'avions;

NOTE 102 L'attention est attirée sur le fait que, dans de nombreux pays, des exigences supplémentaires relatives à l'utilisation en toute sécurité de l'équipement couvert peuvent être spécifiées par les organismes sanitaires nationaux, par les organismes nationaux responsables de la protection des travailleurs, par les organismes nationaux responsables de l'alimentation en eau et par des organismes similaires.

2 Références normatives

L'article de la Partie 1 est applicable avec les exceptions suivantes.

Addition:

IEC 60364-1, *Installations électriques à basse tension – Partie 1: Principes fondamentaux, détermination des caractéristiques générales, définitions*

IEC 61558-2-3, *Sécurité des transformateurs, bobines d'inductance, blocs d'alimentation et des combinaisons de ces éléments – Partie 2-3: Règles particulières et essais pour les transformateurs d'allumage pour brûleurs à gaz et combustibles liquides*

Remplacement:

IEC 61770:2008, *Appareils électriques raccordés au réseau d'alimentation en eau – Exigences pour éviter le retour d'eau par siphonnage et la défaillance des ensembles de raccordement*

3 Termes et définitions

L'article de la Partie 1 est applicable avec les exceptions suivantes.

3.1.9 *Addition:*
conditions de fonctionnement normal
conditions dans lesquelles la machine est mise en fonctionnement en usage normal

Cela désigne le fonctionnement au **débit assigné** et à la **pression assignée**, avec la buse et la **tuyauterie flexible** appropriées équipées, toutes les crépines et tous les filtres étant en condition de fonctionnement et propres et la **soupape de sortie** étant réglée à la **pression assignée**. Le **corps de chauffe**, le cas échéant, est mis en fonctionnement à la puissance maximale. Les machines à moteur électrique sont alimentées sous la **tension assignée**.

Le brûleur est mis en fonctionnement à la puissance assignée. Les machines conçues pour fonctionner à plusieurs puissances assignées sont en outre soumises à l'essai à la puissance la plus défavorable.

Sur les machines conçues pour être utilisées avec un tuyau de fumée, une section de celui-ci est reliée à la machine. Les déterminations relatives aux gaz d'évacuation sont effectuées dans ce tuyau.

Le courant d'air est appliqué comme recommandé dans les instructions.

3.1.12 *Addition:*
Les fonctions qui ne commandent pas le démarrage et l'arrêt du jet à haute pression qui sort de la buse ne sont pas considérées comme des commandes à distance. Les fonctions destinées à d'autres fins, par exemple la commande du débit de détergent ou d'eau, ne sont pas considérées comme des commandes à distance.

3.5.2 *Addition:*

Note 101 à l'article: Les appareils de nettoyage à haute pression sont considérés comme des appareils **portatifs** si le moteur/la pompe et le **pistolet**/la lance de pulvérisation/l'embout constituent une unité unique lorsqu'ils fonctionnent et sont tenus à la main. Les appareils de nettoyage à haute pression dans lesquels le moteur/la pompe et le **pistolet** sont séparés et reliés l'un à l'autre par une **tuyauterie flexible** haute pression ne sont pas considérés comme des appareils **portatifs**.

3.101
soupape de sortie
dispositif manométrique qui, lorsque la pression de la pompe dépasse une valeur prédéfinie, libère la pression et achemine l'excès de fluide vers le système d'entrée

En outre, ce dispositif permet la dérivation de la totalité du flux de la pompe à une pression réduite lorsque son flux de sortie est coupé

3.102
soupape de sécurité
dispositif manométrique qui, lorsque la pression de la pompe ou de l'appareil de nettoyage à vapeur dépasse une valeur prédéfinie, libère la pression et qui peut renvoyer l'excès de fluide ou de vapeur vers le système d'entrée ou dans l'atmosphère

3.103
pression assignée
pression de service maximale au niveau du générateur de pression en **conditions de fonctionnement normal**

3.104
pression admissible
pression maximale à laquelle une machine et/ou des parties de la machine peuvent être soumises sans compromettre sa sécurité

3.105
débit assigné
débit maximal à la **pression assignée** au niveau de la buse en **conditions de fonctionnement normal**

3.106
débit maximal
débit le plus élevé possible au niveau de la buse

Note 1 à l'article: En général, le **débit maximal** se produit à des pressions de service inférieures à la **pression assignée** et avec une buse prévue pour la pulvérisation d'**agents nettoyants**.

3.107
température assignée
température maximale de l'**agent nettoyant** en **conditions de fonctionnement normal**

3.108
manostat
dispositif qui, en réponse à une variation de pression du fluide, assure une fonction de commande à une valeur prédéfinie

3.109
interrupteur de débit
dispositif qui, en réponse à une variation de débit du fluide, assure une fonction de commande à une valeur prédéfinie

3.110
pistolet
dispositif pulvérisateur portatif dans lequel le débit d'**agent nettoyant** est régulé par un dispositif de commande manuel intégré

3.111
embout jet de crayon
embout qui fournit un jet d'eau concentré et parallèle

Note 1 à l'article: Les **embouts jet de crayon** sont également appelés injecteurs à aiguille, buses à jet bâton et buses à jet à zéro degré.

3.112
furet
dispositif de nettoyage de tuyau, relié à un **pistolet** et commandé par celui-ci, qui comprend un flexible haute pression et une tête de nettoyage équipée de buses

3.113
agent nettoyant
eau avec ou sans ajout de détergent gazeux, soluble ou miscible ou d'abrasif solide

3.114
corps de chauffe
dispositif de chauffage de l'**agent nettoyant** par électricité, gaz, combustible liquide ou échange de chaleur

3.115
allumage continu
allumage d'un brûleur à huile ou à gaz qui est maintenu en continu tant que le brûleur est opérationnel, que celui-ci soit utilisé ou non

3.116
commande de sécurité primaire
dispositif de commande qui répond directement aux propriétés de la flamme en détectant la présence de la flamme et qui, en cas de défaut d'allumage ou d'extinction involontaire de la flamme, provoque un arrêt de sécurité

Note 1 à l'article: Les commandes de sécurité primaires sont également appelées dispositifs de surveillance de flamme ou commande de sécurité de flamme.

3.117
tête de nettoyage motorisée
dispositif de nettoyage tenu ou guidé à la main, relié à la machine et équipé d'un moteur électrique intégré

3.118
accessoire basse pression
dispositif, relié à un **pistolet** et commandé par celui-ci, avec de larges orifices de buse qui génèrent une pression inférieure à la **pression assignée**

Note 1 à l'article: Les brosses de lavage, les lances à mousse et les éponges de lavage sont des exemples types d'**accessoires basse pression**.

3.119
machine guidée à la main
machine qu'il est nécessaire de déplacer sur le sol

3.120
tuyauterie flexible
assemblage de flexibles haute pression montés avec les raccords appropriés

3.121
protecteur
élément de la machine spécifiquement conçu pour assurer une protection au moyen d'une barrière matérielle, par exemple un boîtier, une gaine, un couvercle, un écran, une porte, une enveloppe ou une clôture; d'autres éléments de la machine qui remplissent une fonction opérationnelle essentielle, par exemple le cadre de la machine, peuvent également remplir une fonction de protection, mais ne sont pas désignés comme des **protecteurs**

Note 1 à l'article: Trois principaux types de **protecteurs** peuvent être distingués: les **protecteurs** fixes, les **protecteurs** de verrouillage mobiles et les **protecteurs** réglables. Des **protecteurs** de verrouillage mobiles sont exigés lorsqu'un accès fréquent est envisagé, tandis que des **protecteurs** fixes peuvent être utilisés lorsqu'un accès fréquent n'est pas envisagé.

3.122
opérateur
personne chargée de l'installation, du fonctionnement, du réglage, du nettoyage, du déplacement ou de l'**entretien par l'utilisateur** sur la machine

3.123
solution d'essai
solution composée de 20 g de NaCl et de 1 ml d'une solution de 28 % par masse de dodécylsulfate de sodium pour 8 l d'eau

Note 1 à l'article: La désignation chimique du dodécylsulfate de sodium est $C_{12}H_{25}NaSO_4$.

3.124
force de réaction
force qui réagit sur le dispositif pulvérisateur (et ainsi sur l'**opérateur**) du fait de la force d'action du jet d'eau qui sort de la buse

Note 1 à l'article: La **force de réaction** peut également être appelée force de recul. Dans d'autres normes relatives aux vibrations au niveau du système main-bras, le terme technique est force d'avance (série ISO 28927, par exemple) ou force de poussée (ISO 15230, par exemple), ce qui décrit une autre force. Pour les appareils de nettoyage à haute pression, la **force de réaction** est la dimension physique pertinente.

3.125
usage commercial
usage prévu des machines couvertes par la présente norme, c'est-à-dire des machines non destinées à une utilisation domestique normale par des personnes privées, mais qui peuvent représenter un danger pour le public

Cela signifie en particulier

– que les machines peuvent être utilisées par le personnel des entreprises de nettoyage, le personnel d'entretien, etc.;
– qu'elles sont utilisées dans des locaux commerciaux ou publics (c'est-à-dire les bureaux, les magasins, les hôtels, les hôpitaux, les écoles, etc.) ou dans les environnements industriels (usines, etc.) et dans l'industrie légère (ateliers, etc.).

Note 1 à l'article: L'**usage commercial** est également appelé utilisation professionnelle.

3.126
masse opérationnelle type
masse de la configuration la plus fréquente d'une machine prête à l'emploi y compris, le cas échéant, les éléments suivants:

– tuyau,
– dispositif pulvérisateur (lance et pistolet),
– embout normalisé,
– réservoir de carburant rempli au niveau maximal, et
– réservoir de détartrage rempli au niveau maximal,

à l'exception des éléments suivants:

– tout contenu du système hydraulique (flexibles d'alimentation et haute pression, pompe, réservoir d'**agent nettoyant**),
– tout accessoire, non exigé en conditions de fonctionnement normal (par exemple, embouts supplémentaires, bouteille de mousse), et
– **câble d'alimentation** avec fiche

Note 1 à l'article: La **masse opérationnelle type** est également appelée **ToM** (*Typical Operational Mass*).

4 Exigences générales

L'article de la Partie 1 est applicable avec les exceptions suivantes.

Remplacement du premier alinéa par le texte suivant:

Les machines doivent être construites de telle façon qu'elles fonctionnent en toute sécurité et qu'elles ne présentent aucun danger pour les personnes ou leur environnement en usage normal, même en cas de négligence, et durant l'installation, le réglage, l'entretien, le nettoyage, le dépannage ou le transport.

Addition:

Pour les besoins de la présente norme, le terme "appareil" tel qu'il est utilisé dans la Partie 1 doit être compris comme "machine".

5 Conditions générales d'essais

L'article de la Partie 1 est applicable avec les exceptions suivantes.

5.101 *La **solution d'essai** doit être stockée dans un réservoir étanche, à une température ambiante comprise entre 3 °C et 8 °C, et utilisée dans un délai de sept jours après sa préparation.*

5.102 *Les **dispositifs de protection** et les **soupapes de sécurité** doivent rester pleinement fonctionnels, mais ne doivent pas fonctionner en **conditions de fonctionnement normal**.*

5.103 *Si une exigence est fondée sur la masse de l'appareil, la **masse opérationnelle type** doit être appliquée.*

6 Classification

L'article de la Partie 1 est applicable avec les exceptions suivantes.

6.1 *Remplacement:*

Les machines doivent appartenir à l'une des classes suivantes d'après la protection contre les chocs électriques:

– **classe I**,
– **classe II**, ou
– **classe III**.

Cependant, les **appareils portatifs** et les parties tenues à la main qui contiennent des composants électriques des appareils de nettoyage à vapeur et des appareils de nettoyage à haute pression doivent être de la **classe II** ou de la **classe III**.

La vérification est effectuée par examen et par les essais applicables.

6.2 *Remplacement:*

Les machines doivent procurer un degré de protection contre la pénétration dangereuse d'eau conforme au Tableau 101.

Tableau 101 – Degré de protection contre la pénétration dangereuse d'eau

		Classe de protection (choc électrique)	Degré de protection (IEC 60529)
Appareils de nettoyage à vapeur	Pour usage intérieur uniquement	I- II	IPX4
		III	IPX3
	Pour usage extérieur	I-II-III	IPX5
	Parties tenues à la main	II	IPX7
		III	IPX3
Appareils de nettoyage à haute pression	**Appareils portatifs**	II-III	IPX7
	Autres types de machines	I-II-III	IPX5
	Parties tenues à la main	II-III	IPX7

Cependant, les **appareils installés à poste fixe** spécifiés pour une installation dans un local séparé, où ils ne seront pas soumis au déversement ou aux éclaboussures d'eau, doivent être au moins de classe IPX0.

La vérification est effectuée par examen et par les essais applicables.

7 Marquages et instructions

L'article de la Partie 1 est applicable avec les exceptions suivantes.

7.1 *Modification:*

Remplacer le quatrième tiret comme suit:

– le nom commercial et l'adresse du fabricant et, le cas échéant, ceux de son mandataire; toute adresse doit être suffisamment complète pour permettre une communication par courrier;

Addition:

Les machines doivent également porter les marquages suivants:

– numéro de série, le cas échéant;
– désignation de la machine et série ou type, permettant ainsi l'identification technique du produit. Cela peut être réalisé par une combinaison de lettres et/ou de chiffres;

NOTE 101 La désignation de la machine, la série ou le type inclut la référence du modèle ou du type, comme exigé dans la Partie 1.

NOTE 102 Les préfixes pour les valeurs de pression conformes à l'ISO 80000-1, tels que MPa, sont admis.

– année de construction, c'est-à-dire l'année durant laquelle a été achevé le processus de fabrication;
– **pression assignée** en pascals;
– **pression admissible** en pascals;
– **débit assigné** en litres par minute;
– **débit maximal** en litres par minute, si nécessaire. Le nombre de marquages de débit est limité à deux;
– **température assignée** maximale si elle est supérieure à 50 °C;
– puissance maximale du **corps de chauffe** en kW, le cas échéant (pour les dispositifs de chauffage électriques, la puissance d'entrée, pour les dispositifs de chauffage à gaz ou à huile, la puissance de sortie).

Les machines équipées de roues ou autres machines mobiles doivent porter le marquage de la masse de la **ToM** en kg.

Une étiquette jaune avec des lignes noires qui représente, en substance, les symboles de mise en garde conformes à la Figure 101 doit être fixée de manière permanente à la machine.

Les machines doivent également porter les marquages suivants, le cas échéant:

– Lorsque la surface d'un tuyau ou d'un conduit destiné aux gaz d'échappement du dispositif de chauffage dépasse un échauffement de 60 K, une indication de mise en garde doit être apposée à proximité de la surface chaude, mentionnant:

MISE EN GARDE Chaud. Ne pas toucher.

La hauteur des lettres doit être d'au moins 4 mm. Cette formulation peut être remplacée par le symbole IEC 60417-5041 (2002-10).

– les appareils de nettoyage à vapeur doivent être marqués du symbole IEC 60417-5597 (2014-06).
– Les machines qui ne sont pas destinées à être raccordées au réseau d'alimentation en eau potable doivent être marquées du symbole conforme à la Figure 104, en couleurs comme représenté ou bien en monochrome.
– Les machines destinées à une utilisation à l'intérieur et alimentées par des moteurs à combustion interne, à l'exception des moteurs au GPL, doivent être marquées du symbole conforme à la Figure 105. La représentation de ce symbole en couleur monochrome est acceptable.

7.1.101 Tous les flexibles haute pression doivent porter les marquages suivants:

– pression au moins égale à la **pression admissible** en pascals;

NOTE Les préfixes pour les valeurs de pression conformes à l'ISO 80000-1, tels que MPa, sont admis.

– température maximale en degrés Celsius;
– nom commercial du fabricant du flexible et date de production. Ces données peuvent être codées.

La vérification est effectuée par examen.

7.1.102 Tous les accessoires haute pression (par exemple, **pistolet**, lance de pulvérisation) doivent porter les marquages suivants:

– pression au moins égale à la **pression admissible** en pascals;

NOTE Les préfixes pour les valeurs de pression conformes à l'ISO 80000-1, tels que MPa, sont admis.

– température maximale en degrés Celsius.

La vérification est effectuée par examen.

7.1.103 Les **têtes de nettoyage motorisées** doivent porter les marquages suivants:

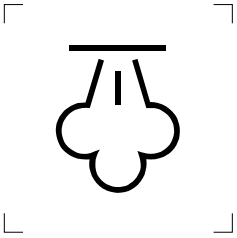
– la **tension assignée** ou la **plage assignée de tensions** en volts;
– la **puissance d'entrée assignée** en watts;
– le nom, la marque commerciale ou la marque d'identification du fabricant ou du fournisseur agréé;
– la référence du modèle ou du type;
– année de construction, c'est-à-dire l'année durant laquelle a été achevé le processus de fabrication;
– la masse de la configuration la plus courante en kg.

Les **têtes de nettoyage motorisées** pour appareils de nettoyage à aspiration d'eau, à l'exception de celles de **construction de classe III** dont la tension de service ne dépasse pas 24 V, doivent être marquées du symbole IEC 60417-5935 (2012-09).

NOTE Ce symbole est un signal d'information et, excepté pour les couleurs, les règles de l'ISO 3864-1 s'appliquent.

La vérification est effectuée par examen.

7.6 *Addition:*



[symbole IEC 60417-5597 (2014-06)] appoint de vapeur

[symbole IEC 60417-5041 (2002-10)] attention, surface très chaude

7.12 *Modification:*

Remplacer le quatrième alinéa par le texte suivant.

Cette machine n'est pas destinée à être utilisée par des personnes (y compris des enfants) qui possèdent des capacités physiques, sensorielles ou mentales réduites, ou qui ont un manque d'expérience et de connaissance.

Addition:

La page de couverture de la notice d'instructions doit inclure, en substance, la mise en garde suivante:

AVERTISSEMENT Lire les instructions avant toute utilisation de la machine.

Cette formulation peut être remplacée par les symboles ISO 7000-0434A (2004-01) et ISO 7000-0790 (2004-01).

Les instructions doivent contenir au moins les informations suivantes:

– le nom commercial et l'adresse complète du fabricant et, le cas échéant, ceux de son mandataire;

– la désignation de la machine et la série ou le type, à l'exception du numéro de série, permettant ainsi l'identification technique du produit. Cela peut être réalisé par une combinaison de lettres et/ou de chiffres;

NOTE 101 La désignation de la série ou du type peut être absente, tant que l'identification du produit est assurée.

– la description générale de la machine;

– l'usage prévu de la machine et de l'équipement auxiliaire couverts par le domaine d'application de la présente norme;

NOTE 102 Les lampes et les brosses motorisées exigées par la présente norme sont, entre autres, des exemples d'équipements auxiliaires.

NOTE 103 D'autres exigences concernant les instructions en version papier sont disponibles au 7.12.9.

– la signification des symboles utilisés sur la machine et dans les instructions, conformément aux exigences de la présente norme;

– les dessins, schémas, descriptions et explications nécessaires à l'utilisation en toute sécurité, l'entretien et la réparation de la machine et afin d'en vérifier le fonctionnement correct;

– les informations relatives à la mise en service, au fonctionnement en toute sécurité, à la manipulation, au transport et au stockage de la machine, en tenant compte de sa masse;

– les instructions qui permettent de réaliser le réglage et l'entretien en toute sécurité, y compris les mesures de protection qu'il convient de prendre pendant ces opérations;

– les conditions dans lesquelles la machine satisfait à l'exigence de stabilité pendant son utilisation, son transport, son assemblage, son démontage lorsqu'elle est hors service, pendant des essais ou des arrêts prévisibles;

– la procédure à suivre afin d'éviter des situations dangereuses en cas d'accident (par exemple, contact ou déversement de détergents, d'acide de batterie, de carburant ou d'huile) ou de panne de l'équipement (par exemple, crevaison ou défaillance d'un composant).

Les instructions doivent indiquer le type et la fréquence des examens et de l'entretien exigés pour assurer une utilisation en toute sécurité, y compris les mesures d'entretien préventif. Elles doivent, le cas échéant, fournir les spécifications des pièces de rechange si elles compromettent la santé et la sécurité de l'**opérateur**.

En outre, les instructions doivent fournir les informations suivantes, si cela est applicable:

– des informations concernant l'équipement de protection individuelle (EPI) approprié pour les appareils de nettoyage à haute pression en fonctionnement, par exemple bottes de sécurité, gants de sécurité, casques de sécurité avec visières, protections auditives, etc., qui doit être porté lors de l'utilisation de l'appareil;

– des instructions doivent être données en ce qui concerne les **furets**, par exemple "insérer le flexible au-delà du repère rouge avant de mettre la machine en fonctionnement afin d'empêcher l'**opérateur** d'être atteint par le jet d'eau ou par des débris/eaux usées";

– des informations pertinentes concernant le raccordement au réseau d'alimentation en eau, y compris la pression d'entrée, si elle n'est pas indiquée sur la plaque signalétique;

– des informations pertinentes concernant les embouts à utiliser, le danger présenté par la **force de réaction** et le couple exercé soudainement sur l'ensemble de pulvérisation lors de l'utilisation du **pistolet**;

– les **forces de réaction** si elles sont supérieures à 20 N;

– le fonctionnement des dispositifs de sécurité, par exemple **soupapes de sécurité**, **interrupteurs de débit**, **manostats**;

– pour les machines qui fonctionnent sur batterie, les précautions à prendre pour le chargement en toute sécurité;

– des informations concernant la mise au rebut en toute sécurité des batteries;

– si des jantes divisées sont utilisées pour les pneus, des instructions doivent être données pour le remplacement sûr des pneus;

– pour les machines qui fonctionnent sur secteur, l'indication suivante, en substance:

Le raccordement à l'alimentation électrique doit être réalisé par un électricien qualifié et satisfaire à l'IEC 60364-1. Il est vivement recommandé que l'alimentation électrique de cette machine comporte un dispositif à courant différentiel résiduel qui coupe l'alimentation si le courant de fuite à la terre dépasse 30 mA en 30 ms ou un dispositif qui vérifie le circuit de terre.

– pour les machines à huile sans **commande de sécurité primaire**, l'indication suivante, en substance:

La machine doit être surveillée pendant le fonctionnement.

– pour les appareils installés à poste fixe destinés à une utilisation dans un local indépendant et sec, et pour les appareils de nettoyage à vapeur destinés à une utilisation à l'intérieur uniquement, l'indication suivante, en substance:

Ne pas éclabousser ou lessiver.

Pour les machines destinées à être raccordées au réseau d'alimentation en eau potable, les instructions doivent fournir les informations suivantes, si cela est applicable:

– des informations pertinentes pour le raccordement correct au réseau d'alimentation en eau potable;

– la longueur et la qualité nécessaires du flexible d'alimentation en eau;

– les mesures nécessaires pour la conversion du raccordement d'une alimentation à partir du réseau d'alimentation en eau potable vers une alimentation à partir d'autres sources d'eau.

Pour les machines qui ne sont pas destinées à être raccordées au réseau d'alimentation en eau potable, les instructions doivent fournir les informations suivantes, si cela est applicable:

– des informations pertinentes pour le raccordement correct à l'alimentation en eau;

– des informations pertinentes concernant l'opération d'aspiration;

– la longueur et la qualité nécessaire du flexible d'alimentation en eau;

– les mesures nécessaires pour la conversion du raccordement d'une alimentation à partir d'autres sources d'eau vers une alimentation à partir du réseau d'alimentation en eau potable.

7.12.9 *Ajouter le texte suivant après le deuxième alinéa:*

A la place d'une version papier, un format électronique peut être utilisé si les conditions suivantes sont respectées:

– les instructions de déballage, d'installation et d'accès à l'ensemble des instructions de sécurité sur un dispositif de lecture approprié doivent être fournies sur papier ou inscrites sur la machine,

– le dispositif de lecture approprié doit être fourni avec la machine ou être nécessaire pour faire fonctionner la machine, et

– le contenu des instructions électroniques doit être fourni avec la machine.

Pour l'utilisation fonctionnelle non relative à la sécurité, le manuel d'utilisation peut être fourni au format électronique:

– sur un affichage électronique adapté intégré à l'appareil, ou

– sur un dispositif électronique distinct fourni avec l'appareil, ou

par le biais d'un lien vers un site web, où il peut être consulté et/ou téléchargé.

7.12.101 Les instructions doivent inclure des mises en garde sur les façons dont la machine ne doit pas être utilisée, et qui sont susceptibles de se produire selon l'expérience du fabricant. Elles doivent au moins inclure en substance, si elles sont applicables, les mises en garde suivantes:

– MISE EN GARDE Cette machine a été conçue pour être utilisée avec l'agent nettoyant fourni ou recommandé par le fabricant. L'utilisation d'autres agents nettoyants ou produits chimiques peut compromettre la sécurité de la machine.

– MISE EN GARDE Lors de l'utilisation d'appareils de nettoyage à haute pression, des aérosols peuvent se former. L'inhalation d'aérosols peut être dangereuse pour la santé.

– MISE EN GARDE Les jets à haute pression peuvent être dangereux en cas de mauvaise utilisation. Le jet ne doit pas être dirigé vers des personnes, des équipements électriques sous tension ou la machine elle-même.

– MISE EN GARDE Ne pas utiliser la machine à portée de personnes à moins qu'elles portent des vêtements de protection.

– MISE EN GARDE Ne pas diriger le jet sur vous-même ou d'autres personnes dans le but de nettoyer vos vêtements ou vos chaussures.

– MISE EN GARDE Risque d'explosion – Ne pas pulvériser de liquides inflammables.

– MISE EN GARDE Les appareils de nettoyage à haute pression ne doivent pas être utilisés par des enfants ou par du personnel non formé.

– MISE EN GARDE Les flexibles haute pression, les raccords et les couplages sont importants pour la sécurité de la machine. Utiliser uniquement les flexibles, raccords et couplages recommandés par le fabricant.

– MISE EN GARDE Pour assurer la sécurité de la machine, utiliser uniquement des pièces de rechange d'origine fournies par le fabricant ou approuvées par le fabricant.

– MISE EN GARDE L'eau qui s'écoule par les dispositifs antiretour est considérée comme non potable.

– Une mise en garde qui précise que la machine doit être déconnectée de sa source d'alimentation durant le nettoyage ou l'entretien et lors du remplacement de pièces ou de la conversion de la machine pour une autre fonction:

  - en retirant la fiche de prise de courant du socle de prise de courant pour les machines qui fonctionnent sur secteur;
  - pour les machines qui fonctionnent sur batterie, en déconnectant de manière sécurisée au moins la borne positive ou la borne négative de la batterie ou en utilisant une méthode équivalente (appareil de déconnexion; pour les machines qui ne sont pas à TBTS, les deux bornes doivent être déconnectées);
  - en enlevant la clé de contact et en déconnectant la batterie pour les machines qui fonctionnent sur moteur à combustion interne.

NOTE 1 Lorsqu'il n'existe aucune clé de contact ni aucune batterie, la déconnexion peut être effectuée par des moyens équivalents.

– MISE EN GARDE Ne pas utiliser la machine si le câble d'alimentation ou des parties importantes de la machine sont endommagés, par exemple les dispositifs de sécurité, les flexibles haute pression, le pistolet.

– MISE EN GARDE Les rallonges électriques inadaptées peuvent être dangereuses. Si une rallonge électrique est utilisée, elle doit être adaptée à une utilisation à l'extérieur, et le raccordement doit maintenu au sec et à distance du sol. Pour cela, il est recommandé d'utiliser un enrouleur de câble qui maintient la prise à au moins 60 mm du sol.

NOTE 2 Les rallonges électriques sont également appelées câbles d'extension.

– MISE EN GARDE Ne pas utiliser les machines qui fonctionnent sur moteur à combustion à l'intérieur, sauf si une ventilation adéquate est évaluée par une personne compétente ou par un organisme responsable du travail.

– MISE EN GARDE S'assurer que les gaz d'échappement ne sont pas émis à proximité des entrées d'air.

– MISE EN GARDE Pour les machines chauffées au gaz ou à l'huile, il est important d'assurer une ventilation adéquate et de veiller à ce que les gaz soient correctement évacués.

– MISE EN GARDE Toujours désactiver l'interrupteur d'isolement du réseau lorsque la machine est laissée sans surveillance.

Les instructions applicables aux machines dans lesquelles du combustible gazeux ou liquide est utilisé doivent également comprendre la spécification du combustible adéquat et, en substance, la mise en garde suivante:

– MISE EN GARDE Des combustibles inadéquats ne doivent pas être utilisés, car ils peuvent s'avérer dangereux.

Les instructions applicables aux machines qui comportent un flexible conducteur et qui fonctionnent sous une tension autre que la **très basse tension de sécurité** doivent également comprendre, en substance, la mise en garde suivante:

– MISE EN GARDE Ce flexible comporte des raccordements électriques: ne pas l'utiliser pour recueillir de l'eau et ne pas l'immerger dans l'eau pour le nettoyage.

Les instructions pour les machines qui ne sont pas destinées à un usage commercial doivent comporter, en substance, la mise en garde suivante:

– MISE EN GARDE Selon l'application, des buses avec écran peuvent être utilisées pour les appareils de nettoyage à haute pression, réduisant considérablement les émissions d'aérosols aqueux. Cependant, toutes les applications n'autorisent pas l'utilisation d'un tel dispositif. Si les buses avec écran ne sont pas applicables pour la protection contre les aérosols, un masque respiratoire de classe FFP 2 ou équivalent peut être nécessaire, en fonction de l'environnement de nettoyage.

Les instructions pour les machines destinées à un usage commercial doivent comporter, en substance, la mise en garde suivante:

– MISE EN GARDE L'employeur doit procéder à une appréciation du risque afin de spécifier les mesures de protection nécessaires concernant les aérosols, en fonction de la surface à nettoyer et de son environnement. Les masques respiratoires de classe FFP 2, équivalents ou de classe supérieure conviennent pour la protection contre les aérosols aqueux.

7.12.102 Informations relatives au bruit

NOTE Les instructions peuvent inclure des informations relatives aux émissions de bruit aérien, indiquées au CC.2.7.

7.12.103 Informations relatives aux vibrations

NOTE Les instructions peuvent comprendre des informations relatives aux émissions de vibrations, indiquées à l'Article DD.2.

7.13 *Addition:*

Les termes "Instructions d'origine" doivent figurer dans la ou les langues vérifiées par le fabricant.

7.14 *Addition:*

La hauteur du symbole IEC 60417-5935 (2012-09) doit être d'au moins 15 mm.

La vérification est effectuée par mesurage.

8 Protection contre l'accès aux parties actives

L'article de la Partie 1 est applicable avec les exceptions suivantes.

8.1 *Addition:*

Les **agents de nettoyage** à base d'eau sont considérés comme conducteurs.

8.1.1 *Modification:*

Remplacer, au deuxième alinéa, "masse" *par* "**ToM**".

Ajouter le texte suivant après le sixième alinéa:

NOTE Les appareils à **usage commercial** conformes à la présente norme ne sont pas considérés comme étant destinés à être installés dans une zone ouverte au public.

9 Démarrage des appareils à moteur

L'article de la Partie 1 est remplacé par le texte suivant:

Il ne doit être possible de démarrer la machine que par l'actionnement volontaire d'un dispositif de commande prévu à cet effet. La même exigence s'applique au redémarrage de la machine après un arrêt, quelle qu'en soit la cause.

La vérification est effectuée par examen et par essai.

10 Puissance et courant

L'article de la Partie 1 est applicable avec l'exception suivante.

10.101 En **conditions de fonctionnement normal**, la pression ne doit pas s'écarter de plus de ± 10 % de la **pression assignée**.

La vérification est effectuée par mesurage. Au cours du mesurage, l'échangeur de chaleur, le cas échéant, est réglé à la température de l'eau la plus élevée en mode de nettoyage à haute pression.

NOTE Les crêtes de pression, détectées par un manomètre à taux d'échantillonnage élevé, sont moyennées pour déterminer la pression.

11 Echauffements

L'article de la Partie 1 est applicable avec les exceptions suivantes.

11.4 *Modification:*

*Remplacer "**appareils chauffants**" par "**appareils chauffants** électriques".*

11.7 *Addition:*

Les machines sont mises en fonctionnement jusqu'à l'établissement des conditions de régime.

11.8 *Addition au Tableau 3, à la fin de la note de bas de tableau a:*

Les moteurs hermétiquement clos sont considérés comme étanches.

11.101 La température maximale des gaz d'évacuation ne doit pas dépasser 400 °C.

La quantité de fumée contenue dans les gaz d'évacuation ne doit pas dépasser:

– pour les brûleurs à pulvérisation et à paroi, la quantité qui correspond à un indice de noircissement de Shell-Bacharach N° 2;
– pour les brûleurs à vaporisation, la quantité qui correspond à un indice de noircissement de Shell-Bacharach N° 2.

La quantité de monoxyde de carbone (CO) contenue dans les gaz d'évacuation ne doit pas dépasser 0,04 % (volume) en l'absence d'air et à sec.

La vérification est effectuée par mesurage dans les conditions spécifiées du 11.2 au 11.7, en tenant compte de ce qui suit:

Les observations d'essai exigées sont enregistrées pour toute puissance d'entrée de la machine. Après 15 min de fonctionnement, des échantillons de gaz d'évacuation sont prélevés en un point situé entre la sortie du tuyau de fumée et la hotte de tirage. Le fonctionnement est considéré comme stable lorsque trois échantillons consécutifs prélevés à 15 min d'intervalle présentent des valeurs d'analyse cohérentes.

11.102 Les flexibles, lances de pulvérisation et accessoires qui contiennent l'**agent nettoyant** doivent supporter au moins la **température assignée**.

La vérification est effectuée par mesurage dans les conditions spécifiées du 11.2 au 11.7.

11.103 Une protection adéquate contre le contact involontaire de l'utilisateur avec des parties métalliques chaudes doit être assurée. Les moyens de protection doivent être considérés comme une enveloppe extérieure.

La vérification est effectuée par examen et par mesurage dans les conditions spécifiées du 11.2 au 11.7.

11.104 Lorsque du combustible liquide est utilisé, la température du combustible dans le réservoir ne doit pas dépasser une température inférieure de 10 °C à la température du point d'éclair, s'il existe une source d'inflammation en contact avec le mélange air/combustible.

La vérification est effectuée par mesurage dans les conditions spécifiées du 11.2 au 11.7.

12 Charge des batteries à ions métalliques

L'article de la Partie 1 est applicable.

13 Courant de fuite et rigidité diélectrique à la température de régime

L'article de la Partie 1 est applicable.

14 Surtensions transitoires

L'article de la Partie 1 est applicable.

15 Résistance à l'humidité

L'article de la Partie 1 est applicable avec les exceptions suivantes.

15.2 *Remplacement:*

Toutes les machines doivent être construites de telle façon que

– le débordement de liquides dû aux **conditions de fonctionnement normal**,
– le remplissage incluant le remplissage excessif, et
– le renversement des **machines guidées à la main**, des **appareils portatifs** et des machines qui ne sont pas stables

n'impactent pas leur isolation électrique.

Les réservoirs prévus pour les liquides suivants sont exclus des essais:

– huile hydraulique;
– liquide de refroidissement;
– carburant (diesel, essence, GPL).

La vérification est effectuée par l'essai suivant.

La machine est placée sur un support incliné à un angle de 10° par rapport à l'horizontale, le réservoir de liquide, le cas échéant, étant rempli à la moitié du niveau indiqué dans les instructions. Une machine est considérée comme n'étant pas stable si elle se renverse lorsqu'une force de 180 N est appliquée au sommet de la machine, dans la direction horizontale la plus défavorable.

*Les machines équipées d'une **fixation du type X**, à l'exception de celles qui ont un câble spécialement préparé, sont équipées d'un câble souple du type le plus léger admis et de la section la plus petite spécifiée dans le Tableau 11.*

*Les **machines guidées à la main**, les **appareils portatifs** et les machines qui ne sont pas stables sont ensuite inclinés, avec les réservoirs de la cabine de flottaison entièrement remplis, le cas échéant, avec le détergent le plus conducteur dans le réservoir de détergent, le cas échéant, et avec le couvercle en place, à partir de la position normale d'utilisation la plus défavorable, puis laissés dans cette position pendant 5 min, sauf si la machine revient automatiquement à sa position normale d'utilisation.*

Les réservoirs de liquide qui sont remplis à la main sont complètement remplis d'une solution saline d'eau qui contient approximativement 1 % de NaCl et 0,6 % d'agent de rinçage, une

quantité supplémentaire de cette solution égale à 15 % de la capacité du réservoir ou 0,25 l, suivant la valeur la plus élevée, est alors versée régulièrement en 1 min.

Tout agent de rinçage non ionique disponible dans le commerce peut être utilisé, mais en cas de doute concernant les résultats d'essai, l'agent de rinçage doit présenter les propriétés suivantes:

– viscosité, 17 mPa s;
– pH, 2,2 (1 % dans l'eau)
– et sa composition doit comprendre les substances suivantes

– Plurafac ® LF 221[1]	15,0 % par masse
– Cumène sulfonate (solution à 40 %)	11,5 % par masse
– Acide citrique (anhydre)	3,0 % par masse
– Eau désionisée	70,5 % par masse

*Les **appareils portatifs** et les machines qui ne sont pas stables sont ensuite renversés, avec les réservoirs de la cabine de flottaison entièrement remplis, le cas échéant, avec le détergent le plus conducteur dans le réservoir de détergent, le cas échéant, et avec le couvercle en place, à partir de la position normale d'utilisation la plus défavorable, puis laissés dans cette position pendant 5 min, sauf si la machine revient automatiquement à sa position normale d'utilisation.*

*Les **têtes de nettoyage motorisées** sont placées dans un bac dont la base est de niveau avec la surface de support de la machine. Le bac est rempli de **solution d'essai** jusqu'à 5 mm au-dessus de sa base, ce niveau étant maintenu tout au long de l'essai. La machine, incluant la **tête de nettoyage motorisée**, est mise en fonctionnement jusqu'à ce que son réservoir de liquide soit totalement plein, puis pendant 5 min supplémentaires.*

Après chacun de ces essais, la machine doit satisfaire à l'essai de rigidité diélectrique décrit au 16.3.

*Il ne doit pas y avoir de trace de liquide sur l'isolation qui réduise les **distances dans l'air** ou les **lignes de fuite** au-dessous des valeurs spécifiées à l'Article 29.*

15.3 *Modification:*

L'humidité relative doit être de (93 ± 6) %.

15.101 Les **têtes de nettoyage motorisées** doivent résister aux liquides qui peuvent venir en contact avec elles en usage normal.

L'essai suivant n'est pas applicable aux **têtes de nettoyage motorisées** de **construction de classe III** et dont la **tension de service** ne dépasse pas 24 V.

La vérification est effectuée par les quatre essais suivants.

*La **tête de nettoyage motorisée** est soumise à un essai de chocs décrit dans l'IEC 60068-2-75, la valeur de l'impact étant de 2 J. La **tête de nettoyage motorisée** est fixée sur un support rigide et trois coups sont appliqués à chaque point de l'enveloppe potentiellement faible.*

[1] Plurafac ® LF 221 est l'appellation commerciale d'un produit distribué par BASF. Cette information est donnée à l'intention des utilisateurs du présent document et ne signifie nullement que l'IEC approuve l'emploi du produit ainsi désigné.

Elle est ensuite soumise à l'essai de chute libre, méthode 1, de l'IEC 60068-2-31. Elle est lâchée 4 000 fois d'une hauteur de 100 mm sur une plaque d'acier d'une épaisseur d'au moins 15 mm. Elle est lâchée:

– *1 000 fois sur son côté droit;*
– *1 000 fois sur son côté gauche;*
– *1 000 fois sur sa face avant;*
– *1 000 fois sur sa surface de nettoyage.*

*La **tête de nettoyage motorisée** est ensuite soumise à l'essai décrit dans l'IEC 60529:1989, 14.2.4, tel que modifié par l'IEC 60529:1989/AMD2:2013, à l'aide de la **solution d'essai**.*

*La **tête de nettoyage motorisée** doit être mise en fonctionnement dans un récipient à fond plat rempli d'une solution saline d'eau qui contient environ 1 % de NaCl, de manière à maintenir une profondeur de 3,0 mm d'eau. Le récipient doit être d'une taille suffisante pour que la **tête de nettoyage motorisée** s'y déplace librement; celle-ci doit fonctionner avec ou sans raccordement à l'appareil de nettoyage à haute pression pendant 15 min, selon le cas. La **tête de nettoyage motorisée** doit alors satisfaire à l'essai de rigidité diélectrique décrit au 16.3, la tension étant appliquée entre les **parties actives** et la **solution d'essai**. Il ne doit pas y avoir de trace de solution saline sur l'isolation qui réduise les **distances dans l'air** ou les **lignes de fuite** au-dessous des valeurs spécifiées à l'Article 29.*

16 Courant de fuite et rigidité diélectrique

L'article de la Partie 1 est applicable avec l'exception suivante.

16.3 *Addition:*

Les flexibles conducteurs, à l'exception de leurs connexions électriques, sont immergés pendant 1 h dans solution saline d'eau qui contient environ 1 % de NaCl, à une température de 20 °C ± 5 °C. Alors que le flexible est encore immergé, une tension de 2 000 V est appliquée pendant 5 min entre chaque conducteur et tous les autres conducteurs raccordés ensemble. Une tension de 3 000 V est ensuite appliquée pendant 1 min entre tous les conducteurs et la solution saline.

17 Protection contre la surcharge des transformateurs et des circuits associés

L'article de la Partie 1 est applicable.

18 Endurance

L'article de la Partie 1 est applicable avec les exceptions suivantes.

18.101 L'isolation, les contacts et les connexions ne doivent pas être endommagés et ne doivent pas se desserrer sous l'effet des échauffements, vibrations, etc.

*Pour les **appareils à moteur**, la vérification est effectuée par les essais décrits au 18.102 et 18.106, et par les essais supplémentaires décrits du 18.103 au 18.105, selon le cas.*

*Au cours des essais décrits au 8.102 et 18.103, les **dispositifs de protection** contre les surcharges et les **soupapes de sécurité** ne doivent pas fonctionner.*

18.102 *La machine est mise en fonctionnement dans les **conditions de fonctionnement normal** et à la **tension assignée** pendant 96 h, moins la durée d'exécution nécessaire pour les essais des Articles 11 et 13.*

La machine est mise en fonctionnement en continu, ou pendant un nombre correspondant de périodes, chaque période étant d'au moins 8 h.

La durée de fonctionnement spécifiée est la durée d'exécution réelle.

Si la machine comporte plusieurs moteurs, les durées de fonctionnement spécifiées s'appliquent à chaque moteur séparément.

L'essai doit être réalisé avec un ***agent nettoyant*** *qui n'a pas été chauffé.*

Toutes les ***tuyauteries flexibles*** *sont enroulées sur du béton lors de cet essai.*

18.103 *Les machines sont mises en marche dans les* ***conditions de fonctionnement normal****, 50 fois à une tension égale à 1,1 fois la* ***tension assignée*** *et 50 fois à une tension égale à 0,85 fois la* ***tension assignée****, la durée de chaque période d'alimentation étant au moins égale à dix fois la durée nécessaire à partir du démarrage à pleine vitesse, mais pas inférieure à 10 s.*

Un intervalle suffisant pour empêcher la surchauffe et au moins égal à trois fois la période d'alimentation est introduit après chaque période d'exécution.

18.104 *Les machines équipées d'un interrupteur centrifuge ou autre interrupteur de démarrage automatique sont mises en marche 10 000 fois dans les* ***conditions de fonctionnement normal*** *et à une tension égale à 0,9 fois la* ***tension assignée****, le cycle de fonctionnement étant celui spécifié au 18.103.*

Si l'échauffement d'une partie de la machine dépasse l'échauffement déterminé au cours de l'essai décrit au 11.8, un refroidissement forcé ou des périodes de repos peuvent être appliqués, ces dernières étant exclues de la durée de fonctionnement spécifiée. Si un refroidissement forcé est appliqué, il ne doit pas altérer le flux d'air de la machine ni redistribuer les dépôts de carbone.

18.105 *Les machines équipées de* ***coupe-circuits thermiques à réarmement automatique*** *doivent fonctionner de manière fiable en conditions de surtension.*

La vérification est effectuée par l'essai suivant.

La machine est alimentée à une tension égale à 1,1 fois la ***tension assignée****, sous une charge telle que le* ***coupe-circuit thermique*** *est activé en quelques minutes, jusqu'à ce que celui-ci ait effectué 200 cycles de fonctionnement.*

18.106 *Après les essais du 18.102 au 18.105, la machine doit satisfaire aux essais de l'Article 16.*

Les connexions, poignées, ***protecteurs****, protections pour brosses et autres accessoires ou composants ne doivent pas s'être desserrés, et il ne doit pas y avoir de détérioration qui compromette la sécurité en usage normal.*

19 Fonctionnement anormal

L'article de la Partie 1 est applicable avec les exceptions suivantes.

19.1 *Addition:*

L'essai décrit au 19.7 n'est pas applicable au moteur de pompe des machines triphasées. Les machines équipées de socles femelles de connecteurs conformes aux feuilles de norme de l'IEC 60320-3 et de socles des prises de courant sont soumises à l'essai décrit au 19.104.

19.5 *Modification:*

Au quatrième alinéa, supprimer le texte suivant: "utilisés dans un système équipé de fiches polarisées destinées à être raccordées à des socles de prise de courant polarisés"

19.7 *Addition:*

*Les **têtes de nettoyage motorisées** sont soumises à l'essai avec la brosse rotative ou le dispositif similaire bloqué pendant 30 s.*

19.11.2 *Addition:*

Les contacteurs qui satisfont aux exigences de la norme IEC appropriée ne doivent pas être débranchés ni court-circuités, à condition que la norme appropriée couvre les conditions qui se produisent dans la machine. Cependant, le blocage en position "marche" des contacts principaux d'un contacteur destiné à mettre en fonctionnement ou arrêter les éléments électriques chauffants en usage normal est considéré comme une condition de défaut, sous réserve que la machine ne possède pas au moins deux systèmes de contacts raccordés en série. Cette condition est remplie, par exemple, en installant deux contacteurs qui fonctionnent indépendamment l'un de l'autre ou en installant un contacteur avec deux armatures indépendantes qui agissent sur deux ensembles indépendants de contacts principaux.

19.101 Pour les machines à huile et les machines à gaz avec ventilateur, ce qui suit s'applique.

Lorsque l'alimentation en air de combustion d'une machine avec un tirage assisté par ventilateur est partiellement ou totalement bloquée, soit la machine doit continuer à fonctionner en toute sécurité, soit l'alimentation en combustible doit être coupée.

La vérification est effectuée suivant 11.101 dans les conditions d'essai spécifiées au 19.101.1 et 19.101.2.

19.101.1 *Le tuyau d'échappement est bloqué à l'aide d'une plaque métallique plate de surface suffisante pour couvrir l'intégralité de l'ouverture. Elle est placée de la façon la plus défavorable au-dessus du tuyau.*

19.101.2 *La machine étant en **conditions de fonctionnement normal**, l'entrée d'air de combustion est restreinte. L'entrée d'air de l'ensemble brûleur est bloquée à l'aide d'une serviette éponge de dimensions adéquates, introduite avec une force qui ne dépasse pas 1 N.*

19.102 Pour les machines à gaz atmosphériques, ce qui suit s'applique.

19.102.1 La sortie de la hotte de tirage étant bloquée, la concentration en monoxyde de carbone dans un échantillon exempt d'air des gaz d'évacuation ne doit pas dépasser 0,04 %.

La vérification est effectuée par examen et par l'essai suivant.

La machine est soumise à l'essai dans une atmosphère avec une alimentation normale en oxygène. La machine est mise en fonctionnement pendant au moins 15 min à la pression d'essai normale. La sortie de la hotte de tirage est ensuite bloquée et un échantillon des gaz d'évacuation est obtenu et analysé.

La quantité de monoxyde de CO contenue dans les gaz d'évacuation ne doit pas dépasser 0,04 % (volume) en l'absence d'air et à sec.

19.102.2 Des pressions de tirage descendant totales comprises entre 0 Pa et 13 Pa imposées à la sortie de la hotte de tirage ne doivent pas éteindre les flammes du brûleur principal ni provoquer le retour, l'élévation, le flottement ou la combustion de celles-ci à l'extérieur de la machine, ni produire une concentration en monoxyde de carbone dans un échantillon exempt d'air des gaz d'évacuation supérieure à 0,04 %.

La vérification est effectuée par examen et par l'essai suivant.

La machine est soumise à l'essai dans une atmosphère avec une alimentation normale en oxygène. La machine est mise en fonctionnement pendant au moins 15 min à la pression d'essai normale. Une section droite du tuyau de fumée, d'un diamètre approprié et d'une longueur au moins égale à dix diamètres de tuyau, est fixée directement à la sortie de la hotte de tirage et raccordée à la sortie d'une soufflerie. La pression de tirage totale est mesurée avec une résolution de 1 Pa dans une section droite du tuyau de fumée, en un point situé à mi-chemin entre ses extrémités, de sorte que la tête de mesure coïncide avec l'axe du tuyau de fumée.

Le tirage dans le tuyau de fumée varie de la pression totale minimale à la valeur spécifiée, et l'effet est consigné. Un échantillon des gaz d'évacuation est obtenu et analysé.

La quantité de monoxyde de CO contenue dans les gaz d'évacuation ne doit pas dépasser 0,04 % (volume) en l'absence d'air et à sec.

19.102.3 Les tirages descendants imposés comme indiqué au brûleur principal ne doivent pas éteindre les flammes des brûleurs veilleuses ni provoquer leur retour lorsque ceux-ci sont utilisés indépendamment du brûleur principal ou des brûleurs principaux.

La construction d'une machine équipée d'un brûleur à air soufflé ou qui fonctionne sous un tirage forcé ou induit doit être telle que ses performances ne soient pas altérées par les tirages de la cheminée ou par l'arrêt de celle-ci.

La sortie du tuyau de fumée ou la sortie du dispositif de déviation de tirage, le cas échéant, étant bloquée à un degré inférieur ou égal à la fermeture complète, la concentration en monoxyde de carbone dans un échantillon exempt d'air des gaz d'évacuation ne doit pas dépasser 0,04 %.

La vérification est effectuée par examen et par l'essai suivant.

La machine est soumise à l'essai dans une atmosphère avec une alimentation normale en oxygène.

La machine est mise en fonctionnement pendant au moins 15 min à la pression d'essai normale. Lorsque la machine comporte une commande qui coupe automatiquement l'alimentation principale en gaz en conditions de tuyau de fumée bloqué, la surface de la sortie du tuyau est progressivement réduite jusqu'au point le plus faible auquel la commande reste en position ouverte. Un échantillon des gaz d'évacuation est ensuite prélevé et analysé.

En cas de creux, le gaz brut ne doit pas être forcé dans la chambre de combustion à la réouverture de la sortie du tuyau.

La quantité de monoxyde de CO contenue dans les gaz d'évacuation ne doit pas dépasser 0,04 % (volume) en l'absence d'air et à sec.

19.102.4 Des pressions de tirage descendant totales comprises entre 0 Pa et 13 Pa imposées à la sortie du tuyau de fumée ou la sortie du dispositif de déviation de tirage, le cas échéant, ne doivent pas éteindre les flammes du brûleur principal ni provoquer le retour, l'élévation, le flottement ou la combustion de celles-ci à l'extérieur de la machine, ni produire une concentration en monoxyde de carbone dans un échantillon exempt d'air des gaz d'évacuation supérieure à 0,04 %.

La vérification est effectuée par examen et par l'essai suivant.

La machine est soumise à l'essai dans une atmosphère avec une alimentation normale en oxygène.

Une section droite du tuyau de fumée, d'un diamètre approprié et d'une longueur au moins égale à 10 diamètres de tuyau, est fixée directement à la sortie du tuyau ou à la sortie du dispositif de déviation de tirage et raccordée à la sortie d'une soufflerie. La pression de tirage totale est mesurée avec une résolution de 1 Pa dans une section droite du tuyau de fumée, en un point situé à mi-chemin entre ses extrémités, de sorte que la tête du dispositif de mesure coïncide avec l'axe du tuyau de fumée.

La pression de tirage descendant totale est réglée à 13 Pa. La machine est ensuite mise en fonctionnement pendant au moins 15 min. Un échantillon des gaz d'évacuation est prélevé et analysé. La pression de tirage descendant totale varie alors de 0 Pa à 13 Pa, et l'effet sur les flammes du brûleur principal est consigné.

La quantité de monoxyde de CO contenue dans les gaz d'évacuation ne doit pas dépasser 0,04 % (volume) en l'absence d'air et à sec.

19.103 La machine doit être capable de démarrer avec un allumage réussi même en condition de sous-tension, le cas échéant.

La vérification est effectuée par l'essai suivant.

*La machine est alimentée sous 0,85 fois sa **tension assignée**. Le démarrage de la machine ne doit pas engendrer de condition dangereuse.*

19.104 *Les machines équipées de socles femelles de connecteurs conformes aux feuilles de norme de l'IEC 60320-3 et de socles des prises de courant doivent être mises en fonctionnement dans les **conditions de fonctionnement normal**, le socle femelle de connecteur ou le socle de prise de courant étant toutefois chargé avec la charge maximale qui correspond à sa configuration, conformément à l'IEC 60320-3 ou à l'IEC TR 60083, respectivement. Les machines équipées de plusieurs socles femelles de connecteurs ou socles de prises de courant sont soumises à l'essai avec chaque socle chargé l'un après l'autre.*

Cependant, cet essai n'est pas appliqué aux appareils équipés de socles femelles de connecteurs ou de socles de prises de courant

- *destinés uniquement à alimenter les accessoires fournis avec la machine,*
- *inaccessibles à l'utilisateur, ou*
- *fournis avec un **dispositif de protection** comme spécifié au 22.61.*

20 Stabilité et dangers mécaniques

L'article de la Partie 1 est applicable avec les exceptions suivantes.

20.1 *Remplacement de la première phrase par ce qui suit:*

Les machines, autres que les **appareils installés à poste fixe**, les **appareils portatifs** et les **machines guidées à la main** sans position de repos verticale fixe de la poignée, destinées à être utilisées sur une surface telle que le sol ou une table, doivent présenter une stabilité adéquate.

20.2 *Ajouter le texte suivant après le deuxième alinéa de la spécification d'essai:*

NOTE 101 Les appareils conformes à la présente norme ne sont pas considérés comme étant destinés à être installés dans une zone ouverte au public.

20.101 Les pompes, tuyaux, flexibles, raccords de tuyau, connecteurs, joints, soupapes et autres composants susceptibles de transporter l'**agent nettoyant**, directement ou en solution, doivent être conçus pour supporter toute contrainte mécanique, chimique ou thermique qui peut se produire en usage normal, sous leurs températures de fonctionnement assignées maximales et dans les **conditions de fonctionnement normal**.

La vérification est effectuée par les essais suivants.

*Les flexibles, lorsqu'ils sont soumis à l'essai à 45 °C pendant 7 jours avec l'**agent nettoyant** normalement dilué, ne doivent pas être endommagés. Les joints utilisés dans la construction de la machine ne doivent pas différer des joints non soumis à l'essai lorsqu'ils sont immergés dans le liquide nettoyant normalement dilué à 45 °C pendant 7 jours puis rincés dans l'eau.*

Le métal utilisé dans la construction des parties de la machine soumises à la pression ne doit pas être érodé, piqué ou corrodé lorsqu'il est immergé dans le liquide nettoyant normalement dilué.

La surface d'une éprouvette convenable de métal (par exemple 200 mm × 200 mm × 2 mm) doit être enregistrée comme dm^2 puis dégraissée dans un solvant tel que l'acétone ou le toluène, et pesée à 0,1 mg près. Cette éprouvette doit être immergée dans la solution de nettoyage à 45 °C pendant 7 jours. Au terme de cette période, elle doit être retirée, rincée dans l'eau, laissée sécher, et la variation de masse doit être calculée comme mg/dm^2. Il ne doit y avoir aucun signe de corrosion sur l'éprouvette et la variation de masse doit être inférieure ou égale à 40 mg/dm^2.

20.102 Les machines équipées de **corps de chauffe** doivent être protégées contre la surpression qui se produit du fait de la chaleur appliquée à l'eau ou aux **agents nettoyants** à base d'eau. La machine doit être équipée de dispositifs de sécurité qui empêchent la température de dépasser la **température assignée** + 20 K, ou le dépassement de la **pression admissible**.

La vérification est effectuée par examen et par mesurage.

20.103 Les machines chauffées au gaz ou à l'huile ne doivent pas provoquer de combustion non contrôlée de combustible gazeux ou liquide. Elles doivent disposer d'une **commande de sécurité primaire**, sauf si elles fonctionnent à l'huile, sont mobiles, et sauf en cas de réallumage au cours du fonctionnement par un dispositif à **allumage continu**.

La vérification est effectuée par examen.

20.104 La fermeture et l'abaissement involontaires des portes, couvercles, etc. susceptibles de causer des blessures doivent être empêchés.

Les roues ou rouleaux destinés au transport des machines de masse supérieure à 20 kg doivent être placés ou protégés de manière à empêcher toute blessure aux pieds de l'**opérateur**.