

INTERNATIONAL STANDARD



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



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2021 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

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

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC online collection - oc.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 18 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.



IEC 60335-2-79

Edition 5.0 2021-06
REDLINE VERSION

INTERNATIONAL STANDARD



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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 97.080

ISBN 978-2-8322-9947-0

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD	4
INTRODUCTION	7
1 Scope	8
2 Normative references	8
3 Terms and definitions	9
4 General requirement	12
5 General conditions for the tests	13
6 Classification	13
7 Marking and instructions	14
8 Protection against access to live parts	20
9 Starting of motor-operated appliances	20
10 Power input and current	20
11 Heating	21
12 Void Charging of metal-ion batteries	22
13 Leakage current and electric strength at operating temperature	22
14 Transient overvoltages	22
15 Moisture resistance	22
16 Leakage current and electric strength	24
17 Overload protection of transformers and associated circuits	24
18 Endurance	24
19 Abnormal operation	25
20 Stability and mechanical hazards	28
21 Mechanical strength	29
22 Construction	30
23 Internal wiring	35
24 Components	35
25 Supply connection and external flexible cords	35
26 Terminals for external conductors	36
27 Provision for earthing	36
28 Screws and connections	36
29 Clearances, creepage distances and solid insulation	36
30 Resistance to heat and fire	37
31 Resistance to rusting	37
32 Radiation, toxicity and similar hazards	37
Annexes	40
Annex B (normative) Appliances powered by rechargeable batteries that are recharged in the appliance	42
Annex B (normative) attery-operated appliances, separable batteries and detachable batteries for battery-operated appliances	42
Annex S (normative) Battery-operated appliances powered by batteries that are non-rechargeable or not recharged in the appliance	42
Annex AA (normative) Requirements to avoid backsiphonage	44

Annex BB (normative) Analysis method for determining the necessary safety device to prevent backsiphonage	50
Annex CC (informative) Emission of acoustical noise	53
Annex DD (informative) Emission of vibration	55
Annex EE (informative) Model test report for vibration emission at handles of high-pressure cleaners	66
Bibliography	68
Index of defined terms	69
Figure 101 – Warning symbol.....	37
Figure 102 – Impact test apparatus	38
Figure 103 – Reactions on handle.....	38
Figure 104 – Warning symbol: Machine not suitable for connection to the potable water mains	39
Figure 105 – Warning symbol: Do not inhale fumes.....	39
Figure AA.1 – Arrangement for the durability test on backflow preventers with reduced pressure zone	49
Figure BB.1 – Example for an air break to drain	52
Figure DD.1 – Trigger gun	55
Figure DD.2 – Trigger gun with additional side handle	56
Figure DD.3 – Measurement locations: Trigger gun, main and secondary measuring point	58
Figure DD.4 – Measurement locations: Trigger gun with additional side handle, main and secondary measuring point	59
Figure DD.5 – Operating conditions – Position of spraying device.....	61
Table 101 – Degree of protection against harmful ingress of water	14
Table 12 – Pull force and torque	36
Table AA.1 – Nominal size versus durability test flow rate	48
Table BB.1 – Matrix of the safety devices appropriate to fluid categories	51
Table DD.1 – Description and units of the symbols used.....	57
Table EE.1 – General information and reported results	66
Table EE.2 – Measurement results for one machine	67

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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).

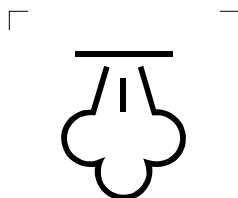
NOTE This symbol is an information sign and, except for the colours, the rules of ISO 3864-1 apply.

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.~~

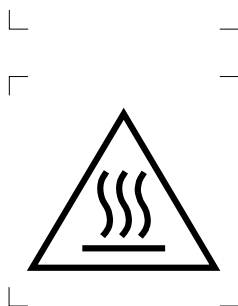
~~Compliance is checked by inspection.~~

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 $\pm 10\%$ 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 221¹ 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 $(93 \pm 6) \%$.

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 $20\text{ °C} \pm 5\text{ °C}$. 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 dm² then degreased in a solvent such as acetone or toluene, dried and weighed to the nearest 0,1 mg. This specimen shall be immersed in the cleaning solution at 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/dm². There shall be no significant signs of corrosion present on the test piece and the mass change shall be within 40 mg/dm².

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

20.102 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 $1,0 \text{ J} \pm 0,04 \text{ J}$.

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 $70\text{ °C} \pm 2\text{ °C}$ 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 $-10\text{ °C} \pm 2\text{ °C}$.

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 mm², 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 jettors 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 jettors 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 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

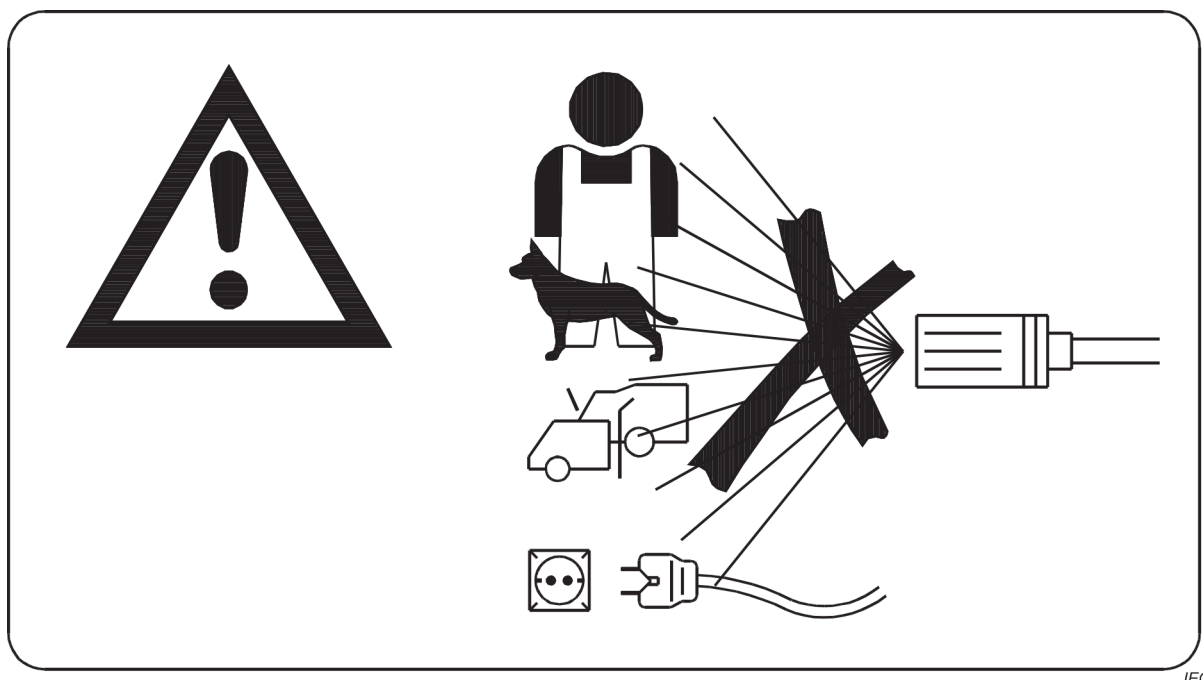
This clause of Part 1 is applicable except as follows.

30.2.3 Not applicable.**31 Resistance to rusting**

This clause of Part 1 is applicable.

32 Radiation, toxicity and similar hazards

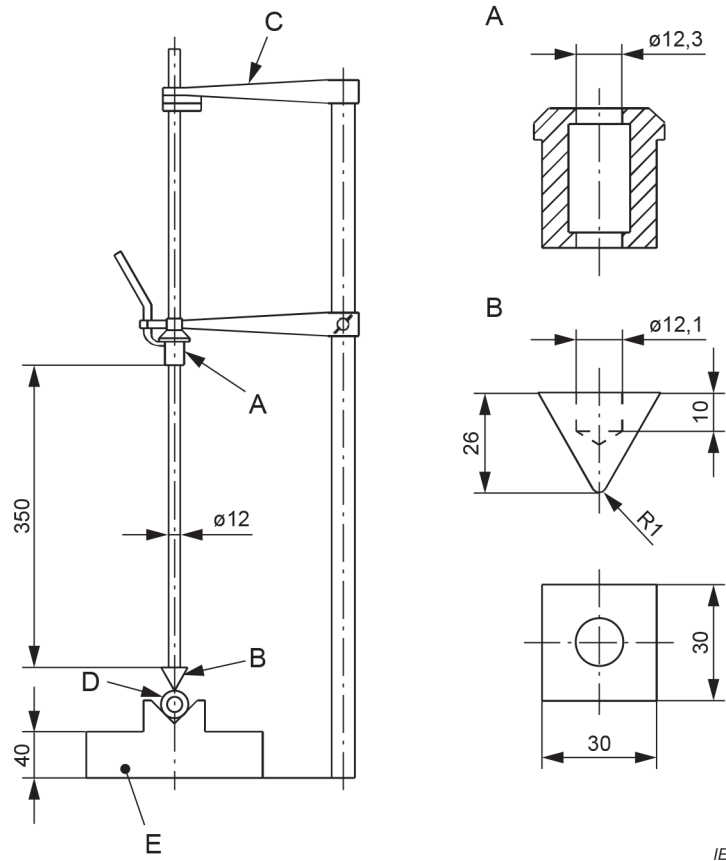
This clause of Part 1 is applicable.



IEC

Figure 101 – Warning symbol

Dimensions in millimetres

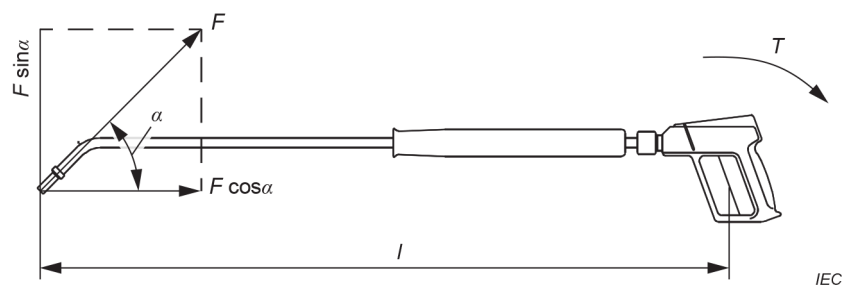


IEC

Key

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

Figure 102 – Impact test apparatus



IEC

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

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 mm², 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 $10 \frac{0}{-2}$ mm).*



Isolate for 5 min $\pm$ 30 s.

Raise the level in the tube to (1 000 $\pm$ 50) mm.

Isolate for 5 min $\pm$ 30 s.

Raise the level in the tube to (2 000 $\pm$ 50) mm.

Isolate for 5 min $\pm$ 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 $\pm$ 5) °C, and at a relative humidity of (50 $\pm$ 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 ⁺⁵⁰₀ cycles at a temperature of (65 $\pm$ 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 $\pm$ 5 % for (6 $\pm$ 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 $\pm 5\%$ 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.