

REDLINE VERSION



**Household and similar electrical appliances – Safety –
Part 2-69: Particular requirements for wet and dry vacuum cleaners, including
power brush, for commercial use**

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

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

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**Household and similar electrical appliances – Safety –
Part 2-69: Particular requirements for wet and dry vacuum cleaners, including
power brush, for commercial use**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-69: Particular requirements for wet and dry vacuum cleaners, including power brush, for commercial use

FOREWORD

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This Redline version provides you with a quick and easy way to compare all the changes between this standard and its previous edition. 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 60335-2-69 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.

This fifth edition cancels and replaces the fourth edition published in 2012. It constitutes a technical revision.

The principal changes in this edition as compared with the third edition of IEC 60335-2-69 are as follows (minor changes are not listed):

- the scope has been revised editorially to avoid misunderstandings;
- terms and definitions has been revised with regard to the requirements revised;
- the standard has been revised in general and updated regarding state-of-the-art, as far as necessary, in particular some changes have been made to Clauses 15, 22 and 25;
- the standard has been aligned with the newest amendment of IEC 60335-1:2010+A1:2013;
- Annex AA was revised and restructured;
- Annex CC was revised;
- general additions for vacuum cleaners with blowing functions have been introduced;
- a new Annex GG ‘Particular requirements for mobile wet vacuum cleaners for rescue and firefighting services (MWF)’ was added.

The text of this standard is based on the following documents:

FDIS	Report on voting
61J/637/FDIS	61J/646/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

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 fifth edition (2010) of that standard..

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

This part 2 supplements or modifies the corresponding clauses in IEC 60335-1, so as to convert that publication into the IEC standard: Safety requirements for wet and dry vacuum cleaners, including power brush, for commercial use.

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

NOTE 2 The following numbering system is used:

- sub clauses, 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 sub clause;
- 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.

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.

The following differences exist in the countries indicated below.

- 22.207: A mobile power generator in accordance with DIN 14685 is required (Germany)
- 25.6: A safety plug in accordance with DIN 49443 is required. (Germany)

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.

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.

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INTRODUCTION

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

This standard recognizes the internationally accepted level of protection against hazards such as electrical, mechanical, thermal, fire and radiation of appliances when operated as in normal use taking into account the manufacturer's instructions. It also covers abnormal situations that can be expected in practice 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 2-69: Particular requirements for wet and dry vacuum cleaners, including power brush, for commercial use

1 Scope

This clause of Part 1 is replaced by the following.

This part of IEC 60335 deals with the safety of electrical motor-operated vacuum cleaners, including **back-pack vacuum cleaners**, and **dust extractors**, for wet suction, dry suction, or wet and dry suction, intended for commercial indoor or outdoor use with or without attachments. **They may be provided with a blowing or inflating function.**

It also deals with the safety of **centrally-sited vacuum cleaners**, excluding the installation of the system.

NOTE 101 Attention is drawn to the fact that additional requirements on the safe installation of **centrally-sited vacuum cleaners** are not addressed by this standard but need to be taken into account.

NOTE 102 This standard applies to machines for **commercial use**. The following list, although not comprehensive, gives an indication of locations that are included in the scope:

- public use areas such as hotels, schools, hospitals;
- industrial locations, for example factories and manufacturing shops;
- retail outlets, for example shops and supermarkets;
- business premises, for example offices and banks;
- all uses other than normal housekeeping purposes.

They are not equipped with a traction drive. The following power systems are covered:

- mains powered motors up to a **rated voltage** of 250 V for single-phase appliances and 480 V for other appliances,
- battery powered motors.

This standard also applies to machines handling **hazardous dust**, such as asbestos.

NOTE 103 Additional requirements for machines handling **hazardous dust** are given in Annex AA. Attention is drawn to the fact that in many countries additional requirements on hazardous substances might apply.

NOTE 104 Radioactive substances are not covered by definition of **hazardous dust** for the purposes of this standard.

This standard does not apply to

- vacuum cleaners and water-suction cleaning appliances for household use (IEC 60335-2-2);
- floor treatment machines for **commercial use** (IEC 60335-2-67, IEC 60335-2-72);
- spray extraction machines for **commercial use** (IEC 60335-2-68);
- hand-held mains-operated electrical garden blowers, vacuums and blower vacuums (IEC 60335-2-100);
- hand-held and transportable motor-operated electric tools (IEC 60745 series, IEC 61029 series, **IEC 62841 series**);
- appliances for medical purposes (IEC 60601-1);

- machines designed for use in corrosive environments;
- machines designed for picking up liquids with a flash point below 55 °C;
- machines designed for use in explosive environments (dust, vapour or gas), except those designed for use in zone 22.

NOTE 105 The flash point temperature limit may vary in different countries. National regulations will need to be taken into account.

NOTE 106 Additional requirements for vacuum cleaners designed for collecting **combustible dust** in zone 22 are given in Annex CC.

NOTE 107 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 60312-1, *Vacuum cleaners for household use – Part 1: Dry vacuum cleaners – Methods for measuring the performance*

IEC 60335-2-41, *Household and similar electrical appliances – Safety – Part 2-41: Particular requirements for pumps*

IEC 61540, *Petit appareillage – Dispositifs différentiels mobiles sans dispositif de protection contre les surintensités incorporé pour usages domestiques et analogues (PCDM)*

ISO 2602, *Statistical interpretation of test results – Estimation of the mean – Confidence interval*

ISO 6344-2, *Coated abrasives – Grain size analysis – Part 2: Determination of grain size distribution of macrogrits P12 to P220*

ISO 7731, *Ergonomics – Danger signals for public and work areas – Auditory danger signals*

ISO 11428, *Ergonomics – Visual danger signals – General requirements, design and testing*

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1.9 Replacement:

normal operation

conditions under which the machine is operated in normal use, obtained at the following power input P_m of the vacuum motor:

$$P_m = 0,5 (P_f + P_i)$$

where

P_f is the input, in watts, when the machine has been operated for 3 min, fitted with the nozzle and hose giving the highest input;

P_i is the input, in watts, when the machine has been operated for 20 s with the nozzle sealed, immediately following the 3-minute-period with the nozzle open. Any valve or

similar device used to ensure a flow of air to cool the motor in the event of a blockage of a main air inlet is rendered ineffective.

P_f and P_i are measured with the supply voltage adjusted to **rated voltage**, or to a voltage equal to the mean value of the **rated voltage range** if the difference between the limits of the **rated voltage range** does not exceed 10 % of the mean value of the range. If the difference between the limits of the **rated voltage range** exceeds 10 % of the mean value, the tests are carried out with the supply voltage set to the upper limit of the range.

The measurements are made with the machine fitted with a clean dust bag and filter and with the water container, if any, empty. If the machine is intended for use only with a hose, detachable nozzles are removed and the hose is laid out straight. If the machine is provided with a hose as an optional accessory, it is operated without the hose.

Electrically driven devices, if any, are in operation but are not in contact with the floor or any other surface or with the means used to seal the air inlet.

The normal load is equal to the mean load P_f for the electrically driven agitating device such as a motor driven brush determined in accordance with the following:

- the agitating device operates on a carpet as specified in IEC 60312-1;
- the mean load P_f is determined when using the device in the following way:
After setting the device, the device is moved twice over a distance of 5 m in the direction giving the highest load;
- the motor responsible for the airflow operates under the same conditions as for determining P_f , i.e. no airflow restrictions, and measurements are taken after 3 min;
- the device is adjusted to the carpet pile height;
- it is necessary to move the agitating device slowly across the carpet to avoid carpet damage.

Soiled water discharge pumps, if applicable, are operated as follows.

The pump delivers a continuous flow of water without any soiled water discharge hose attached to the soiled water outlet of the machines unless the discharge hose is permanently attached to the machine. The vacuum motor works during the test, unless an interlock device is provided to prevent combined operation of both motors.

Machines equipped with an inflating function are also operated whilst equipped with the hose as described in the instructions for use. The hose is placed in a straight line away from the machine. Power adjustment controls are set to the highest input power.

Machines equipped with a blowing function are also operated whilst equipped with the two hoses or as described in the instructions for use. Both hoses are placed in a straight line away from the machine. Power adjustment controls are set to the highest input power. The blowing hose is not equipped with any attachments, e.g. nozzles.

3.101 **water-suction cleaning machine**

machine for sucking up a water-based cleaning solution

3.102 **back-pack vacuum cleaner**

vacuum cleaner designed to have the power source and collector carried on the **operator's** back by means of a supporting device

3.103 **motorized cleaning head**

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

Note 1 to entry: The permanently attached main cleaning head is not regarded as a **motorized cleaning head**.

3.104 hazardous dust

non-radioactive dust which is hazardous to health if inhaled, ingested or in contact with the skin

Note 1 to entry: IEC Directive 79/831/EEC amending 67/548/EEC lists dusts for which the general indication of nature of risk is specified as very toxic, harmful, corrosive or irritant; some dusts can be subject to an exposure limit in the country of use; micro-organisms can be considered as dusts creating a hazard to the health of a person.

Note 2 to entry: Requirements for machines intended to pick up **hazardous dust** are specified in Annex AA.

3.105 combustible dust

~~dust with a particle size below 1 mm, able to undergo an exothermic reaction with air when ignited~~

finely divided solid particles, 500 µm or less in nominal size, which may be suspended in air, may settle out of the atmosphere under their own weight, may burn or glow in air, and may form explosive mixtures with air at atmospheric pressure and normal temperatures

Note 1 to entry: This includes dust and grit as defined in ISO 4225

Note 2 to entry: The term solid particles is intended to address particles in the solid phase and not the gaseous or liquid phase, but does not preclude a hollow particle.

[SOURCE: IEC 60050-426:2008, 426-02-18]

3.106 explosive dust atmosphere ~~(dust)~~

~~atmosphere where the dust will explode when simultaneously subjected to the following conditions:~~

- ~~— the dust must be combustible;~~
- ~~— the dust must be in suspension in the atmosphere which must contain sufficient oxygen to support combustion;~~
- ~~— the dust must have a particle size distribution that will propagate flame;~~
- ~~— the dust concentration in the suspension must be within the explosive range;~~
- ~~— the dust suspension must be in contact with an ignition source of sufficient energy.~~

mixture with air, under atmospheric conditions, of flammable substances in the form of dust, fibres or flyings which, after ignition, permits self-sustaining propagation

Note 1 to entry: Minimum ignition energy values for common dusts can be found in Annex BB.

Note 2 to entry: Requirements for machines intended to pick up **combustible dust** in an **explosive atmosphere** are specified in Annex CC.

[SOURCE: IEC 60050-426:2008, 426-01-08, modified: the notes to entry have been added]

3.107 ESD protected area EPA

area with a minimum risk for electrostatic discharge that could damage electronic devices, and in which people present in that area are not subjected to any additional risk

Note 1 to entry: Requirements for machines intended to pick up dust in **ESD protected areas** are specified in Annex DD.

3.108 dust extractor

stationary or portable equipment specifically designed to be connected to dust-generating machines

Note 1 to entry: A vacuum cleaner is designed to pick up already settled dust.

3.109

centrally-sited vacuum cleaner

vacuum cleaner that is connected to a ducting system installed in the building

Note 1 to entry: During use, the nozzle and its associated hose are connected to one of the suction inlets of the ducting system.

3.110

guard

part of the machine specifically designed to provide protection by means of a physical barrier, such as, for example, 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, such as, 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.

3.111

operator

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

3.112

test solution

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 $C_{12}H_{25}NaSO_4$.

3.113

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.

3.114

mobile machine

machine capable of being moved from one location to another

Note 1 to entry: This includes portable and hand-held appliances, and excludes fixed and stationary appliances.

[SOURCE: IEC 60050-151:2001, 151-16-45, modified: term modified, deletion of the mention of the use of vehicles in the definition and addition of the note to entry]

3.115

MWF vacuum cleaner

vacuum cleaner for picking up liquids, intended to be used by rescue and firefighting services, integrating a pump for a continuous disposal of the sucked up liquid

Note 1 to entry: **MWF** is the abbreviation of Mobile Wet vacuum cleaners for rescue and Firefighting and rescue services.

3.116 inflating function

operation mode with the clean air exhaust used to inflate objects with the standard suction hose connected to the air outlet of the machine

Note 1 to entry: Only one hose is connected to the machine at a time.

3.117 blowing function

operation mode with the clean air exhaust connected to an air exhaust hose as specified in the instructions for use, the purpose being to transport the clean exhaust air away from the working location

Note 1 to entry: In this case, two hoses are connected to the vacuum cleaner simultaneously.

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 purpose 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 is to be stored in a cool atmosphere and used within seven days after its preparation.*

6 Classification

This clause of Part 1 is applicable, except as follows.

6.1 *Replacement:*

Vacuum cleaners and their attachments shall be of one of the following classes with respect to the protection against electric shock:

- class I,
- class II, or
- class III.

Metal parts that may continuously contact the body shall be considered as handles for which 22.36 applies.

Compliance is checked by inspection and by the relevant tests.

6.2 Addition:

Water suction cleaning machines and products intended for outdoor use and storage shall be at least IPX4.

7 Marking and instructions

This clause of Part 1 is applicable, except as follows.

7.1 Replacement of the 4th 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.
- year of construction, i.e. the year in which the manufacturing process is completed;
NOTE 102 The year of construction can be part of the serial number.
- machines equipped with wheels and other mobile machinery shall be marked with the mass of the most usual configuration in kg.

When permitted by Table 101, the appliance may be marked adjacent to the air outlet with:

- the substance of "CAUTION: Hot surface", or
- symbol IEC 60417-5041 (2002-10).

7.1.101 Motorized cleaning heads shall be marked with

- **rated voltage** or **rated voltage range** in volts;
- **rated power input** in watts;
- name, trade mark or identification mark of the manufacturer or responsible vendor;
- model or type reference;
- mass of the most usual configuration in kg.

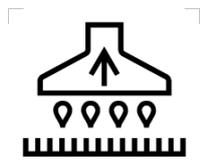
Motorized cleaning heads for water-suction cleaning appliances except those of **class III construction** having a **working voltage** up to 24 V shall be marked with symbol IEC 60417-5935 (~~2002-10~~ 2012-09).

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

Compliance is checked by inspection.

7.1.102 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 60417-5935 (~~2002-10~~ 2012-09)]

motorized cleaning head for water-suction cleaning



[symbol IEC 60417-5041 (2002-10)]

caution, hot surface

7.12 Modification:

Replace the 4th 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 instruction manual before using the machine.

This wording may be replaced by symbols ISO 7000-0434A (2004-01) and ~~either ISO 7000-1641 (2004-01) or ISO 7000-0790 (2004-01)~~.

If symbol IEC 60417-5041 (2002-10) is marked on appliances, its meaning shall be explained.

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 series or type of the machine as marked on the machine itself, except for the serial number;

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 **motorized cleaning heads** and lights.

- the meaning of the symbols used on the machine and in the instructions;
- 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;
- information regarding putting into service, safe operation, handling, transportation, and storage of the machine taking into account its weight;

- 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;
- the substance of the following:

This machine is intended for commercial use, for example in hotels, schools, hospitals, factories, shops, offices and rental businesses.

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

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

- for battery powered machines, instructions regarding the precautions to be taken for safe charging;
- precautions to be taken when changing brushes or other attachments;
- information on the detergents or other liquids that may be used including the choice and use of personal protective equipment (PPE);
- essential characteristics of auxiliary equipment which may be fitted to the machine;
- information regarding safe disposal of batteries;
- purposes of the socket outlet on the machine;
- the precautions to be taken when using the machine under specific conditions such as handling flammable liquids or dusts and dusts hazardous to health;
- **wet filters and the interior part of the liquid container shall be dried before storage.**
- the intended use of the brushes specified for the machine.

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, it shall include the substance of the following warnings, if applicable.

- **WARNING** Operators shall be adequately instructed on the use of these machines.
- **WARNING** This machine is not suitable for picking up hazardous dust.
- **WARNING** This machine is for dry use only.
- **CAUTION** This machine is for indoor use only.
- **CAUTION** This machine shall be stored indoors only.
- 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 powered machines, by safely disconnecting at least the B+ or B– pole of the battery or an equivalent method (disconnecting device); for non-SELV both poles **must** **shall** be disconnected.

Instructions for mains operated machines shall also include the substance of the following:

- **WARNING** Do not allow the supply cord to come into contact with the rotating brushes.
- **WARNING** Only use the socket outlet on the machine for purposes specified in the instructions.

Instructions for water suction cleaning machines shall also include the substance of the following:

- WARNING If foam or liquid escapes from the machine, switch off immediately.
- CAUTION Clean the water level limiting device regularly and examine it for signs of damage.

Instructions for machines having a current-carrying hose for dry suction, 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.

Compliance is checked by inspection.

7.12.102 Information on noise

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

7.12.103 Information on vibration

NOTE The instructions can include information on the vibration total value as indicated in Clause FF.2.

7.12.104 The instructions for use of vacuum cleaners with **blowing or inflating functions** shall include information concerning the use of these functions and the nominal overpressure.

The instructions for use of vacuum cleaners with inflating functions shall include this function is not intended for blowing away deposited dust.

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 (~~2002-10~~ 2012-09) shall be at least 15 mm.

The height of symbol IEC 60417-5041 (2002-10) shall be at least 10 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.

9 Starting of motor-operated appliances

This clause of Part 1 is not applicable.

10 Power input and current

This clause of Part 1 is applicable.

11 Heating

This clause of Part 1 is applicable except as follows.

11.3 Addition:

If it is necessary to dismantle the machine for fitting thermocouples or other wiring, the input shall be measured before and after fitting at the lowest possible load, for example, with closed suction openings, with brushes not in contact with the floor, with declutched drive, etc. to check that the assembling has been accomplished properly.

Where the accessible external surfaces are suitably flat and access permits, then the test probe of Figure 106 may be used to measure the temperature rises of accessible external surfaces specified in Table 101. The probe is applied with a force of $4\text{ N} \pm 1\text{ N}$ to the surface in such a way that the best possible contact between the probe and the surface is ensured.

NOTE 102 The probe may be held in place using a laboratory stand clamp or similar device. Any measuring instrument giving the same results as the probe may be used.

11.4 Not applicable.

11.5 Addition:

For the heating test, the normal load P_n on the motor driving the moving brushes can be simulated by a brake or other means.

11.6 Not applicable.

11.7 Addition:

Machines are operated until steady conditions are established.

11.8 Modification

During the test, the temperature rises are monitored continuously and shall not exceed the values shown in Table 101.

The temperature rise limits in Table 3 specified for “External enclosure of motor-operated appliances, except handles held in normal use” and the corresponding footnotes are not applicable.

Add the following new table:

Table 101 – Maximum temperature rises for specified accessible external surfaces under normal operating conditions

Surface	Temperature rise of external surfaces K	
	Surfaces of hand-held appliances ^e	Surfaces of other appliances ^d
Bare metal	42	48
Coated metal ^a	49	59
Glass and ceramic	56	65
Plastic and plastic coating > 0,4 mm ^{b,c}	62	74

NOTE Some limit less than 2X is surely achievable for process air outlets of wet vacuum cleaners.

^a Metal is considered coated when a coating having a minimum thickness of 90 µm made by enamel or non-substantially plastic coating is used.

^b The temperature rise limit of plastic also applies for plastic material having a metal finish of thickness less than 0,1 mm.

^c When the thickness of the plastic coating does not exceed 0,4 mm, the temperature rise limits of the coated metal or of glass and ceramic material apply.

^d Within 25 mm from air outlets the above values can be twice the limit but the product shall be marked with the wording as stated in 7.1 .

^e Within 25 mm from air outlets the above values can be increased by 5 K.

12 Void

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable except as follows.

13.2 Addition:

For class I appliances where several motors operate at the same time, the leakage current shall not exceed 3,5 mA.

14 Transient overvoltages

This clause of Part 1 is applicable.

15 Moisture resistance

This clause of Part 1 is applicable except as follows.

15.1.2 Addition:

Water-suction cleaning machines are operated for 10 min on a level surface wetted by the test solution.

In practice, the pick-up consists largely of air such that there is no overloading of the suction motor; the input load should be observed to avoid overloading.

15.2 Replacement:

Machines having a liquid container shall be so constructed that

- spillage of liquid due to **normal operation**,
- filling including overfilling, and
- overturning of unstable machines

do not affect their electrical insulation.

Compliance is checked by the following tests:

The machine is placed on a support inclined at an angle of 10° to the horizontal, the liquid container being 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 having a liquid container and provided with an appliance inlet are fitted with an appropriate connector and flexible cable or cord; machines having a liquid container and **type X attachment** are fitted with the lightest cross-sectional area specified in Table 11. Other machines are tested as delivered.

The liquid container of the machine is 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 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 be

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

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.

Machines which are unstable are then, with the container completely filled and with the cover or 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.

Nozzles and **motorized cleaning heads of water-suction cleaning machines** 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 of water suction cleaning machines shall be resistant to liquids that may come into contact with them during normal use.

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

Compliance is checked by the following four tests.

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

It is then subjected to the free fall test procedure 1 of IEC 60068-2-31. It is dropped 4 000 times from a height of 100 mm onto a steel plate having a thickness of not less than 15 mm. It is dropped

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

The **motorized cleaning head** is then subjected to the test described in 14.2.4 of IEC 60529, using the **test solution**.

The **motorized cleaning head** is to 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:

- without connection to the vacuum cleaner for 15 min, if applicable; and
- connected to the vacuum cleaner until the vacuum cleaner has picked up as much water as its capacity holds or for 5 min, whichever occurs sooner.

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 the **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 not applicable.

19 Abnormal operation

This clause of Part 1 is applicable except as follows.

19.1 Addition:

Machines are also subjected to the test of 19.101.

*The test of 19.7 is only carried out on **motorized cleaning heads** and fan motors of **centrally-sited vacuum cleaners**.*

NOTE 101 Separate fan motors are not intended for vacuuming, but for cooling the equipment. These motors are independent from the main vacuum motor.

***Dust extractors** are also subjected to the tests of 19.102 and 19.103, if applicable.*

***Centrally-sited vacuum cleaners** are also subjected to the tests of 19.104 and 19.105, if applicable.*

19.2 Addition:

The machine is tested without liquid in the container.

NOTE 101 The term restricted heat dissipation of Part 1 means without liquid in the container.

19.7 Addition:

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

*Unattended **dust extractors** are operated until steady conditions are reached.*

*Separate fan motors of **centrally-sited vacuum cleaners** are operated until steady conditions are reached.*

NOTE 101 Separate fan motors are not intended for vacuuming, but for cooling the equipment. These motors are independent from the main vacuum motor.

19.9 Not applicable.

19.10 Addition:

For this test, the lowest possible load for radial turbines is obtained with the air inlet sealed. For other types of turbines, the characteristics shall be taken into account.

In the case of cleaners driving a brush or agitator, the belt is removed.

19.13 Modification:

In the second paragraph, add “and 22.104” after “20.2”.

19.101 *Machines having liquid containers that are provided with shut-off device(s) or valve(s) are again subjected to the test of 15.2.*

Stop valves or other fluid shut-off devices are made inoperative. If two or more independent shut-off devices are provided, only one of them is made inoperative at a time, provided that they have passed the test of operating 3 000 times satisfactorily. Otherwise all devices that failed are made inoperative.

Care should be taken to suck up an air-liquid mixture to prevent overloading of the motor of the suction unit. The input power should be observed to avoid overloading.

*After this test, the machine shall be subjected to the electrical strength test of 16.3. Inspection shall show that water has not entered the machine to any dangerous extent. In particular, there shall be no trace of water on the electrical insulation that reduces the **clearance** or **creepage distances** below the limits specified in Clause 29.*

19.102 *Dust extractors for which 30.2.3 applies are supplied at **rated voltage** and operated with the inlet for the suction hose closed.*

The temperatures of the windings shall not exceed the values specified in 19.9.

19.103 *Dust extractors for which 30.2.3 applies with separate ventilation for the motor are supplied at **rated voltage** and operated with the airflow through the motor blocked.*

The temperatures of the windings shall not exceed the values specified in 19.9.

19.104 *Centrally-sited vacuum cleaners are supplied at **rated voltage** and operated with the inlet for the suction hose open and then closed.*

The temperatures of the windings shall not exceed the values specified in 19.9.

19.105 *Centrally-sited vacuum cleaners with separate ventilation for the motor are supplied at **rated voltage** and operated with the airflow through the motor blocked.*

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.1 *Modification:*

Add to the existing NOTE:

Aluminium oxide paper (grain size 80) or similar material may be used to prevent sliding.

Addition:

Motorized cleaning heads are not subjected to this test.

20.2 *Addition:*

These requirements do not apply to rotating brushes and similar devices, or to moving parts exposed during the fitting of accessories that allow conversion from one application to another.

20.101 Shaft ends and similar rotating parts shall be protected if they protrude by more than a quarter of their diameter. Shafts up to 50 mm diameter do not need to be protected if they are rotating at less than 5 revolutions per second, and their ends are rounded and smooth.

*Compliance is checked by inspection and measurement, the machine having all pads, brushes etc. in place for **normal operation**.*

The unintentional closing and lowering of doors, lids, covers etc., which could cause injury, shall be prevented.

Machines heavier than 20 kg (empty weight), except stationary machines and **back-pack vacuum cleaners**, shall be equipped with wheels or rollers for transport, which shall be located or protected so as to prevent injury to the feet of the **operator**.

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

21 Mechanical strength

This clause of Part 1 is applicable except as follows.

21.1 Replacement of the first paragraph:

Machines and their **components** and fittings shall have adequate mechanical strength and be constructed to withstand such rough handling as 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 Those parts of the machine that are subjected to impact in normal use are tested as follows:

*If failure of the part subjected to impact would cause a failure to comply with this specification, any spot of the machine which may be exposed during **normal operation** to impacts or blows shall be subjected to a single blow with an impact energy of 6,75 Nm. The impact stress on the free-standing machines shall be exerted by a steel sphere with a diameter of 50,8 mm and a mass of 0,535 kg dropped from a height of 1,3 m or hanging on a string acting as a pendulum, falling from a height of 1,3 m.*

21.102 Current-carrying hoses shall be resistant to crushing.

Compliance is checked by the following test.

The hose is placed between two parallel steel plates each having a length of 100 mm, a width of 50 mm and the edges of the longer sides rounded with a radius of 1 mm. The axis of the hose is positioned at right angles to the longer sides of the plates. The plates are placed at a distance of approximately 350 mm from one end of the hose.

The steel plates are pressed together at a rate of $50 \text{ mm/min} \pm 5 \text{ mm/min}$ until the applied force is 1,5 kN. The force is then released and the electric strength test of 16.3 is carried out between the conductors connected together and the saline solution.

21.103 Current-carrying hoses shall be resistant to abrasion.

Compliance is checked by the following test.

One end of the hose is attached to the connecting rod of the crank mechanism shown in Figure 102. The crank rotates at 30 revolutions per minute resulting in the end of the hose moving horizontally backwards and forwards over a distance of 300 mm.

The hose is supported by a rotating smooth roller over which a belt of abrasive cloth moves at a speed of 0,1 m/min. The abrasive is corundum grit size P100, as specified in ISO 6344-2.

A mass of 1 kg is suspended from the other end of the hose, which is guided to avoid rotation.

In the lowest position, the mass has a maximum distance of 600 mm from the centre of the roller.

The test is carried out for 100 revolutions of the crank.

*After the test, **basic insulation** shall not be exposed and the electric strength test of 16.3 is carried out between the conductors connected together and the saline solution.*

21.104 Current-carrying hoses shall be resistant to flexing.

Compliance is checked by the following test.

*The end of the hose intended to be connected to the **motorized cleaning head** is attached to the pivoting arm of the test equipment shown in Figure 103. The distance between the pivot axis of the arm and the point where the hose enters the rigid part is $300 \text{ mm} \pm 5 \text{ mm}$. The arm can be raised from the horizontal position by an angle of $40^\circ \pm 1^\circ$. A mass of 5 kg is suspended from the other end of the hose or from a convenient point along the hose so that when the arm is in the horizontal position, the mass is supported and there is no tension on the hose.*

NOTE It may be necessary to reposition the mass during the test.

The mass slides against an inclined plate so that the maximum deflection of the hose is 3° .

The arm is raised and lowered by means of a crank that rotates at a speed of 10 r/min ± 1 r/min.

The test is carried out for 2 500 revolutions of the crank after which the fixed end of the hose is turned through 90° and the test continued for a further 2 500 revolutions. The test is repeated in each of the other two 90° positions.

After 10 000 revolutions, the hose shall withstand the electric strength test of 16.3.

If the hose ruptures before 10 000 revolutions are achieved, the flexing test is terminated. The hose shall still withstand the electric strength test of 16.3.

21.105 Current-carrying hoses shall be resistant to torsion.

Compliance is checked by the following test.

One end of the hose is held in a horizontal position with the remainder of the hose freely suspended. The free end is rotated in cycles, each cycle consisting of five turns in one direction and five turns in the opposite direction, at a rate of 10 turns per minute.

The test is carried out for 2 000 cycles.

After the test, the hose shall withstand the electric strength test of 16.3 and shall not be damaged to such an extent that compliance with this standard is impaired.

21.106 Current-carrying hoses shall be resistant to cold conditions.

Compliance is checked by the following test.

A 600 mm length of hose is bent as shown in Figure 104 and the ends are tied together over a length of 25 mm. The hose is then placed for 2 h in a cabinet having a temperature of $-15\text{ °C} \pm 2\text{ °C}$. Immediately after the hose is removed from the cabinet it is flexed three times, as shown in Figure 105, at a rate of one flexing per second.

The test is carried out three times.

There shall be no cracks or breaks in the hose and it shall withstand the electric strength test of 16.3. Any colour change of the hose is not considered as a failure.

22 Construction

This clause of Part 1 is applicable except as follows.

22.6 Addition:

Water-suction cleaning machines shall be so constructed that neither water nor foam from detergents can penetrate into the motor or come in contact with **live parts**.

22.35 Addition:

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

A sample of the covered part is conditioned at a temperature of $70\text{ °C} \pm 2\text{ °C}$ for seven 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 101. The weight "A", having a mass of 0,3 kg, falls from a height of 350 mm on to the chisel "B" of hardened steel, the edge of which is placed on the sample.

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

After this test, it shall be shown 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.

For **centrally-sited vacuum cleaners**, this subclause of Part 1 is applicable.

22.54 *This subclause is not applicable.*

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

Live parts of machines for wet use shall be at least 30 mm distance from the surface of the floor, measured in vertical direction through existing holes. This requirement does not apply to **motorized cleaning heads**.

Compliance is checked by inspection and measurements.

22.102 Class I appliances or **class II appliances** shall be equipped with a mains isolating switch that ensures **all-pole disconnection** according to overvoltage category III conditions.

For built-in battery chargers, this **all-pole disconnection** can be realised by pulling the plug.

Other switches may be of single pole construction.

The following circuits need not be disconnected by the supply disconnecting device:

- plug and socket-outlets;
- undervoltage protection circuits that are only provided for automatic tripping in the event of supply failure;
- phase rotating indicators;
- control circuits for interlocking.

It is recommended, however, that such circuits be provided with their own disconnecting device.

Compliance is checked by inspection.

22.103 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.

22.104 If machines are provided with shut-off devices, the devices shall prevent the liquid level from exceeding the maximum allowed level.

Compliance is checked by inspection.

22.105 Harness of back-pack vacuum cleaners

All measurements are made with all filters in place, empty dust containers and without the weight of the **supply cord**.

Back-pack vacuum cleaners with a mass exceeding 6 kg shall be equipped with at least a single shoulder harness. A double shoulder harness shall be provided for **back-pack vacuum cleaners** exceeding a mass of 7,5 kg.

Single shoulder harnesses shall be designed so that the machine can be released quickly from the **operator** in the event of emergency. One way to fulfil this is to have a quick release mechanism on the harness.

Double shoulder harnesses shall always have a quick release mechanism. The quick release mechanism shall only allow separation by a deliberate action.

All harnesses shall be adjustable to the size of the **operator**. The harness shall distribute the load evenly on the **operator's** back, shoulders, waist and/or hip.

Back-pack vacuum cleaners exceeding a mass of 7,5 kg shall be supplied with a pad at the points of contact between the machine and the body.

Compliance is checked by inspection and functional test.

22.106 Handgrip of back-pack vacuum cleaners

Back-pack vacuum cleaners shall be equipped with a handgrip with a surface or structure specifically designed for the **operator's** hand to allow the **operator** to grasp the **back-pack vacuum cleaner** to place it on his back or take it off.

Compliance shall be checked by inspection and functional test.

22.107 Interlock switches

Interlock switches that prevent access to live parts shall be located to prevent unintentional operation.

Compliance is checked by inspection and by applying test probe B of IEC 61032.

23 Internal wiring

This clause of Part 1 is applicable.

24 Components

This clause of Part 1 is applicable except as follows.

24.1.3 Addition:

The main switch in vacuum cleaners shall be tested for 50 000 cycles of operations.

This test specification does not apply for **centrally-sited vacuum cleaners**.

Interlock switches are operated 10 000 times.

If the interlock switch operates a relay or contactor or is operated by a mechanical actuation system, the complete switching system is subjected to the test.

24.2 Addition:

For **back-pack vacuum cleaners** with a switching device located at the end of an interconnecting cord, the switching device shall be designed so that it cannot come into contact with the floor in normal use.

The strain relieves on both sides of the interconnecting cord shall comply with 25.15.

24.101 Machines with motors 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 locked rotor conditions so as to cause the **thermal cut-out** to operate within a few minutes, until the **thermal cut-out** has performed 200 cycles of operation.

After the test, the machine shall withstand the tests of Clause 16.

24.102 Interlock switches that prevent access to **live parts** shall

- disconnect all poles, unless the secondary circuit is supplied through an isolating transformer;
- if a single switching action is obtained by a switching device, the switching device shall provide full disconnection and the clearances for full disconnection specified in 20.1.5.3 of IEC 61058-1:2000 shall be obtained from Table 22 of IEC 61058-1:2000 using a rated impulse withstand voltage of 4 000 V.

Compliance is checked by inspection.

25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows.

25.1 Addition:

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 an appliance inlet shall also be provided with an appropriate cord set.

25.7 Replacement:

Supply cords shall be one of the following types:

- Rubber sheathed
Their properties shall be at least those of ordinary tough rubber sheathed cords (code designation 60245 IEC 53);

NOTE 101 These cords are not suitable for machines intended to be used outdoors or when they are liable to be exposed to significant amounts of ultraviolet radiation.

- Polychloroprene sheathed
Their properties shall be at least those of ordinary polychloroprene sheathed cords (code designation 60245 IEC 57);

NOTE 102 These cords are suitable for machines intended to be used in low temperature applications.

~~— Cross-linked polyvinyl chloride sheathed~~

~~Their properties shall be at least those of cross-linked polyvinyl chloride sheathed cords (code designation 60245 IEC 87);~~

~~NOTE 103 These cords are suitable for machines when they may come into contact with hot surfaces. Due to the composition of the conductors, the cords are suitable for applications where high flexibility is required.~~

- Polyvinyl chloride sheathed

These cords shall not be used if they are likely to touch metal parts having a temperature rise exceeding 75 K during the test of Clause 11. Their properties shall be at least those of ordinary polyvinyl chloride sheathed cord (code designation 60227 IEC 53);

- Heat resistant polyvinyl chloride sheathed

These cords shall not be used for **type X attachments** other than specially prepared cords. Their properties shall be at least those of heat-resistant polyvinyl chloride sheathed cord (code designation 60227 IEC 57).

Compliance is checked by inspection.

25.14 Addition:

*For machines incorporating a **type X attachment** or **type Y attachment**, the number of flexings is 20 000.*

25.15 Modification:

Replace Table 12 by the following:

Table 12 – Pull force and torque

Mass of machine 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.

29.2 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 Addition:

For **centrally-sited vacuum cleaners**, 30.2.3 is 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, except as follows.

Addition:

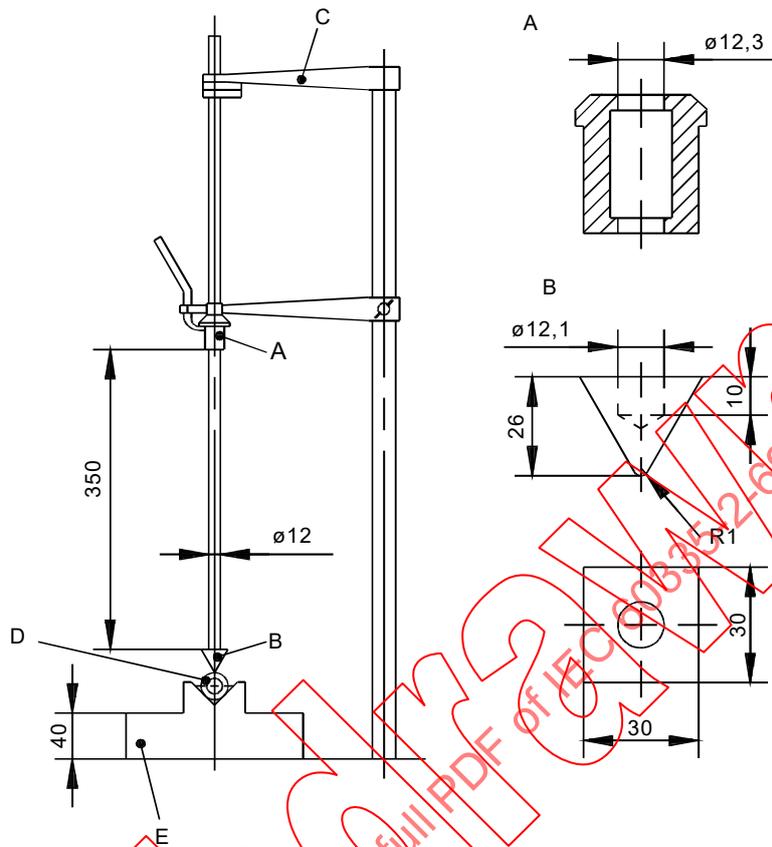
For machines intended to pick up **hazardous dust**, additional requirements are specified in Annex AA.

NOTE 101 Information on the explosion risk of certain dusts is given in Annex BB.

For machines intended to pick up **combustible dust** in an **explosive atmosphere**, additional requirements are specified in Annex CC.

For machines intended to pick up dust in **ESD protected areas**, additional requirements are specified in Annex DD.

Dimensions in millimetres

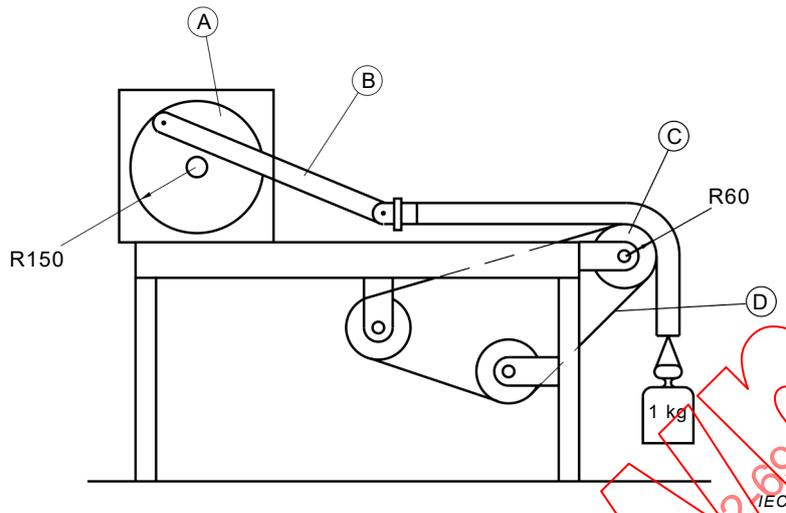


Key

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

Figure 101 – Impact test apparatus

Dimensions in millimetres



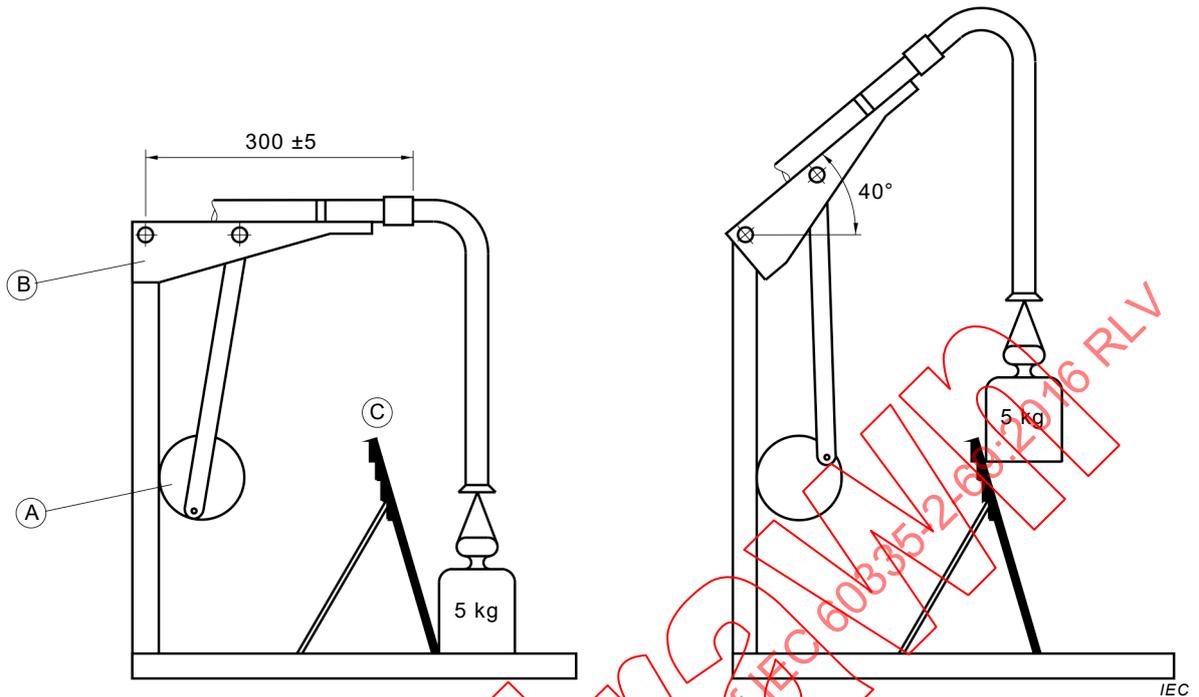
Key

- A crank mechanism
- B connecting rod
- C roller, diameter 120 mm
- D abrasive cloth belt

Figure 102 – Apparatus for testing the abrasion resistance of current-carrying hoses

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Dimensions in millimetres



Key

- A crank mechanism
- B arm
- C inclined plane

Figure 103 – Apparatus for testing the resistance to flexing of current-carrying hoses

Dimensions in millimetres

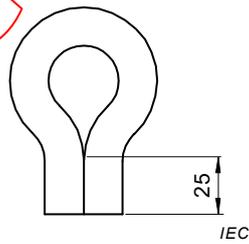


Figure 104 – Configuration of the hose for the freezing treatment

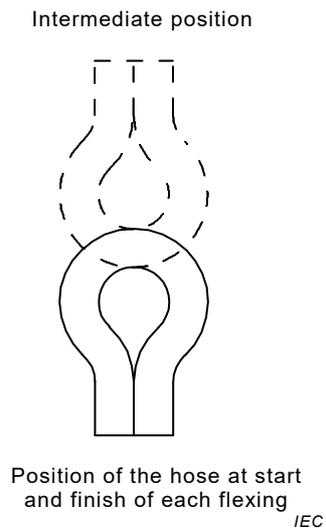
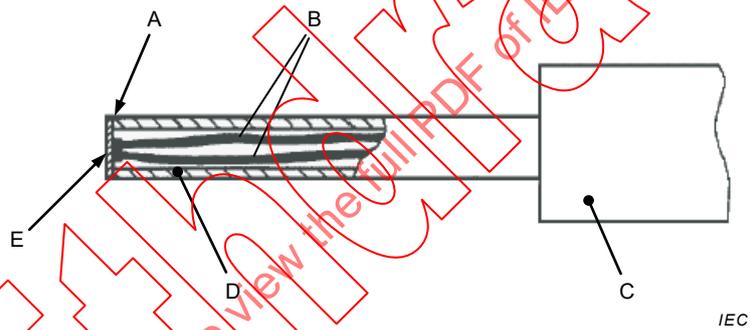


Figure 105 – Flexing positions for the hose after removal from the freezing cabinet



Key

- A adhesive
- B thermocouple wires 0,3 mm diameter to IEC 60584-1 Type K (chrome alumel)
- C handle arrangement permitting a contact force of $4\text{ N} \pm 1\text{ N}$
- D polycarbonate tube: inside diameter 3 mm, outside diameter 5 mm
- E tinned copper disc: 5 mm diameter, 0,5 mm thick

The contact face of the disc is to be flat.

Figure 106 – Probe for measuring surface temperatures

Annexes

The annexes of Part 1 are applicable except as follows.

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Withdrawn

Annex A (normative)

Routine tests

For the purpose of this standard, this annex of Part 1 is considered normative.

Annex A of Part 1 is applicable except as follows.

A.3 Functional test

Addition:

For machines of dust class H, compliance with the **penetration** requirement of Table AA.1 shall be shown either for the complete machine or for the **essential filter** element.

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Withdawn

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 the following:*

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.*

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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.

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Withdrawn

Annex AA (normative)

Particular requirements for vacuum cleaners and dust extractors for the collection of hazardous dusts

The following modifications to this standard are applicable to vacuum cleaners and **dust extractors** specifically designed for wet and/or dry suction for **commercial use** and specify the requirements for collecting non-explosive **hazardous dusts**.

NOTE 1 In this annex, subclauses and notes that are numbered starting from 201 are additional to those in this part 2.

NOTE 2 When power sources other than electricity (e.g. compressed air, internal combustion engine etc.) or a **negative pressure unit** are used, the use of classification for filtration of dust given in this annex can be useful.

3 Terms and definitions

3.AA.201 penetration

D

degree of **penetration** of a filter material, a filter or a machine, determined as follows:

$$D = \frac{\dot{m}_{\text{out}}}{\dot{m}_{\text{in}}} \times 100 \%$$

where

\dot{m}_{out} is the average mass concentration of the test aerosol in the downstream air during the sampling time;

\dot{m}_{in} is the average mass concentration of the test aerosol in the upstream air during the sampling time.

3.AA.202 air change rate

acr

number of hourly fresh air changes, calculated as follows:

$$acr = \frac{Q}{V} [1/h]$$

where

V is the room air volume (m^3);

Q is the flow rate of the air exchanger of the room (m^3/h).

3.AA.203 safe change filter

filter which can be changed without atmospheric or **operator** contamination, such as by means of handling the filter from the exterior of an impervious membrane and by the use of a double sealing method of withdrawal, removal and replacement without exposing the interior of the filter housing

3.AA.204
dust class x machine

machine designed to comply with requirements specified for dust class L, M or H in accordance with 6.AA.201

3.AA.205
essential filter

principal filter in a system which may use multiple filters and is a filter which ensures that the **penetration** limits of Table AA.1 are met

3.AA.206
dust collection means

container having means of safe dust disposal to be undertaken when handled in accordance with the manufacturer's instructions

3.AA.207
negative pressure unit

extraction unit used to ensure that the pressure within a working enclosure is below atmospheric

6 Classification

6.AA.201 The machines are classified according to dust classes:

- L (light hazard) suitable for separating dust with a limit value of occupational exposure of greater than 1 mg/m^3 ;
- M (medium hazard) for separating dust with a limit value of occupational exposure not less than $0,1 \text{ mg/m}^3$;
- H (high hazard) for separating all dusts with all limit values of occupational exposure, including carcinogenic and pathogenic dusts.

NOTE 1 The use of an **essential filter** of a specified dust class does not allow the complete machine to be classified with that dust class.

NOTE 2 In some countries, national regulations exist concerning disposal of **hazardous dusts**.

7 Marking and instructions

7.1 Addition.

The model or type reference marked on the machine shall include the dust class letter. Safety relevant spare parts, such as filters, **dust collection means** and disposable devices (e.g. rigid containers or plastic bags), when provided with the machine, shall be marked with an indication to ensure use of the correct spare parts.

7.12 Addition:

In addition, the instructions shall include the substance of the following:

- The most important operational data of the machine as specified in 3.1.9 of this part 2, its dust class, its intended use and, if applicable, any limitations of use.
- Specification of spare parts relating to safety, such as filters and **dust collection means**, and information of where they can be obtained.
- Maximum flow rate (m^3/h) and maximum underpressure (hPa).
- Before use, **operators** shall be provided with information, instruction and training for the use of the machine and the substances for which it is to be used, including the safe method of removal and disposal of the material collected.

- For user servicing, the machine ~~must~~ shall be dismantled, cleaned and serviced, as far as is reasonably practicable, without causing risk to the maintenance staff and others. Suitable precautions include decontamination before dismantling, provision for local filtered exhaust ventilation where the machine is dismantled, cleaning of the maintenance area and suitable personal protection.
- The manufacturer, or an instructed person, shall perform a technical inspection at least annually, consisting of, for example, inspection of filters for damage, air tightness of the machine and proper function of the control mechanism. In addition, on class H machines, the machine filtration efficiency should be tested at least annually, or more frequently as may be specified by national requirements. The test method that can be used to verify the machine's filter efficiency is specified in 22.AA.201.2. If the test fails, it shall be repeated with a new **essential filter**.
- When carrying out service or repair operations, all contaminated items which cannot be satisfactorily cleaned are to be disposed of; such items shall be disposed of in impervious bags in accordance with any current regulation for the disposal of such waste.
- The method by which covers of non-dust proof compartments should be removed for cleaning.

In addition, the instructions shall include the substance of the following, if applicable.

- for class M and class L machines, the meaning of the relevant warning label according to Figure AA.2;
- for class H and class M machines, the outside of the machine should be decontaminated by vacuum cleaning methods and wiped clean or treated with sealant before being taken out of a hazardous area. All the machine parts shall be regarded as contaminated when removed from the hazardous area and appropriate action taken to prevent dust dispersal;
- for class H machines, the meaning of the warning label according to Figure AA.1, including the corresponding warning text according to 7.14;
- for vacuum cleaners with an inflating function, that the use of the **inflating function** is not permitted in areas where hazardous dusts are present;
- for **dust extractors**, it is necessary to provide for an adequate **air change rate** \geq **acr** in the room if the exhaust air is returned to the room. Reference to National regulations is necessary.

In addition, the instructions may recommend the following:

- **operators** should observe any safety regulations appropriate to the materials being handled.

7.14 Addition:

Class H machines shall be fitted with the label according to Figure AA.1.

Class M and class L machines shall be fitted with the relevant label according to Figure AA.2.

The following warning shall be given on the label for class H machines:

WARNING: This machine contains dust hazardous to health. Emptying and maintenance operations, including removal of the dust collection means, must only be carried out by authorised personnel wearing suitable personal protection. Do not operate without the full filtration system fitted.

For class L, class M and class H machines, covers and **guards** which do not require **tools** for removal shall be fitted with an additional label worded: REMOVE FOR CLEANING.

7.15 Addition:

Lettering in warning notices on the machine shall have a minimum height of 3 mm.

The warning notices shall be so positioned that they can easily be seen by the **operator** when switching the machine on or off.

22 Construction

22.AA.201 Dust collecting machines shall be designed and constructed in accordance with the dust classes given in 6.AA.201 and meet the values given in Table AA.1.

Table AA.1 – Penetration limits

Dust class	Suitability for hazardous dust with limit values for occupational exposure $\text{mg} \times \text{m}^{-3}$	Degree of penetration <i>D</i> %	Essential filter material test	Essential filter element test	Assembled machine test method
L (light hazard)	> 1	< 1	22.AA.201.1 or 22.AA.201.2	Not required	22.AA.201.3 if essential filter material test is not carried out
M (medium hazard)	$\geq 0,1$	< 0,1	22.AA.201.1 or 22.AA.201.2	Not required	22.AA.201.3
H (high hazard)	< 0,1 including carcinogenic dusts and dusts contaminated with carcinogens and/or pathogens	< 0,005	Not required	22.AA.201.2	22.AA.201.3

Machines of similar construction and with identical **essential filter** and mountings and with an identical airflow velocity may be treated equally.

Machines designed for picking up wood dust and mineral dust (containing quartz) shall be at least of dust class M.

Compliance is checked by the following tests, if applicable as stated in Table AA.1, and taking into account the flow chart as shown in Figure AA.6.

22.AA.201.1 Essential filter material test

*For dust class L and M machines, the degree of **penetration** of the filter material is determined as follows:*

Compliance is tested using apparatus similar to Figure AA.3. An integrally measuring photometer or a suitable particle measuring system can be used. The test is carried out using 6 new material samples.

The dust laden air is sucked through the filter material for 1 h, the air flow velocity at the measuring point P being the same as the air flow velocity at the filter in the machine.

The test dust used is a wide spectrum quartz dust in a concentration of $(200 \pm 20) \text{ mg/m}^3$, where 90 % of the particle diameters at the measuring point P are between $0,2 \mu\text{m}$ and $2 \mu\text{m}$, based on Stokes diameter.

The degree of **penetration** is calculated by means of the following formula:

$$D = \frac{C_H - C_o}{C_v - C_o} \times 100 \% \quad [\text{AA.1}]$$

where

C_H is the light-scattering signal downstream of the filter;

C_o is the blank value of the apparatus for ambient air;

C_v is the light scattering signal upstream of the filter.

The degree of **penetration** is averaged over the duration of the test, the first readings being taken 5 min after the commencement of the flow of dust laden air through the filter sample material.

The degree of **penetration** D is determined for 6 samples.

The arithmetic mean of the 6 values, plus twice the standard deviation, shall be less than the required value of D according to Table AA.1.

22.AA.201.2 Essential filter element test

For dust class H machines, the degree of **penetration** of the **essential filter** element shall be determined as follows:

Compliance is checked by using apparatus similar to Figure AA.4.

On machines with a ducted outlet, Figure AA.3 can be used.

All dust filters are removed, except the **essential filter** element.

It shall be ensured that the **essential filter** element is evenly loaded with the test aerosol.

The test is carried out with a new **essential filter** element.

The test aerosol is a narrow spectrum mist of paraffin oil, dispersed oil particulate (DOP) or NaCl, in a concentration between 10 mg/m^3 and 200 mg/m^3 . To maintain the concentration between these limits, adjustments may be made after 5 min, if necessary.

According to Stokes diameter, 90 % of the number of particles is below $1 \mu\text{m}$.

An integrally functioning photometer or a suitable particle counter is used to measure D continually.

After a second delay of 20 min, D is calculated with equation [AA.1]. The effect of carbon brush dust shall be taken into consideration.

D is not allowed to exceed the limit value given in Table AA.1.

22.AA.201.3 Assembled machine test

For dust class M and class H machines, a polydisperse limestone dust of particle size distribution 10 % < 1 μm , 22 % < 2 μm , 75 % < 5 μm is used for testing, in an apparatus as specified in Figure AA.5.

For machines equipped with a built-in filter cleaning mechanism, before this test, carry out a minimum of 1 cleaning cycles as described under 22.AA.202.

For machines equipped with collection bags, replace any clogged bags to restore the airflow rate.

When the airflow velocity has fallen to 20 m/s in the nominal suction hose diameter, with a maximum measuring time of 8 h, D is determined, either gravimetrically with a 95 % one-sided confidence level according to ISO 2602, or with an equivalent measuring system.

If the fan of the vacuum cleaner under test is strong enough to maintain the required airflow rate, QE may be reduced to zero.

The upstream concentration of the test substance during the entire test shall be 5 g/m³ airflow.

The influence of air temperature, humidity and density shall be taken into consideration.

D shall not exceed the values given in Table AA.1.

22.AA.201.4 Burst strength test

If the machine is equipped with a safety switch to protect the motor and filter system, the safety switch shall be made inoperable.

Any parts, with the exception of the **essential filter** itself, shall be dried to facilitate the flow of the clogging medium. All pre-filters that can be removed without the use of a **tool** shall be removed from the machine to ensure that the **essential filter** is subjected to the full loading of the clogging medium and to the pulsing effect of blocking the inlet as described below.

Suck up a clogging medium (e.g. French chalk) until a differential pressure corresponding to 90 % of the maximum vacuum generated by the machine has been reached, or until the differential pressure stabilises for a minimum of 2 h. Cover the inlet to the machine for 5 s followed by opening for 1 s to achieve a pulsing effect.

The pulsing test shall be repeated 30 times over a period of 3 min.

The **essential filter** shall not show any damage (e.g. rip up, loosening, holes cracking).

22.AA.202 Filtration efficiency

Dust class M and dust class H machines may be provided with a **safe change filter** if a dust free filter exchange cannot be guaranteed. If dust class M and dust class H machines are provided with a built-in filter cleaning mechanism for the **essential filter**, the cleaning process shall not affect the filtration efficiency.

Compliance is checked by the following test.

Collect a suitable dust so that the airflow velocity is reduced below 20 m/s. The filter cleaning is carried out 50 times according to the instructions. The clogged bags are then emptied if necessary to restore the airflow according to 22.AA.203.

22.AA.203 Suction performance

If machines are provided with a built-in cleaning mechanism, it shall restore the required suction performance.

Compliance is checked by comparing the suction airflow with the desired value after operating the cleaning device according to the instructions. The cleaning operation shall be performed when the minimum suction airflow has been reached. The following performance, after the cleaning, shall be reached:

- for suction-sweeping machines, the reduction of pressure in the brush area is at least 50 N/m²;
- for other machines, the suction airflow is 20 % greater than the minimum airflow volume as specified in 22.AA.205.

22.AA.204 'Upholstery tacks' test

Dust class M and dust class H machines shall be designed and constructed so that the **essential filter** will not be damaged when collecting sharp objects such as broken glass or nails which may be sucked up.

Compliance is checked during normal operation by collecting 1 kg per kW rated power input, with a maximum of 1 kg, of upholstery tacks, 13 mm long. The filter shall show no damage.

If there is no visible damage, the tests of 22.AA.201 shall be carried out.

22.AA.205 Indication regarding dust removal

All machines shall be capable of achieving an adequate removal of dust, and an indication shall be given as follows.

- a) Vacuum cleaners of dust class M and class H shall be provided with an indicator which operates before the air velocity, through the largest hose (or tube) supplied by the manufacturer, falls below 20 m/s, referring to the largest section in the hose. If airflow indicator adjustments are necessary, they shall be adjustable without **tools**.
- b) For suction-sweeping machines, the indicator shall operate before the reduction of pressure in the suction region of the brush area becomes less than 50 N/m². This also applies to the side brush area.
- c) For **dust extractors** (excluding **negative pressure units** and dust class L machines), the indicator shall operate before the suction velocity becomes less than that stated by the manufacturer or 20 m/s, whichever is greater, referring to the largest section in the hose, or the dust source is shut off by a mechanism in the dust collector. If airflow indicator adjustments are necessary, they shall be adjustable without **tools**. If the dust source cannot be shut off automatically (e.g. when the **dust extractor** is connected to a circular saw), then at least one of the following warning signals shall be given:
 - an acoustic warning signal, if used, shall comply with ISO 7731;
 - a visual warning signal, if used, shall comply with ISO 11428;
 - a pair of voltage-free contacts and installation instructions for their use as a warning signal switching device.

Compliance is checked by inspection and the following test.

*Operate the machine at nominal voltage, at **rated voltage** +6 %, and at **rated voltage** –10 %; and, if necessary, compare the values with the specified values. No leaking of dust shall occur.*

22.AA.206 Disposable collection means

Dust class M machines (except suction sweeping machines) and dust class H machines shall be fitted with a disposable collection means.

For dust class M and dust class H machines, it shall be possible to remove the collection means with a minimum of dust release.

Compliance is checked by inspection and functional test.

22.AA.207 Removability of the essential filter

In dust class H machines, the **essential filter** shall only be removable by the use of a **tool**. This requirement does also apply to filter elements which are relevant for the first numeral of the IP protection designation.

Compliance is checked by inspection.

22.AA.208 Air speed of the dust exhaust

The air speed of the exhaust of dust class M and dust class H machines shall not unduly disturb dust lying on the floor.

Compliance is checked by the following test:

The machine shall be at least 2 m from any wall or vertical surface. The humidity of the air in the test area shall not exceed 60 % and the test shall be carried out in still air conditions. The working hose shall be fitted to the inlet and the intake end shall be positioned in an upward direction at a minimum height of 2 m above floor level. The exhaust velocity shall not exceed 1 m/s at a height of 50 mm above floor level.

22.AA.209 Upstream location of the essential filter

In dust class H machines, the **essential filter** shall be at less than atmospheric pressure.

For dust class L machines, if the **essential filter** is on the positive side, then the **penetration** test of 22.AA.201.3 shall be conducted.

Compliance is checked by the relevant test.

22.AA.210 Guard

Dust class M and dust class H machines shall be constructed so as to **guard** against accidental entry and the release of **hazardous dust** from any part of the machine when not in use.

Compliance is checked by inspection and the use of test probe B of IEC 61032.

22.AA.211 Easy cleaning

Dust class H machines and dust class M machines shall be designed and constructed in such a way that they can be easily cleaned, without impairing their safety. They shall comply with the following:

- covers which are not protecting against both mechanical and electrical hazards and behind which dust can deposit shall be removable without **tools**;
- **guards** which are protecting against mechanical and electrical hazards shall have electrical interlocks which disconnect the mains supply on removal, or shall be removable

only by using **tools**. **Guards** fitted with electrical interlocks shall be removable without **tools**. The interlock shall be double pole if protecting against electrical hazard, and double or single pole if protecting against mechanical hazard only.

Compliance is checked by inspection.

22.AA.212

Machines of dust classes M or H shall not be equipped with an **inflating function**.

For machines equipped with a **blowing function**, the hoses for suction and for the **blowing function** shall not be interchangeable.

Compliance is checked by inspection.

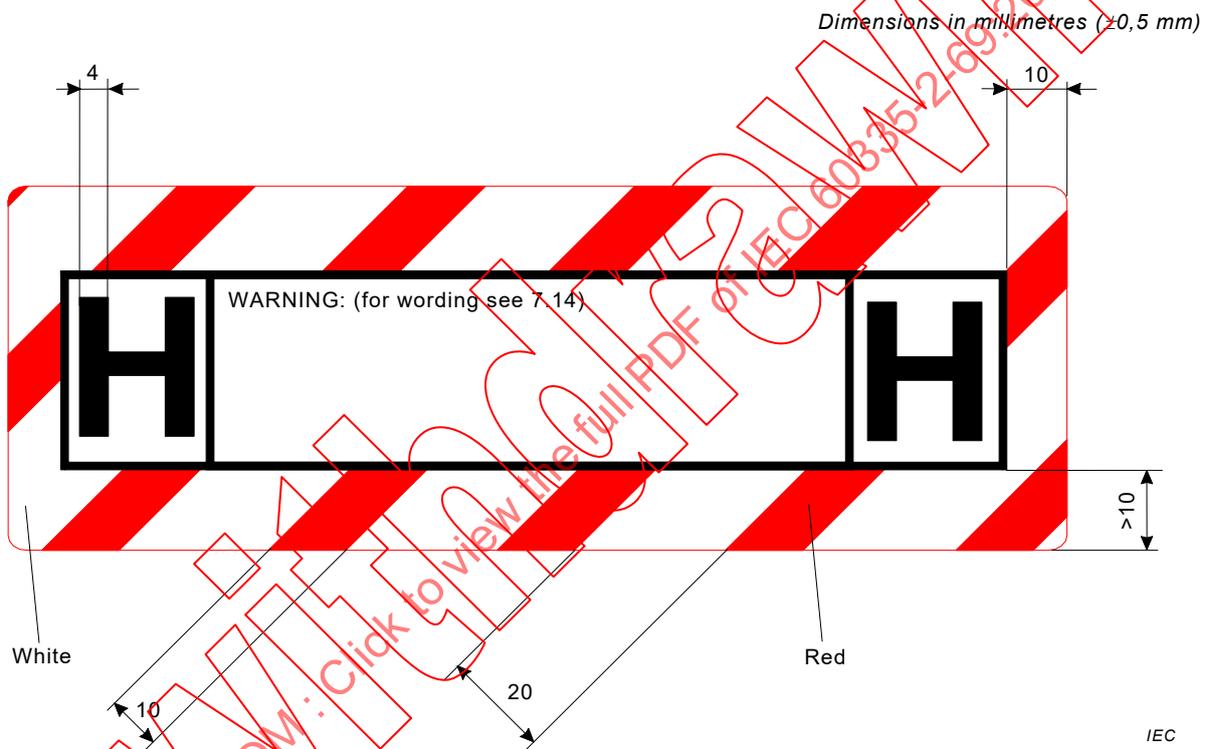


Figure AA.1 – Warning label for dust class H machines

Dimensions in millimetres ($\pm 0,5$ mm)

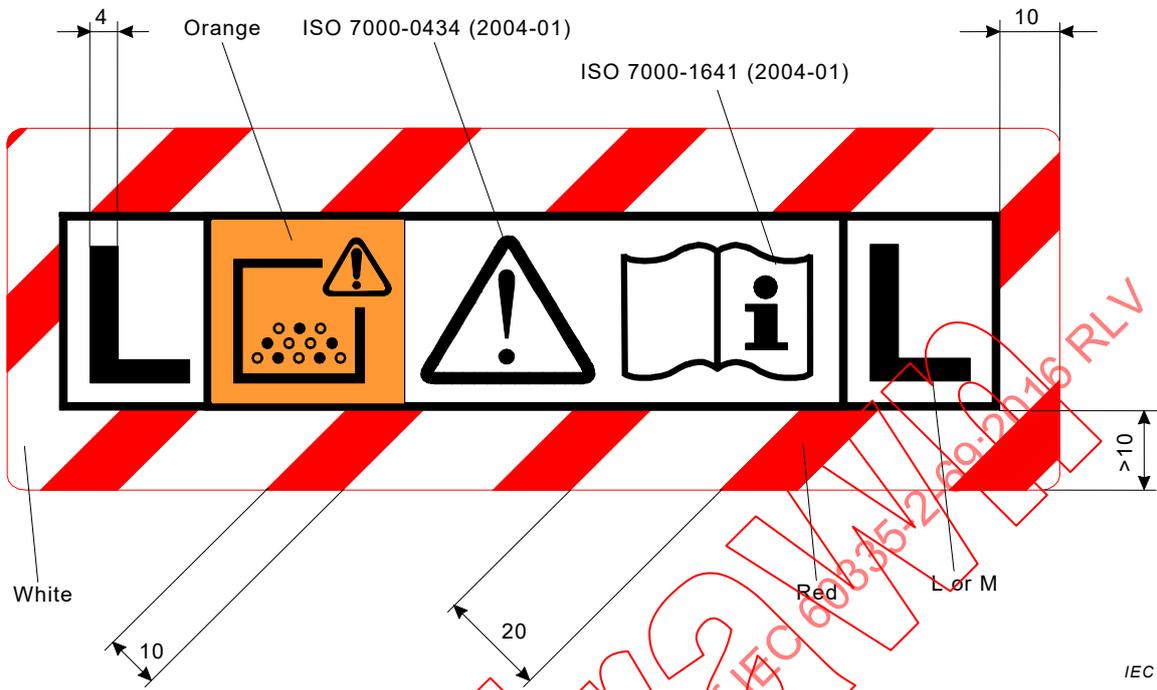


Figure AA.2 – Warning label for dust class L and dust M machines

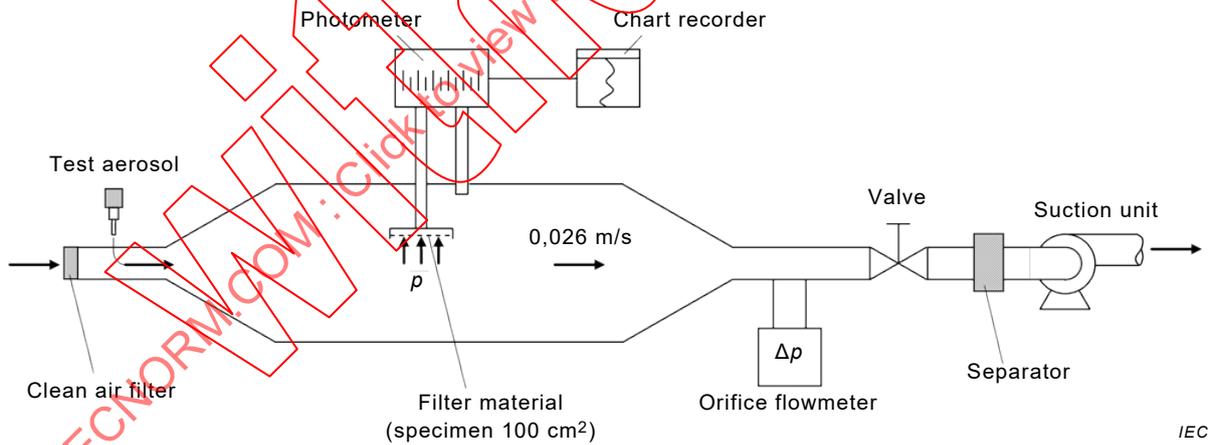


Figure AA.3 – Test method for essential filter material

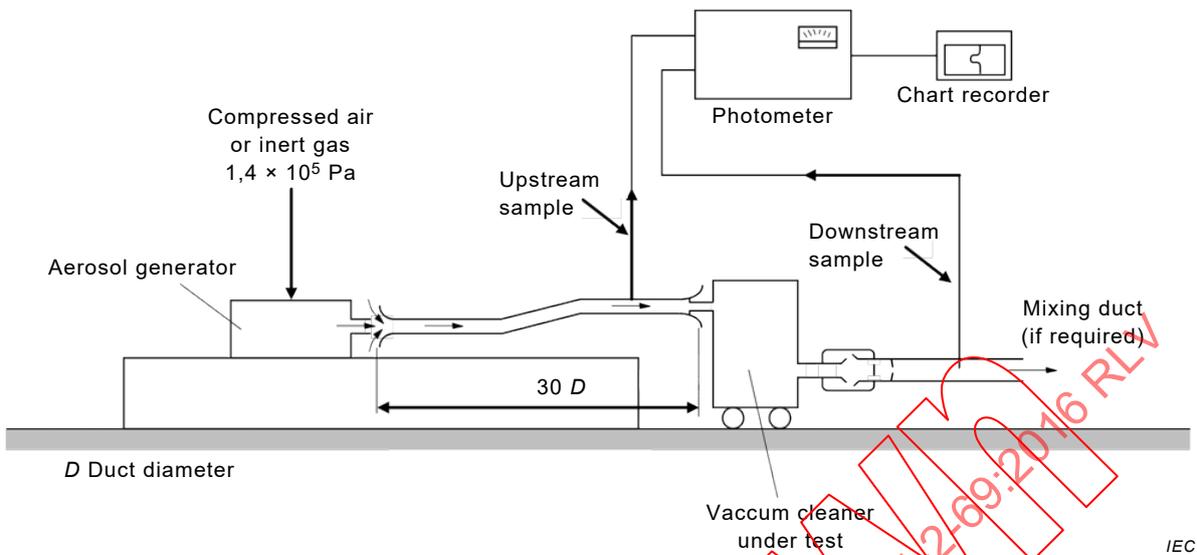
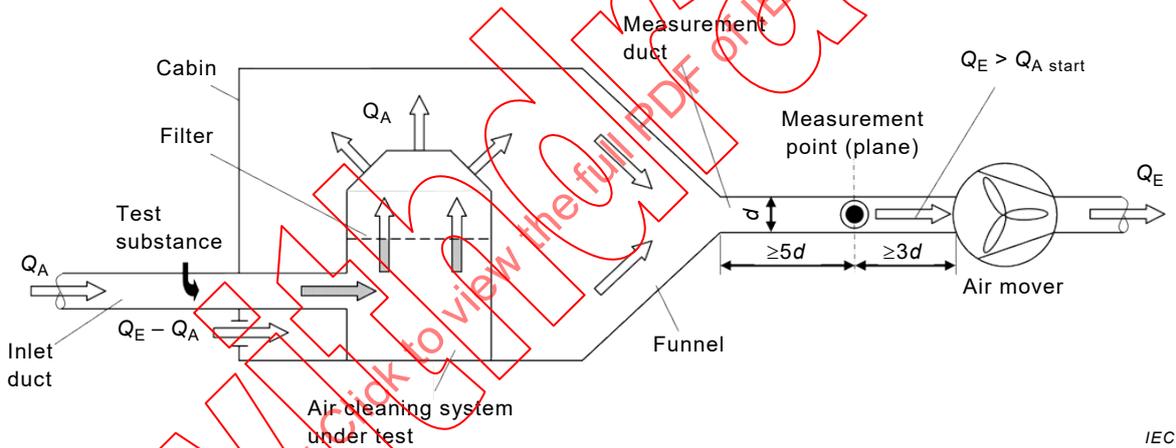
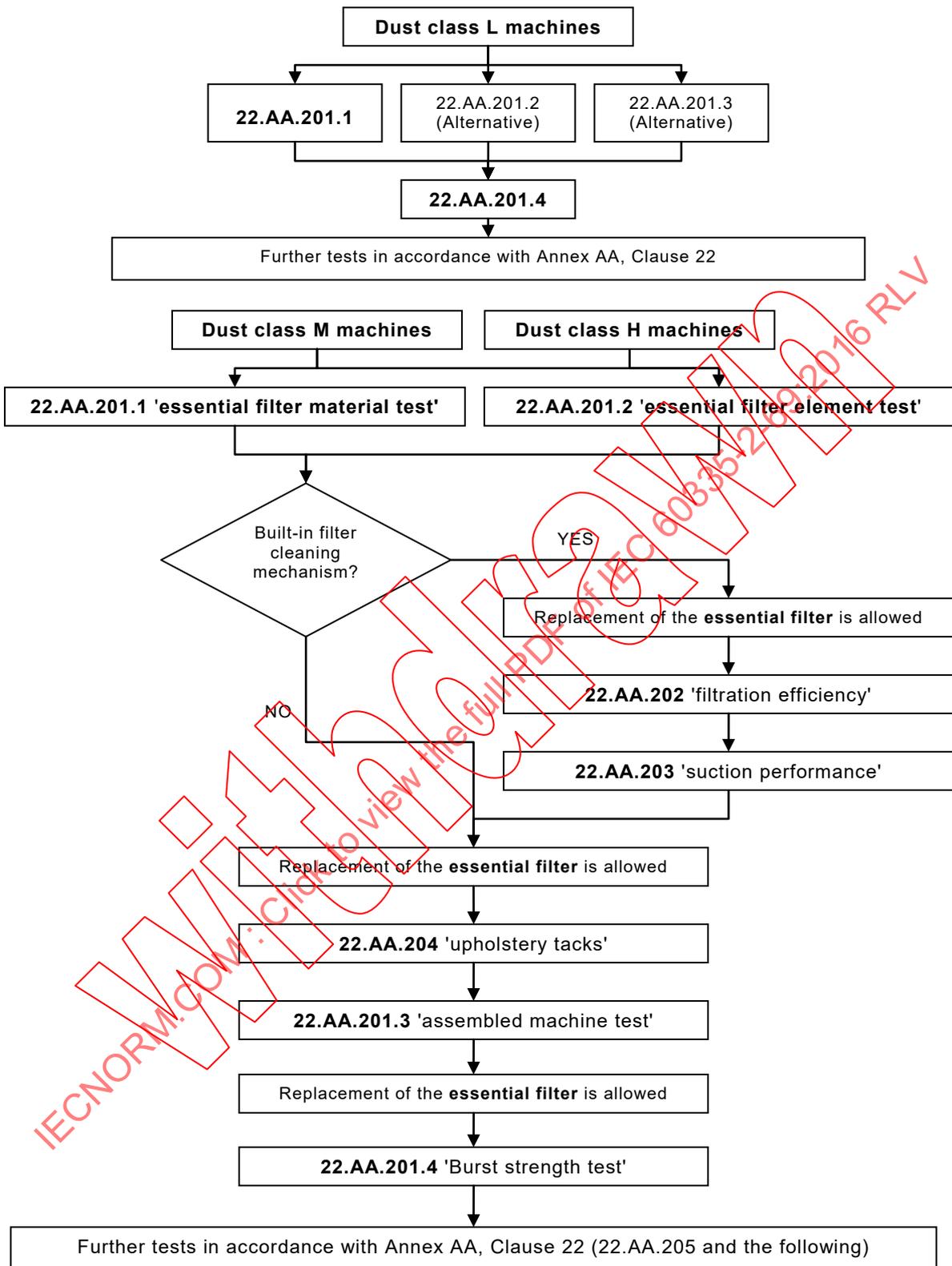


Figure AA.4 – In situ essential filter element test



The air entering at Q_E should be filtered. The filter used shall be of dust class M.

Figure AA.5 – Assembled machine test



IEC

Figure AA.6 – Sequence and selection of tests according to Clause 22

Annex BB (informative)

List of dusts which present an explosion risk when subject to ignition conditions

Values of explosion parameters are given in Table BB.1 as a guide for those concerned with the design and operation of dust-handling machines. The dust samples are not necessarily in the most hazardous form that could arise in industry. In addition, the design of the machine, the quantity of material and the methods for handling should all be taken into account when considering explosion hazards.

NOTE Attention is drawn to the fact that in many countries particular information on explosion parameters may be specified by the national health authorities, the national authorities responsible for the protection of labour, or similar authorities. This information might be available online, e.g.

– for Germany [cited 2011-11-04 2016-03-14]: <http://www.dguv.de/ifa/GESTIS/GESTIS-Stoffdatenbank/index.jsp>

Table BB.1 – Explosion parameters

Dust	Minimum ignition temperature °C	Minimum explosible concentration kg/m ³	Minimum ignition energy mJ
Acetamide	560	-	-
Acetoparaphenetidine	-	-	11,5
Acetyl-p-nitro-o-toludine	450	-	-
Acetyl salicylic acid (Aspirin)	550	0,015	16
Acrylonitrile-butadiene-styrene copolymer	400	-	-
Acrylonitrile-vinylidene chloride copolymer	-	0,05	70
Alkyd powder coatings	360	0,028	22
Aluminium, 6 µm	-	0,03	13
Aluminium, <1 400 µm	420	-	-
Aluminium, cuttings and buffings	480	-	-
Aluminium, fibres	610	-	-
Aluminium, finishings	600	-	-
Aluminium, polishings	460	-	-
Aluminium, swarf	590	-	-
Aluminium octoate	460	-	-
Animal feed stuff	450	-	-
Anthracene	-	-	7
Anthraquinone	670	-	-
Asbestos, resinated	480	-	-
Azodicarbonamide	-	0,6	130
Barley, milled	370	-	-
Battery case dust	400	-	-
Benzoic acid	600	0,011	12
Benzoyl peroxide	-	-	31
Benzoyl peroxide 44 %, gypsum 56 %	-	-	12
Bleach powder, 60/100 µm	580	-	-

Dust	Minimum ignition temperature	Minimum explosible concentration	Minimum ignition energy
	°C	kg/m ³	mJ
Bone flour, steamed	540	-	-
Boron carbide	640	-	-
Bread	450	-	-
Bronze	440	-	-
Brunswick green	360	-	-
Cadmium sulphide	700	-	-
Cadmium sulphoselenide	710	-	-
Cadmium yellow	390	-	-
Cadmium zinc sulphide	660	-	-
Calcium citrate	470	-	-
Calcium gluconate	550	-	-
Calcium pantothenate	430	-	-
Calcium propionate	530	-	-
Calcium silicide	-	-	< 4,6
Calcium stearate	450	-	24
Caprolactam	430	0,07	60
Carbon, 13 % volatile	590	-	45
Casein	460	-	-
Casein meal, steamed	460	-	-
Cellulose, bleached	410	-	-
Cellulose acetate	340	-	-
Cellulose acetate, fibres	430	-	-
Cellulose acetate butyrate	380	-	-
Cellulose triacetate	390	-	-
Charcoal, wood	470	-	-
Chicken manure	680	-	-
Chloro-amino-toluene sulphonic acid	650	-	-
p-Chloro o-toluidine hydrochloride	650	-	-
Coal, 30 % volatile	530	-	-
Coal, 36 % volatile	490	-	-
Coal, anthracite < 63 µm	530	-	-
Coal, Pittsburgh < 74 µm	530	0,03	-
Coal, pulverized < 150 µm	550	-	-
Coal, silkstone	490	-	-
Cocoa, bean husk	400	-	-
Coconut shell	490	-	-
Coffee	360	-	-
Coffee 55 %, chicory 45 %	370	0,1	140
Cork	400	-	-
Cornflour	390	-	-
Cornstarch	380	0,15	-

Dust	Minimum ignition temperature °C	Minimum explosible concentration kg/m ³	Minimum ignition energy mJ
Cyclohexanone peroxide	-	-	21
Detergent, high non-ionic	410	-	-
Detergent, low non-ionic	560	-	-
Detergent, standard ABS	520	-	-
Dextrine	440	-	-
Dextrose monohydrate	350	-	-
Diamino stilbene disulphonic acid	450	-	-
Dibutyl tin maleate	600	-	-
Dibutyl tin oxide	530	0,012	7
Dihydro streptomycin sulphate	670	-	-
Dimethyl acridan	540	-	-
Dimethyl diphenyl urea	490	-	-
Dinitroaniline	470	-	-
Dinitrobenzoyl chloride	380	-	-
Dinitro stilbene disulphonic acid	450	-	-
Diphenyl guanidine + 1,5 % de-dusting powder	540	-	28
Diphenyl propane	-	0,012	11
Epoxide resin	-	-	9
Epoxy powder, semi-gloss coating	-	0,013	-
Epoxy resin	490	0,012	12
Esparto grass	-	-	-
Face powder	440	-	-
Farina starch, 20 % H ₂ O	-	-	-
Ferrochrome	600	-	-
Fish meal	520	-	-
Flour, English 13 % H ₂ O	-	-	-
Flour, wheat	390	-	100
Grain, distillers dried solubles	420	0,06	128
Grain, dried brewers	440	0,009	-
Grass	380	-	-
Gum, arabic, 250/1 400 µm	550	-	-
Hoof and horn, hydrolysed	460	-	-
Hops, ground	340	-	-
Hydroxy ethyl cellulose	420	-	-
Hydroxy ethyl methyl cellulose	410	-	-
Irish moss	540	-	-
Isinglass	520	-	-
Jaborandi leaf	470	-	-
Lauryl peroxide	-	-	12
Lead stearate, dibasic	-	-	12
Leather, < 420 µm	520	-	-

Dust	Minimum ignition temperature °C	Minimum explosible concentration kg/m ³	Minimum ignition energy mJ
Liquorice root	-	0,2	-
Magnesium swarf	610	-	-
Maize gluten meal	430	-	-
Maize husk	430	-	-
Male fern, crushed	510	-	-
Malt, coarse	390	-	-
Manganese ethylene bis-dithio carbamate	270	0,07	35
Manioc flour	430	-	-
Meat meal	500	-	-
Meat and bone meal	440	-	-
Melamine formaldehyde resin	410	0,02	68
Methyl cellulose	480	-	-
2,2 Methylene bis-4-ethyl-6-tertiary butyl phenol	310	-	-
Methyl methacrylate	-	-	13
Milk powder	440	-	-
Milk powder, skimmed	-	-	-
Monochloroacetic acid	620	-	-
Monosodium salt of tri-chloroethyl phosphate	540	-	-
β-Naphthol	670	-	-
Nigrosine hydrochloride	630	-	-
p-Nitro o-anisidine	400	-	-
Nitrocellulose	-	-	30
Nitrodiphenylamine	480	-	-
Nitrofurfural semi-carbazone	240	-	-
m-Nitro p-toluidine	470	-	-
p-Nitro o-toluidine	470	-	-
Nylon, ground flock	450	-	-
Nylon 11	-	0,005	32
Paper	400	0,03	-
Paper tissue, < 1 400 µm	-	-	39
Peat	450	-	-
Peat, dried	-	0,1	-
Pectin, powdered	390	-	-
Penicillin, N-ethyl, piperidine salt of	310	-	-
Phenol formaldehyde	520	-	-
Phenol formaldehyde resin	450	0,015	-
Phenothiazine	590	-	-
Polyester resin < 1 400 µm	400	-	-
Polyethylene	390	0,02	38
Polyethylene, commercial	-	-	57
Polyethylene, ground	400	-	-

Dust	Minimum ignition temperature °C	Minimum explosible concentration kg/m ³	Minimum ignition energy mJ
Polyethylene glycol	320	-	-
Polyethylene high density < 90 µm	-	-	17
Polypropylene	380	-	43
Polyurethane	460	-	-
Polyvinyl acetate	450	-	-
Polyvinyl acetate, beads	-	-	70
Polyvinyl chloride	510	-	-
Polyvinyl chloride, dispersion resin	550	-	-
Polyvinylidene chloride	670	-	-
Poppy flower	410	0,4	600
Potato, dried, < 200 µm	450	-	-
Propylidone	470	-	-
Protein	480	-	-
Protein, groundnuts	460	-	-
Protein concentrate	390	-	-
Provender	370	-	-
Quillaia bark	450	-	-
Rag, < 1 400 µm	470	-	-
Rayon, viscose	420	-	-
Rayon flock	-	0,03	-
Rayon flock, 8 denier, 1,5 mm	425	0,15	-
Resin, rubber	400	-	-
Resin, synthetic	400	-	-
Rubber	380	-	-
Rubber, latex	450	-	-
Rubber, synthetic	410	-	-
Rubber accelerator	310	-	-
Rubber crumb	440	-	-
Sawdust	430	-	-
Senna	440	0,01	105
Silicon	900	-	-
Soap	570	0,02	25
Sodium acetate	560	0,15	-
Sodium carboxy methyl cellulose	320	1,1	440
Sodium salt of 2,2 dichloropropionic acid	520	-	-
Sodium salt of 2,2 dihydroxy naphthalene disulphonic acid	510	-	-
Sodium glucaspaldrate	600	-	-
Sodium glucoheptonate, dried	600	-	-
Sodium monochloracetate	550	-	-
Sodium propionate	470	-	-

Dust	Minimum ignition temperature °C	Minimum explosible concentration kg/m ³	Minimum ignition energy mJ
Sodium toluene sulphonate	530	-	-
Sodium xylene sulphonate	490	-	-
Sorbic acid	440	-	-
Soya bean	390	0,23	370
Soya meal	410	0,18	330
Starch	470	-	-
Starch, cold water	490	-	-
Starch, maize 10 % H ₂ O	-	0,15	-
Stearic acid	330	-	-
Steel	450	-	-
Streptomycin sulphate	700	-	-
Sugar	330	0,015	48
Sulphur	220	0,02	-
Tallow, hydrogenated	620	-	-
Tartaric acid	350	-	-
Tea	500	-	-
Tobacco, dried	320	-	-
Urea	900	-	-
Urea formaldehyde moulding powder	450	0,04	-
Urea formaldehyde moulding powder, paper filled	430	0,07	49
Wax, paraffin	340	-	-
Whey flour	480	-	-
Wood	360	-	-
Wood, flour	380	0,06	100
Wood, flour, < 1 400 µm	410	-	100
Wood, ground fluffed	450	-	-
Wood, shavings	400	0,1	-
Wood pulp, dehydrated	450	-	-
Wood pulp, flock	470	-	-
Zinc stearate	420	-	14

Annex CC (informative)

Particular requirements for vacuum cleaners and dust extractors providing equipment protection level Dc for the collection of combustible dusts ~~which present an explosion risk~~

NOTE 1 This annex will be withdrawn after the publication of IEC 62784: Particular requirements for vacuum cleaners and dust extractors providing equipment protection level Dc for the collection of combustible dusts.

The following modifications to the relevant clauses in this part 2 are applicable to vacuum cleaners and **dust extractors providing equipment protection level Dc (EPL Dc)** for the collection of **combustible dusts** ~~which present an explosion risk~~.

NOTE 2 In this annex, subclauses and notes that are numbered starting from 201 are additional to those in this part 2.

1 Scope

Replacement of the first paragraph:

This standard deals with the safety of **mobile** electrical motor-operated vacuum cleaners, including **dust extractors** ~~and back-pack vacuum cleaners~~, for wet suction, or dry suction, ~~or wet and dry suction~~, intended for commercial indoor or outdoor use with or without attachments, to ~~pick up~~ collect **combustible dust** in an **explosive dust atmosphere** ~~specified as zone 22~~ and providing **EPL Dc**.

NOTE 201 Machines as covered by these annex are also suitable for use in **non-hazardous areas**. The presence of combustible dust does not automatically imply the presence of zone 22, as referred in IEC 60079-10-2.

Addition:

This standard does not cover specific hazards associated with extreme ambient temperatures (less than -20°C or higher than 40°C).

This standard does not cover motorized cleaning heads for which additional requirements are under consideration.

This standard does not apply to **back-pack vacuum cleaners**.

3 Terms and definitions

This clause of this part 2 is applicable, together with IEC 60079-0, 60079-31, 60079-10-2, except as follows.

3.CC.201 type 22 machine

vacuum cleaner or **dust extractor**, together with suction hoses, nozzles and other accessories, suitable for ~~suction~~ collection of **combustible dust** ~~in zone 22~~ and providing **EPL Dc**

~~The inner part of suction hoses and nozzles is considered to be zone 22.~~

~~3.CC.202~~

~~zone 20~~

~~place in which an explosive atmosphere in the form of a cloud of combustible dust in air is present continuously, or for long periods or frequently~~

~~3.203~~

~~zone 22~~

~~place in which an explosive atmosphere in the form of a cloud of combustible dust in air is not likely to occur in normal operation but, if it does occur, will persist for a short period only~~

3.CC.202

electrostatic earthing

connection to earth with a maximum resistance of 1 MΩ

3.CC.203

conductive parts

parts made of materials with a specific resistance of not more than 10 000 Ω·m

3.CC.204

flow through turbine

turbine where the suction air is also used to cool the electric motor

3.CC.205

antistatic filter material

filter material with a surface resistance of not more than $10^8 \Omega$

Note 1 to entry: The surface resistance was limited in accordance with IEC TS 60079-32-1.

Note 2 to entry: A measurement method can be found in DIN 54345-5.

4 General requirement

Addition:

4.CC.201

~~Machines of type 22 shall comply with dust class L, class M or class H according to Annex AA. For dust class L, an indicator is required in accordance with 22.CC.205 (indicator). Machines of type 22 and class L shall comply with the requirements of 22.CC.204 ('upholstery tacks' test). For all machines, flow-through collector motors are not allowed.~~

The requirements given in this standard apply to each **type 22 machine**, including all accessories, such as nozzles, hoses, unless otherwise stated.

The type 22 machines complying with the requirements of this annex are intended for use in areas requiring EPL Dc. This does not imply that the internal of the machine is required to be EPL Da or that it should be classified in accordance with IEC 60079-10-2. The internal parts of a type 22 machine shall comply with all of the requirements of this annex in order to meet the minimum safety requirements to process combustible dust.

Any electrical accessories, used inside the vacuum cleaner and in contact with combustible dust, that comply with EPL Da are considered to meet the requirement of this standard.

4.CC.202

~~The temperature of the surfaces of a **type 22 machine** that are in contact with **combustible dust** shall not exceed 135 °C.~~

~~Lower temperatures can be stated by the manufacturer.~~

~~Compliance is checked by the tests of Clauses 11 and 19.~~

Machines of **type 22** shall comply with dust class L, class M or class H according to Annex AA. In addition, machines of **type 22** and class L shall comply with the requirements of 22.AA.204 [upholstery tacks test] and of 22.AA.208 [speed of exhaust air], and shall be provided with an indicator in accordance with 22.AA.205. For all machines, **flow-through turbines** are not permitted. For all machines, motors with commutators or other potential sparking sources are not permitted, unless provided with explosion protection level to EPL Da.

4.CC.203 Non-metallic enclosures and non-metallic parts of enclosures shall meet the requirements of IEC 60079-0 for thermal endurance to heat (IEC 60079-0:2011, Subclause 26.8), thermal endurance to cold (IEC 60079-0:2011, Subclause 26.9) and resistance to impact (Clause 21), in that order.

4.CC.204 For materials used for cementing the requirements of 'materials used for cementing' of IEC 60079-0 shall be fulfilled additionally.

4.CC.205 For battery powered machines the requirements of IEC 60079 series shall be fulfilled additionally.

6 Classification

~~6.1 Addition:~~

~~Type 22 machines shall be of class I.~~

6.2 Addition:

~~Type 22 machines shall be at least IP54 according to IEC 60529.~~

~~The test is carried out with air moving fans working.~~

~~Data lead connectors are not required to be IP54 if they are SELV and their current is limited to 20 mA.~~

~~Compliance is checked by inspection and by the relevant tests.~~

~~6.CC.201 The machines are classified as follows:~~

~~— Type 22: Machines suitable for operation in zone 22.~~

The degree of protection against harmful ingress of water to reach EPL Dc for **type 22 machines of group IIIA, IIIB, and IIIC** shall be at least IPX4, as specified for the second numeral of the IP code in IEC 60529.

The protection against harmful ingress of dust to reach EPL Dc for **type 22 machines of group IIIA, IIIB and IIIC** is checked according to IEC 60529, taking into account the modifications described by the following test procedure, after carrying out the tests as described in 4.CC.203 where applicable.

Compliance is checked by the following tests:

The vacuum cleaner is operated at rated power in the dust test chamber as specified in 13.4 of IEC 60529:1989, and is exposed to the dust atmosphere of the required concentration and dust type.

Its suction hose is laid through a suitable opening of the chamber so that fresh air from outside the chamber is vacuumed to the cleaner, as functional vacuum air stream. Air of any separate motor cooling stream is taken from the inside of the dust test chamber.

Depending on the geometry of the exhaust opening(s) of the cleaner, its functional exhaust air may be conducted through another hose to the outside of the dust chamber.

The air pressure inside the chamber shall be held equal to the ambient air pressure, which may be achieved by means of an auxiliary vacuum cleaner attached to the test chamber.

The vacuum cleaner is operated during 8 hours. If the cooling air stream becomes restricted by blocked cooling air filters, resulting in tripping of temperature protection devices, the test can be interrupted to exchange the blocked filter with a clean filter. Inspection shall show that clearances and creepage distances shall not be reduced below the values specified in Clause 29.

The test is repeated for another 8 hours, with the vacuum cleaner non-energized.

In addition, for **type 22 machines of group IIIC**, internal components with any arcing or sparking contacts shall be protected IP6X according to IEC 60529.

Compliance is checked by inspection and the relevant tests.

Alternatively to the test described, in case machines are too big to be placed in the dust test chamber, all parts and components that might create an ignition risk shall be independently protected IP6X (for **type 22 machines of group IIIC**) or respectively IP5X (for **type 22 machines of group IIIA and IIIB**) and verified to comply with IEC 60529.

Compliance is checked by inspection and tests according to IEC 60529.

7 Marking and instructions

7.1 Addition:

Machines shall be marked ~~in accordance~~ at least with ~~IEC 61241-1-1~~, for example "Ex II 3D ~~T135°C~~" the following:

- the letters Ex;
- reference to this document (IEC 60335-2-69 Annex CC);
- Group IIIA, IIIB, or IIIC;
- the maximum surface temperature T , marked as a temperature value in °C;
- the EPL.

NOTE 201 An example for this marking may be "Ex IEC 60335-2-69 Annex CC IIIB T135°C Dc".

The equipotential bonding connector shall be marked with symbol IEC 60417-5021 (2002-10) on the connector or close to it.

~~Appliance inlets shall be marked with the essence of the statement: "Do not plug or unplug under load."~~

~~7.6 Type 22 vacuum cleaners shall be clearly and permanently marked with the symbol of Figure CC.1.~~

~~Type 22 dust extractors shall be clearly and permanently marked with the symbol of Figure CC.2.~~

7.12 Addition:

In addition, the instructions shall include the substance of the following for all **type 22 machines**:

- The dust container has to be emptied when necessary, but also ~~after every use~~ at the end of a working shift and before each transport;
- The machine shall only be operated when all filters are in position and undamaged. If the machine is equipped with filters for motor cooling air, they also shall be in position and undamaged. This is to be checked before every use;
- Extension cords shall not be used unless verified as suitable for the hazardous area;
- The correct rotation ~~sense~~ direction shall be ensured, if necessary, to avoid blowing and high temperatures caused by rotation in the wrong ~~sense~~ direction.
- The user shall be aware of all relevant characteristics of the combustible dusts within the zone in which the machine is used and to determine the safety issues associated.
- The user shall be aware of the fact that this machine is not suitable for picking up liquids with a flash point below 55 °C.

NOTE 201 The flash point temperature may vary in different countries. National regulations will need to be taken into account.

- For dusts with ignition energy less than 1 mJ, additional restrictions of the labour authorities may apply. The machine is not intended to be used for dusts with ignition energy less than 1 mJ.

NOTE 202 Typical values for ignition energy can be found in Annex BB.

~~During normal operation, surface temperatures may rise to $(T_{max})^{\circ}C$, if T_{max} exceeds 80 °C.~~

~~Type 22 machines are not suitable to pick up dusts or liquids of high explosion risk, nor mixtures of combustible dust with liquids.~~

- WARNING – Only use accessories approved by the manufacturer ~~for type 22 use~~. The use of other accessories may cause explosion hazard.
- The machine shall only be ~~operated when all filters, including filters for motor cooling air, are in position and undamaged~~ used in ambient temperatures higher than –20 °C and less than 40 °C.

~~In addition, the instructions shall include the substance of the following for suction-sweeping machines:~~

~~Type 22 suction-sweeping machines are suitable for picking up combustible dust in zone 22.~~

- WARNING – Attention is drawn to the issues associated with handling metallic dusts and the possibility of exothermic reaction (e.g. fire, explosion).
- An equipotential bonding connector is provided to enable the temporary bonding requirements of IEC 60079-14;
- The hazardous area classification (zone 22) is not changed with the use of type 22 vacuum cleaner.
- It has to be ensured that no potential ignition sources will be picked up.
- WARNING – Picking up of hot particles or glowing material can trigger fire and explosion in the ducts and the container. For this case additional safety measures are needed.

NOTE 203 Those additional safety measures are not covered by this standard.

In addition, the instructions shall include the substance of the following for wet or wet and dry vacuum cleaners:

- The user shall be aware of all relevant characteristics of liquids and mixtures of combustible dusts with liquids for which the type 22 machine shall be used and to determine the safety issues associated.

NOTE 204 E.g. textile fibres may auto-ignite when contaminated with certain oils.

In addition, the instructions shall include the substance of the following for vacuum cleaners:

- Type 22 vacuum cleaners are suitable for picking up combustible dust in **zone 22** areas requiring **EPL Dc**. They are not suitable to be connected with dust-generating machines.

In addition, the instructions shall include the substance of the following for **dust extractors**:

- Type 22 dust extractors are suitable to be connected to dust-generating machines in **zone 22** areas requiring **EPL Dc**. ~~It has to be ensured that no ignition sources will be picked up. Conductive machine parts, including suction hoods and conductive parts of Class II machines, shall be electrostatically earthed. Electrostatic earthing can be accomplished through the dust extractor or through a separate electrostatic earthing means.~~
 - Conductive machine parts, including suction hoods and conductive parts of Class II machines that generate dust, shall be electrostatically earthed. Electrostatic earthing can be accomplished through the dust extractor or through a separate electrostatic earthing means.
- NOTE 205 Examples for machines that generate dust are orbital sanders, circular saws, drills.
- Type 22 dust extractors are not suitable ~~for to be used in conjunction with machines where that can produce ignition sources are produced.~~

Information shall be given about ~~the additional national regulations that may apply for to the~~ installation of data lead wiring and power sockets in **zone 22** areas requiring **EPL Dc**.

~~The meaning of the symbols, according Figure CC.1 or Figure CC.2 shall be explained, including the substance of the following warnings:~~

- ~~— Do not pick up glowing dust or other ignition hazards (Figure CC.1).~~
- ~~— Do not pick up glowing dust or other ignition hazards. Do not use with spark-generating machines (Figure CC.2).~~

11 Heating

~~Addition to Table 3 (Maximum normal temperature rises):~~

NOTE 201 For parts that come into contact with **combustible dust**, the values in the table are based on an ambient temperature of 40 °C.

11.8 Addition:

The maximum surface temperature on any external part of a **type 22 machine** shall be according to the 'maximum surface temperature' requirements of IEC 60079-0. The maximum surface temperature shall not exceed 135 °C. Lower temperatures can be stated by the manufacturer.

The maximum surface temperature on any internal part of a **type 22 machine** shall be according to the 'maximum surface temperature' requirements of IEC 60079-0. The maximum surface temperature shall not exceed 135 °C.

The temperature limits as specified in 11.8, Table 3 shall be taken into account.

Compliance is checked in accordance with IEC 60079-0.

19 Abnormal operation

19.7 Modification:

Delete Note 101 ~~of this Part 2.~~

Addition:

The machine shall be tested until stable conditions are reached.

Addition:

19.8 Addition:

The test is repeated after interchanging two of the three-phase leads in the plug to induce rotation in the wrong sense, if possible, and if there is no warning signal for incorrect rotation sense.

22 Construction

22.CC.201 The suction fan shall be on the clean air side and shall be protected against intake of particles greater than 8 mm.

Compliance is checked by inspection and measurement.

22.CC.202 Machines shall be so constructed that ~~a minimum of~~ dust will deposit ~~in or~~ on the machine ~~as minimum as possible,~~ or that the dust deposition on the machine can be easily removed.

Compliance is checked by inspection.

22.CC.203 Outer parts of the machine, parts enclosing collected dust, nozzles and dust conduits shall not be made from aluminium containing more than 7,5 % of magnesium and not be coated with aluminium coating.

Nozzles made of cast aluminium containing more than 7,5 % of magnesium have to be protected against impact by ~~steel or resilient protectors~~ non-sparking metals such as bronze, monel-metal or low tensile strength austenitic stainless steel.

Compliance is checked by inspection.

22.CC.204 Dust deflectors shall not be made of materials that generate sparks on impact.

Examples are non-sparking metals such as bronze, monel-metal, low tensile strength austenitic stainless steel, or thermoplastics.

Compliance is checked by inspection.

22.CC.205 ~~Downstream of the essential filter, the air is considered to be free of combustible dust.~~ The essential filter shall be located upstream of the suction unit.

Compliance is checked by inspection.

22.CC.206 If a data connection is provided, then it shall be suitably explosion protected in accordance with a recognised protection technique as given in the IEC 60079 series.

Compliance is checked by inspection.

23 Internal wiring

23.CC.201 Cables and wires not within the IP54 compartment shall not be lighter than 60245 IEC 66.

This requirement does not apply to external data wiring.

NOTE For external data wiring, national regulations can apply.

Compliance is checked by inspection.

24 Components

Addition:

24.1 Addition:

Components that may introduce a potential ignition source should, as far as reasonably practicable, be located outside the dust collection enclosure.

Components located within enclosures containing collected **combustible dust** ~~shall be suitable for zone 20~~ and which may produce an explosion risk shall be suitable for use in areas in which **explosive dust atmospheres** caused by air/dust mixtures are present continuously, for long periods or frequently. Components in this area shall ensure the requisite level of protection, even in the event of rare incidents relating to equipment, and are characterized by means of protection such that either

- in the event of failure of one means of protection, at least an independent second means provides the requisite level of protection; or
- the requisite level of protection is assured in the event of two faults occurring independently of each other.

The possible existence of excessive layers of dust shall be considered.

The air is considered to be free of **combustible dust** either

- downstream of the **essential filter**
- or
- downstream of the first filter that allows at least the L Class penetration level on the machine (see Figure CC.2).

NOTE 201 Requirements are given in Annex AA, 22.204.

Essential filters are not considered to produce an explosion risk, as long as either

- a) their time constant (resistance to earth times capacity) is less than 0,02 s, or
- b) they are built with **antistatic filter material** and **electrostatically earthed**, or
- c) they are located downstream of another main filter that allows at least the L Class penetration level on the machine (see Figure CC.2). In this case the other main filter should either respect condition a) or b).

Compliance is checked by inspection.

24.CC.201 ~~Cooling air filters which are needed to make the machine compliant with 6.2 as specified in this~~ If filters for cooling air are needed to comply with 6.2 of Annex CC, they shall be removable only by using **tools**.

Compliance is checked by inspection.

24.CC.202 Machine socket outlets shall comply with the requirements of IEC 60079-0 and IEC 60079-31.

Compliance is checked by inspection.

25 Supply connection and external flexible cords

25.1 Addition:

~~Appliance inlets shall be so arranged that the plug is inserted from below. When disconnected, the appliance inlet shall be protected against deposition of dust by a permanently attached dust cover.~~

Type 22 machines shall not be supplied with detachable supply cords, unless the appliance inlet complies with the requirements of IEC 60079-0 and IEC 60079-31.

Compliance is checked by inspection.

25.7 Replacement:

Power supply cords for **type 22 machines** shall not be lighter than code designation 60245 IEC 66. The conductors shall be stranded and shall have a minimum cross-sectional area of 1,0 mm².

This requirement does not apply to external data wiring.

NOTE 201 For external data wiring, national regulations ~~can~~ may apply.

Compliance is checked by inspection.

25.23 Addition:

Interconnection cords for **type 22 machines** shall not be lighter than code designation 60245 IEC 66.

This requirement does not apply to external data wiring.

NOTE 201 For external data wiring, national regulations may apply.

Compliance is checked by inspection.

25.CC.201 The supply cord shall have a length of at least 7,5 m.

NOTE In some countries other limits regarding the length of the supply cord exist.

27 Provision for earthing

27.CC.201 An additional external connection facility for an equipotential bonding conductor shall be provided in accordance with IEC 60079-0.

Compliance is checked by inspection.

30 Resistance to heat and fire

30.2 Addition:

Non-metallic parts ~~surrounding~~ enclosing collected **combustible dust** (i.e. covering or supporting, see Figure CC.1) shall be resistant to ignition and spread of fire. This requirement does not apply to removable dust-collection media placed within the flame-resistant enclosure, e.g. paper disposal bags.

Compliance is tested as follows:

The following test is not carried out on machines exclusively intended to pick up wood dust, having a maximum rated power of 1 200 W and with the volume of the dust container not exceeding 50 dm³.

*Non-metallic parts covering but not supporting the collected **combustible dust** are subjected to the glow-wire test according to IEC 60695-2-11, the test being made at a temperature of 550 °C.*

*Non-metallic parts supporting the collected **combustible dust** shall have a glow-wire flammability index of at least 850 °C according to IEC 60695-2-12, the test sample being no thicker than the relevant part and are subjected to the glow-wire test according to IEC 60695-2-11, the test being made at a temperature of 750 °C. Parts that withstand the glow-wire test of IEC 60695-2-11, but which, during the test, produce a flame that persists for longer than 2 s, are subjected to the needle-flame test of Annex E.*

The needle-flame test is not carried out on parts which are made of material classified as V-0 or V-1 according to IEC 60695-11-10, provided that the test sample was not thicker than the relevant part.

30.CC.201 Type 22 machines shall not create any ignition source.

All **conductive parts** that are in contact with **combustible dust** shall be **electrostatically earthed**.

The requirement for **electrostatic earthing** does not apply to small **conductive parts**, when their time constant (resistance to earth times capacity) is below 0,02 s.

~~Filter materials are not required to be conductive.~~

The requirements for non-conductive parts of equipment and non-conductive layers on metal parts, not enclosing electrical components, only apply if they are exposed to the **explosive dust atmosphere** and if there is a foreseeable electrostatic charging.

Compliance is checked as follows:

*The **electrostatic earthing** is measured with minimum 100 V DC, with an electrode surface not exceeding 20 cm². The electrode is applied with a force of 10 N ± 2 N.*



IEC 2308/07

Figure CC.1 – Marking – Type 22 vacuum cleaners



IEC 2309/07

Figure CC.2 – Marking – Type 22 dust extractors

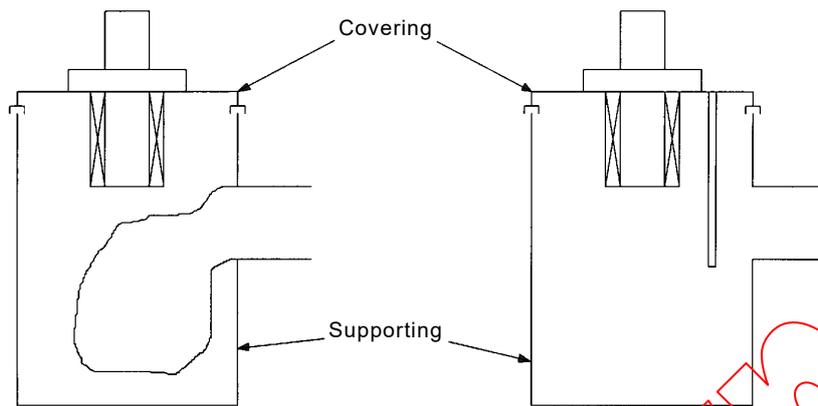


Figure CC.1 – Non-metallic parts enclosing collected combustible dust

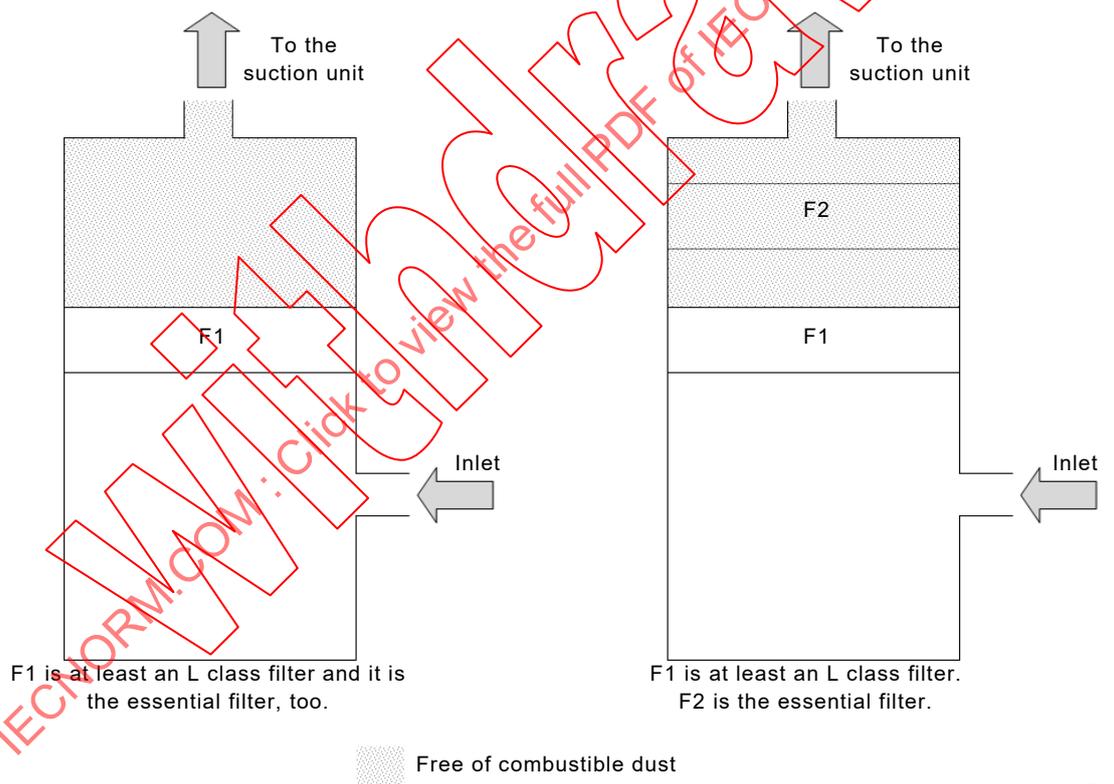


Figure CC.2 – Areas considered free of combustible dust

Annex DD (normative)

Particular requirements for vacuum cleaners for use in ESD protected areas

The following modifications to this part 2 are applicable to vacuum cleaners for use in **ESD protected areas**.

NOTE In this annex, subclauses and notes that are numbered starting from 201 are additional to those in this part 2.

1 Scope

Replacement of the first paragraph:

This standard deals with the safety of electrical motor-operated vacuum cleaners, including **back-pack vacuum cleaners**, for wet suction, dry suction, or wet and dry suction, intended for **commercial use** with or without attachments in **ESD protected areas**.

3 Terms and definitions

3.DD.201

type ESD vacuum cleaner

vacuum cleaner for use in **ESD protected areas**

3.DD.202

electrostatic earthing

connection to earth with a maximum resistance of 1 M Ω

3.DD.203

conductive parts

parts made of materials with a specific resistance of not more than 10 000 Ω ·m

4 General requirement

Addition:

Type ESD vacuum cleaners shall comply with dust class L, class M or class H according to Annex AA.

6 Classification

6.1 *Addition:*

Type ESD vacuum cleaners shall be **class I**.

6.2 *Addition:*

Type ESD vacuum cleaners shall be at least IP54 according to IEC 60529.

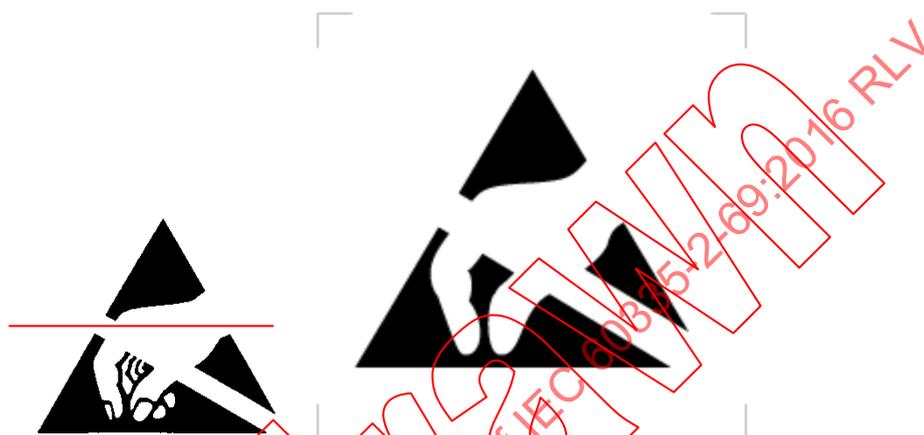
The test is carried out with air moving fans working.

Compliance is checked by inspection and by the relevant tests.

7 Marking and instructions

7.1 Addition:

Type ESD vacuum cleaners shall be clearly and permanently marked with the following symbol or symbol IEC 60417-5134 (2003-04):



7.12 Addition:

In addition, the instructions shall include the substance of the following for all **type ESD vacuum cleaners**:

- Extension cords shall be **Class I**.
- **Type ESD vacuum cleaners** are not suitable to pick up dusts or liquids of high explosion risk, nor mixtures of **combustible dust** with liquids.
- **WARNING** – Only use accessories approved for Type ESD use. The use of other accessories may cause electrostatic discharges.
- The machine shall only be operated when all filters, including filters for motor cooling air, are in position and undamaged.

NOTE National regulations may contain requirements for the installation of data lead wiring and power sockets in EPAs.

22 Construction

22.DD.201 Machines shall be so constructed that a minimum of dust will deposit in or on the machine.

22.DD.202 Type ESD vacuum cleaners shall not generate or keep electrostatic charge. All **conductive parts** shall be electrostatically earthed.

The requirement for **electrostatic earthing** does not apply to small **conductive parts**, when their time constant (resistance to earth times capacity) is below 0,02 s.

Compliance is checked as follows.

The **electrostatic earthing** is measured with 100 V DC, with an electrode surface not exceeding 20 cm². The electrode is applied with a force of 10 N ± 2 N.

22.DD.203 The surface resistance of chargeable shell parts and accessories shall not exceed $10^9 \Omega$.

Compliance is checked as follows.

The surface resistance is measured between 2 parallel electrodes, each 100 mm long, in a distance of 10 mm to each other, making contact to the measuring surface. The applied voltage shall be $500 \text{ V} \pm 10 \text{ V}$. The measurement shall be done on standard conditions ($23 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$; $50 \% \pm 5 \%$ air humidity).

24 Components

24.1 Addition:

Components located within enclosures shall be suitable for **EPA's**.

Compliance is checked by inspection.

24.DD.201 Cooling air filters which are needed to make the machine compliant with 6.2 as specified in this Annex DD shall be removable only by using **tools**.

Compliance is checked by inspection.

30 Resistance to heat and fire

30.2 Addition:

Non-metallic parts surrounding collected dust shall be electrically conductive.

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Annex EE (informative)

Emission of acoustical noise

EE.1 Noise reduction

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

The major sound sources of vacuum cleaners are: motors and fans.

EE.2 Noise test code

EE.2.1 Emission sound pressure level determination

The emission sound pressure level for all vacuum cleaners except for **back-pack vacuum cleaners** is determined in accordance with ISO 11203 applying the method described in 6.2.3 d) with the measurement distance $d = 1$ m.

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

The emission sound pressure level for **back-pack vacuum cleaners** is determined in accordance with ISO 11201, grade 2. The microphone is placed at a height of $1,65 \text{ m} \pm 0,05 \text{ m}$, and at a distance of $0,10 \text{ m} \pm 0,025 \text{ m}$ in y direction from the ear of the **operator** on the louder side, and at a distance of $0,00 \text{ m} \pm 0,025 \text{ m}$ in x direction from the ear of the **operator**. The microphone shall be pointed towards the ear.

EE.2.2 Sound power level determination

The sound power level is measured in accordance with ISO 3744, or with ISO 3743-1 if a suitable hard-walled test room is available, or with ISO 9614-2. The direction of the x-axis in Figures EE.1 and EE.2 ~~must~~ shall be the same as the x-axis defined for the microphone configurations in ISO 3744.

EE.2.3 Operating and mounting conditions

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

In addition to **normal operation** in accordance with 3.1.9, the following requirements for different types of vacuum cleaners shall be taken into account. The measurement time shall be at least 15 s.

EE.2.3.1 Canister vacuum cleaners

The vacuum cleaner shall be installed on the reflecting plane.

Immediately before each series of measurements, the machine shall be operated for at least 10 min; battery powered machines shall be operated for at least 2 min, starting with a fully charged battery. The noise emission of the non-motorised suction nozzle shall be excluded

from measurement so that it does not interfere with the measurement result, e.g. by placing the nozzle outside of the measurement area.

NOTE 201 Figures are not considered to be necessary for **canister vacuum cleaners** without **motorized cleaning head**. Figures EE.1 and EE.2 show the **motorized cleaning head** as well as the upright vacuum cleaners according to EE.2.3.2.

EE.2.3.2 Upright vacuum cleaners and motorized cleaning heads

Before starting the measurement procedure, the cleaning head shall be adjusted correctly in accordance with the manufacturer's instructions for cleaning carpets.

If the cleaning head is equipped with a device to put out brushes or other retractable parts for cleaning carpets, the cleaning head shall be adjusted so that the bristles of rotating brushes or other retractable parts go beyond the theoretical supporting plane of the cleaning head on a hard floor from $(2_{-0}^{+0,2})$ mm or, if not possible, from at least 2 mm.

All parts intended for hard floor treatment only shall be removed or retracted. For upright vacuum cleaners, crevice nozzles or similar accessories, if applicable, shall not be taken into account.

The upright vacuum cleaner shall be fixed directly without any resilient means on the Wilton carpet (according to IEC 60312-1) of a size 2 m × 1 m, placed on the floor of the test room. If the measurement is done in a reverberation test room or a hard-walled test room, a minimum **clearance** of 1 m between any part of the machine or attachments and the nearest wall shall be observed. The vacuum cleaner shall be positioned in accordance with Figures EE.1 or EE.2.

The hose and connecting tube(s) or the handles of hand-supported and upright vacuum cleaners shall be resiliently suspended or supported in normal position of use (middle of the handles at (80 ± 5) cm above the carpet, if possible), the cleaning head being in full contact with the carpet.

If necessary, the cleaning head shall be resiliently fastened to prevent self-propulsion.

Sound radiation due to possible vibrations of the standard test carpet shall be prevented.

The test carpet is considered to be a part of the machine to be tested and its possible influence on the acoustical characteristics of the test environment, for example of the hard reflecting plane, or on the absorption (reverberation time) of the reverberant test room or hard-walled room shall not be taken into account.

EE.2.3.3 Back-pack vacuum cleaners

Before starting the measurement procedure, the nozzle intended for cleaning carpets shall be adjusted correctly in accordance with the manufacturer's instructions for cleaning carpets.

If the nozzle is equipped with a device to put out brushes or other retractable parts for cleaning carpets, the nozzle shall be adjusted so that the bristles or other retractable parts go beyond the theoretical supporting plane of the nozzle on a hard floor from $(2_{-0}^{+0,2})$ mm or, if not possible, from at least 2 mm.

All parts intended for hard floor treatment only shall be removed or retracted. Crevice nozzles or similar accessories, if applicable, shall not be taken into account.

The **back-pack vacuum cleaner** shall be carried by an **operator**. The **operator** shall stand upright and look straight ahead. The **operator** shall be $1,75 \text{ m} \pm 0,05 \text{ m}$ tall. The harness of the **back-pack vacuum cleaner** shall be adjusted to the size of the **operator**.

The handle is held by the **operator** in the right hand in $0,80 \text{ m}$ height with inclination of 45° to the floor and the suction nozzle is placed with no pressure on the Wilton carpet (according to IEC 60312-1) of a size $2 \text{ m} \times 1 \text{ m}$, placed on the floor of the test room. The vacuum cleaner and the **operator** shall be positioned in accordance with Figure EE.3.

If the measurement is done in a reverberation test room or a hard-walled test room, a minimum **clearance** of 1 m between any part of the machine or attachments and the nearest wall shall be observed.

Sound radiation due to possible vibrations of the standard test carpet shall be prevented.

The test carpet is considered to be a part of the machine to be tested and its possible influence on the acoustical characteristics of the test environment, for example of the hard reflecting plane, or on the absorption (reverberation time) of the reverberant test room or hard-walled room shall not be taken into account.

EE.2.3.4 Centrally-sited vacuum cleaners

The airflow through the machine shall be adjusted so that the power consumption is according to the rated power.

When carrying out free field measurements, the machine may be operated with the mounting side on the reflecting floor. A suction hose shall be used, long enough to avoid measuring suction noise. Carpets are not required.

EE.2.4 Measurement uncertainties

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

EE.2.5 Information to be recorded

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

EE.2.6 Information to be reported

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

EE.2.7 Declaration and verification of noise emission values

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

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

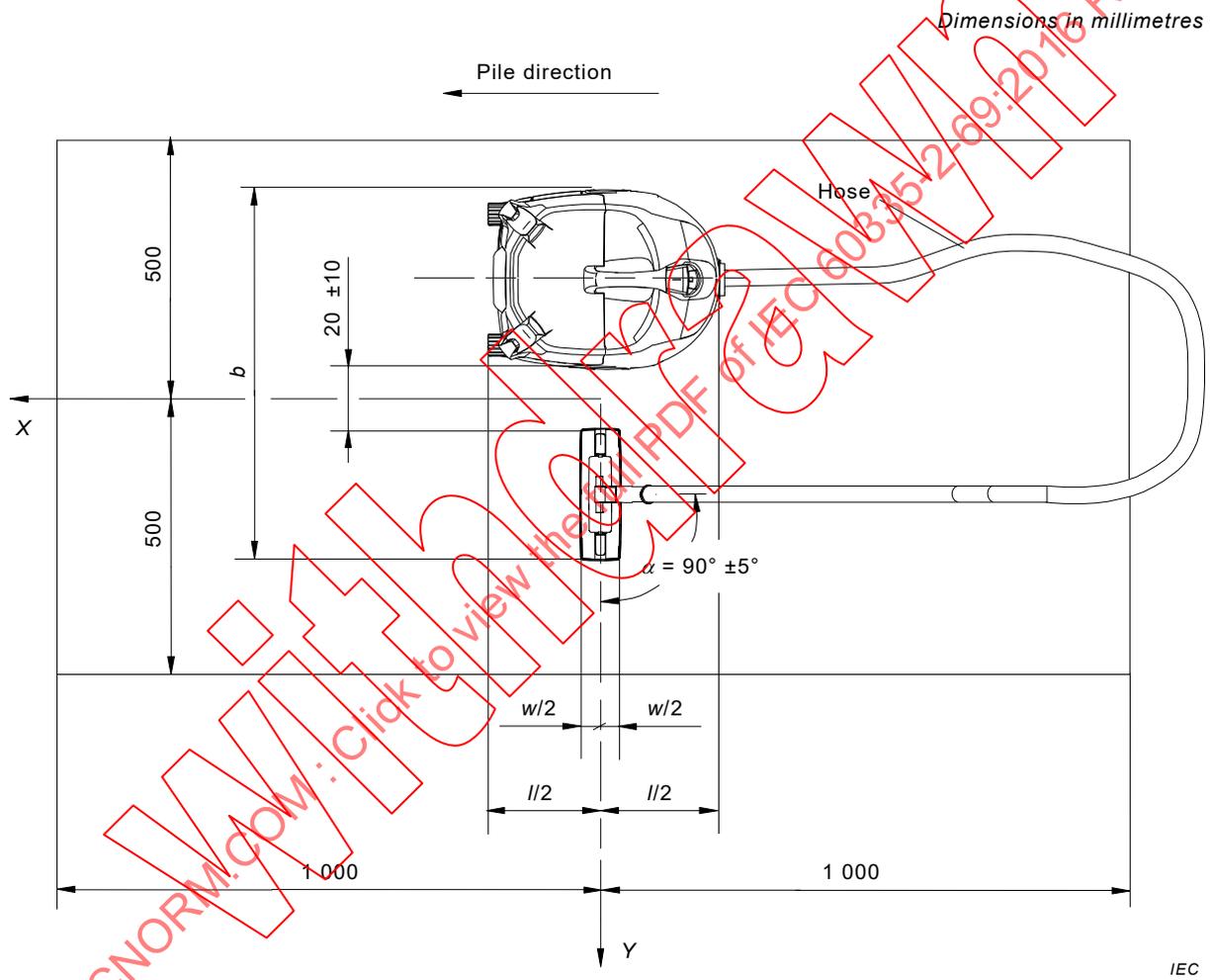
The sound power level shall be given as a dual-number noise emission declaration according to ISO 4871, where the emission sound pressure level exceeds 80 dB(A) .

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

NOTE K_{pA} and K_{WA} are expected to be 2 dB.

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

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



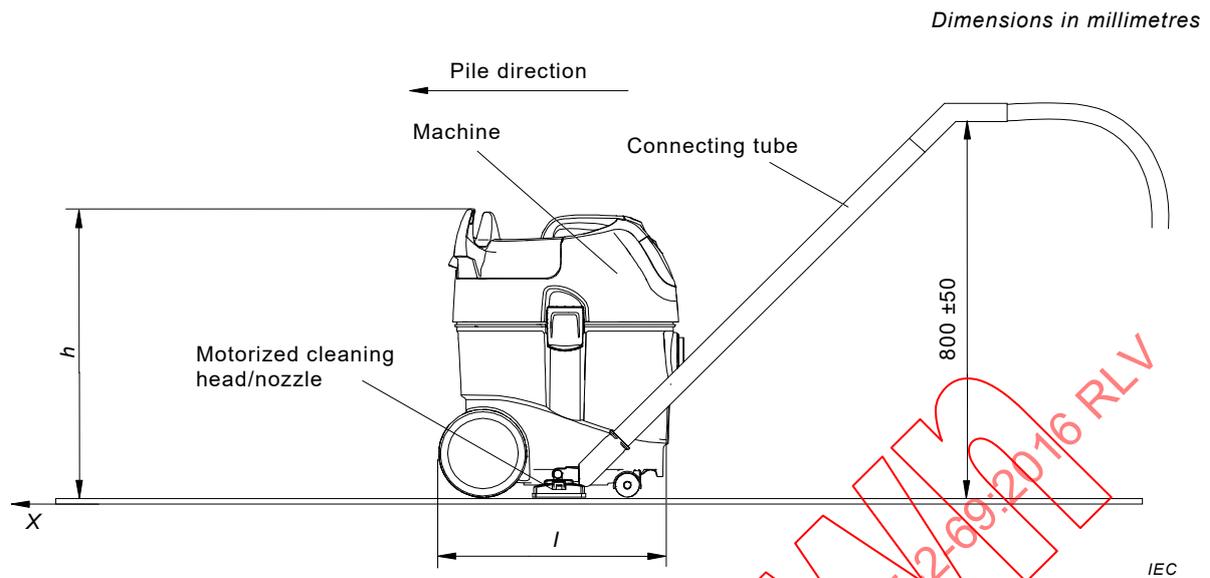
Key

w = depth of the motorized cleaning head/nozzle

l = length of the machine

b = width of machine including nozzle

a) Machine with cleaning head connected by hose and connecting tube (top view)



Key

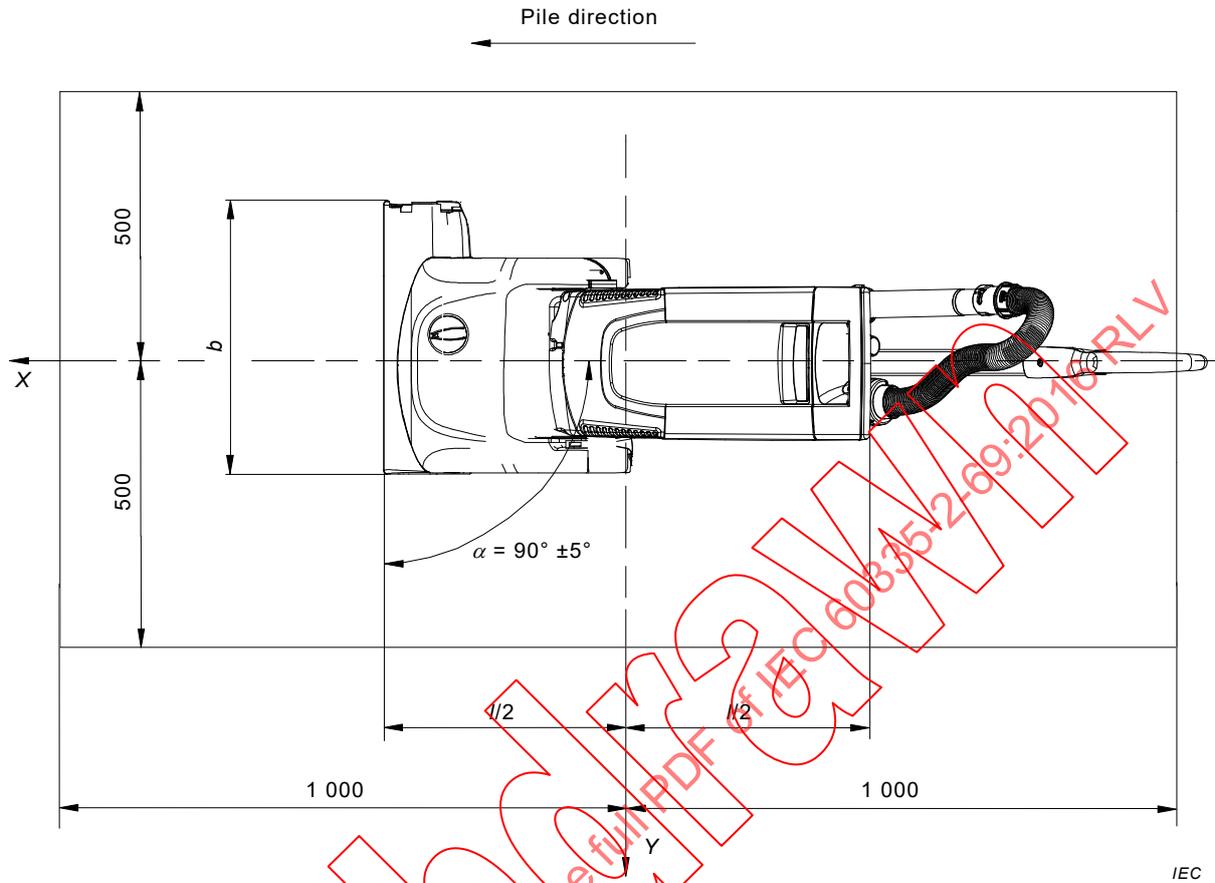
l = length of the machine

h = height of the machine

- b) Machine with cleaning head connected by hose and connecting tube (side view)

Figure EE.1 – Position of vacuum cleaners and its accessories

Dimensions in millimetres

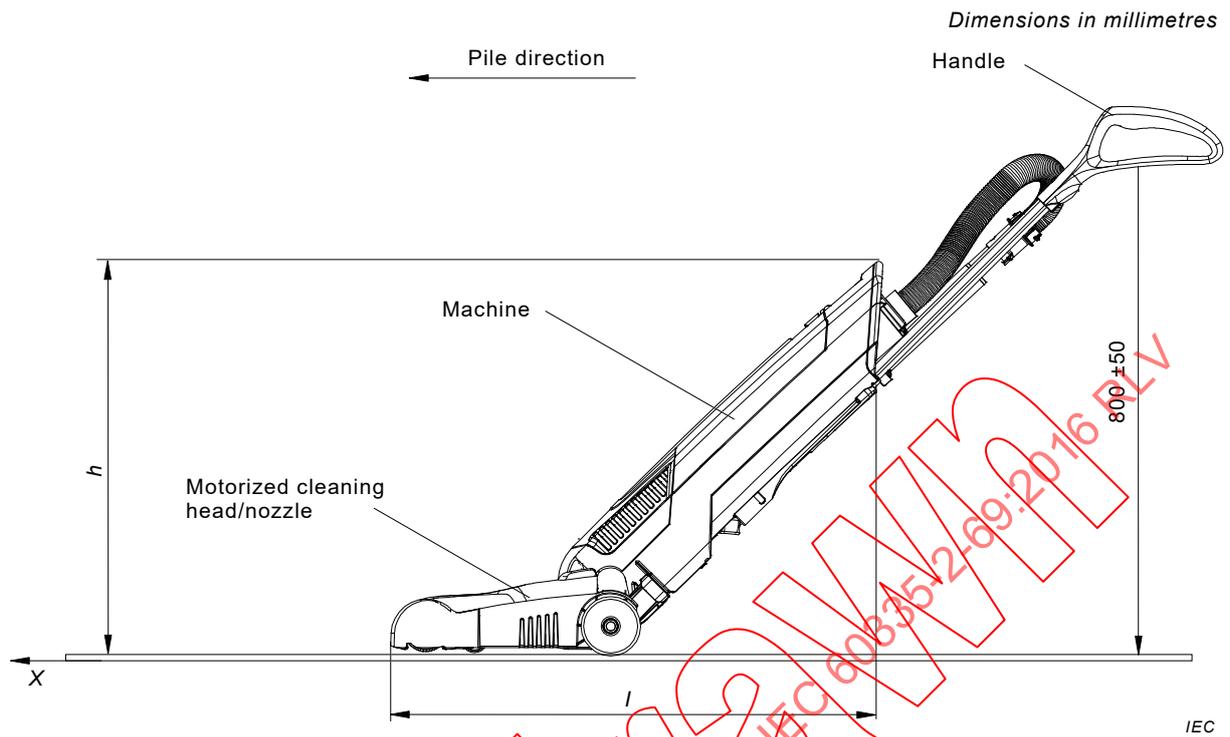


Key

l = length of the machine

a) Machine with cleaning head connected directly (top view)

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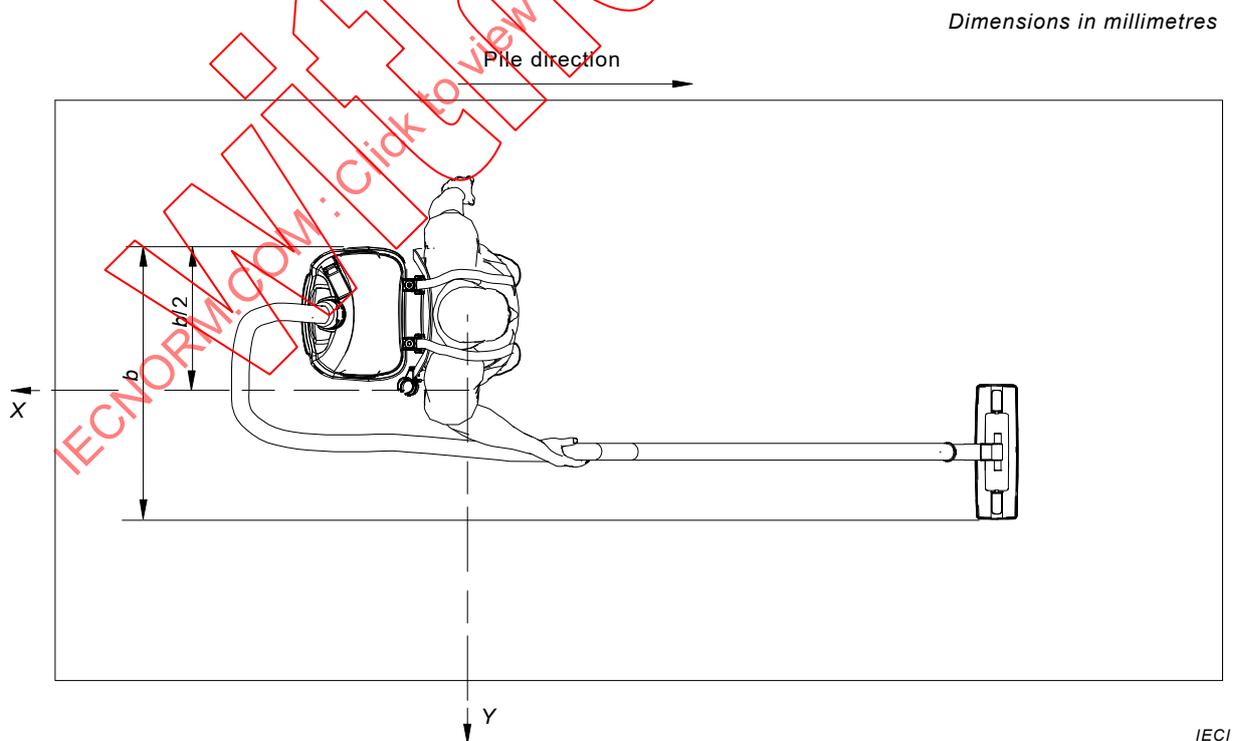


Key

l = length of the machine

b) Machine with cleaning head connected directly (side view)

Figure EE.2 – Position of upright machines

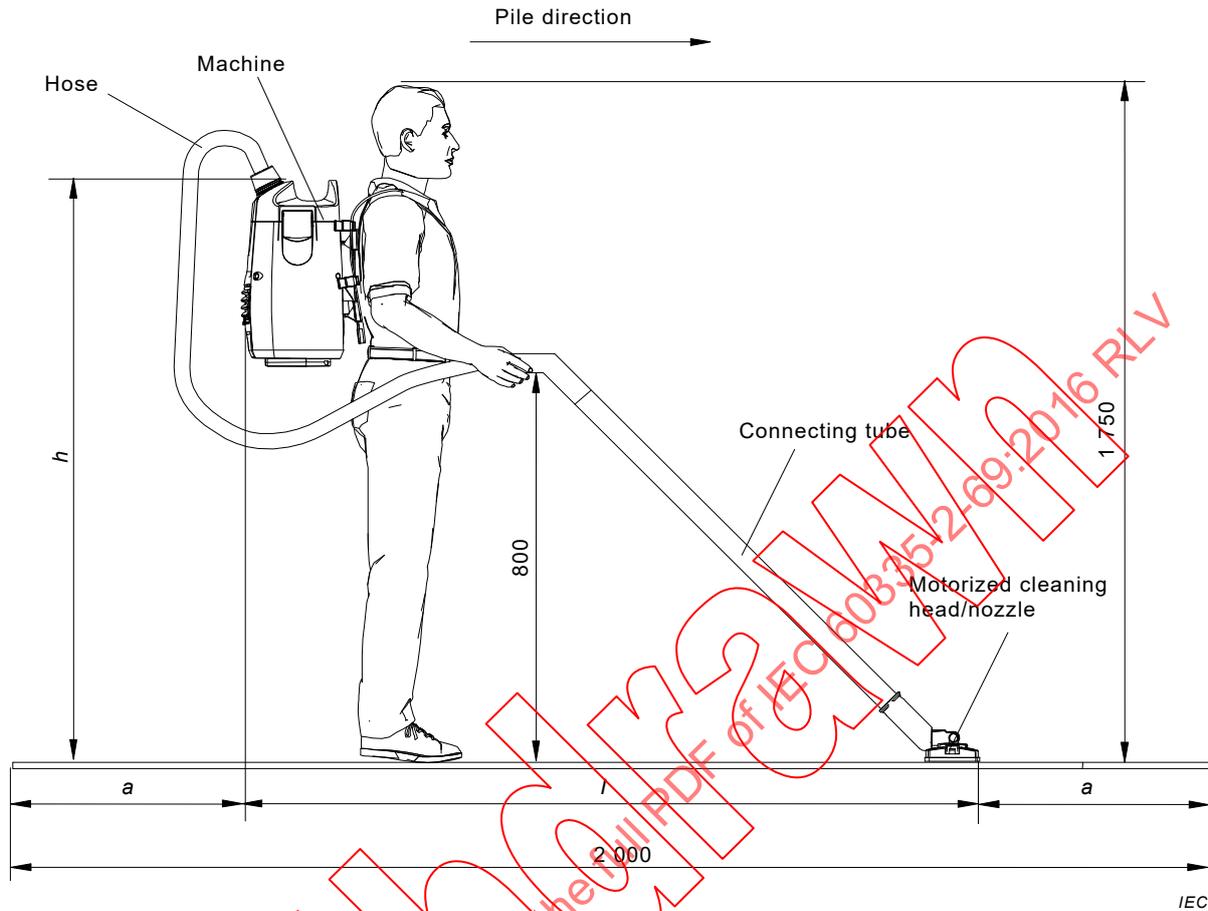


Key

b = width of machine including nozzle

a) Back-pack vacuum cleaners (top view)

Dimensions in millimetres



Key

h = height of machine

l = length of the machine including nozzle

a = distance to carpet border

b) Back-pack vacuum cleaners (side view)

Figure EE.3 – Position of back-pack vacuum cleaners

Annex FF (informative)

Emission of vibration

FF.1 Reduction of vibration

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

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

FF.2 Information on vibration emission

The instructions for hand-held and walk-behind machines and hand-held parts of other machines shall give the following information:

- the vibration total value to which the hand-arm system is subjected, measured in accordance with ISO 5349-1 for arm vibrations, the machine being supplied at **rated voltage** or at the maximum **rated voltage** for machines with a range of voltages, if the vibration total value exceeds 2,5 m/s². Where this value does not exceed 2,5 m/s², this fact may be stated in place of the emission value and uncertainty, e.g. by declaring $a_h \leq 2,5 \text{ m/s}^2$;
- the uncertainty surrounding these values, in accordance with the above given standards.

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

Regarding operating conditions during measurement and the methods used for measurement, the reference of the standard applied (IEC 60335-2-69) ~~must~~ shall be specified.

NOTE Experience has shown that for these machines the magnitude of hand-arm vibration is in general significantly below 2,5 m/s². Therefore, unless the equipment concerned has a technical specification that renders this experience inapplicable, it is sufficient to mention that the emission value is below 2,5 m/s².

Annex GG (normative)

Particular requirements for mobile wet vacuum cleaners for rescue and firefighting services (MWF)

The following modifications to the relevant clauses in this part 2 are applicable to mobile wet vacuum cleaners for rescue and firefighting services.

NOTE In this annex, subclauses and notes that are numbered starting from 201 are additional to those in this part 2.

1 Scope

Replacement of the first paragraph:

This standard deals with the safety of electrical motor-operated vacuum cleaners for wet suction or wet and dry suction, for picking up dusts or liquids including water emulsions, intended to be used by rescue and firefighting services.

Replacement of the second paragraph:

They are not equipped with a traction drive. The following power systems are covered:

- mains powered motors up to a **rated voltage** of 250 V for single-phase appliances.

3 Terms and definitions

GG.3.201 portable residual current device PRCD

a portable mechanical switching device designed to make, carry and break currents under normal service conditions and to cause the opening of the contacts when the residual current attains a given value under specified conditions

Note 1 to entry: A **PRCD** may be also called ground fault circuit interrupter (**GFCI**).

[SOURCE: IEC 60050-442:1998, 442-05-02, modified – "portable" has been added to the term defined and the note to entry has been changed]

6 Classification

6.1 Replacement:

MWF vacuum cleaners shall be of **class I** with respect to the protection against contact with live parts.

Compliance is checked by inspection and by the relevant tests.

7 Marking and instructions

7.1 Addition:

The model or type reference marked on the machine shall include the letters MWF.

MWF vacuum cleaners shall be marked in addition with the symbol according to Figure GG.1 and the symbol according to Figure GG.2.

7.12 Addition:

In addition, the instructions shall include the substance of the following for all **MWF vacuum cleaners**:

- **WARNING** – Flammable fluids and their emulsions or mixtures can only be picked up when their flash-point is 55 °C or higher. If the flash-point is lower (e.g. gasoline), precautions are necessary to avoid risk of explosion.
- **WARNING** – Do not use to pick up flammable or combustible liquids, such as gasoline, or use in areas where they may be present.
- before use, operators shall be provided with information regarding the applicable **PRCD** system;
NOTE 201 The SPE-PRCD according to 24.201 may not work in combination with a mobile power generator. If the MWF vacuum cleaner is equipped without any **PRCD**, the operator takes care of the appropriate protection before using the MWF vacuum cleaner.
- before use, operators shall be provided with information, instruction and training for the use of the MWF vacuum cleaner and the substances for which it is to be used, including the safe method of removal and disposal of the material collected;
- the container shall be emptied and cleaned when necessary, but also after every use and before storage.

In addition, the instructions shall include the substance of the following warning for those **MWF vacuum cleaners** which are equipped without any **PRCD**:

- **WARNING** – The MWF vacuum cleaner must not be used without **PRCD**. The use without **PRCD** may cause severe hazard.

19 Abnormal operation

19.1 Modification:

Replace the first sentence by the following:

Machines are again subjected to the test of 15.2. Disposal pumps are made inoperative.

20 Stability and mechanical hazards

20.GG.201 **MWF vacuum cleaners** shall be equipped with adequate devices to lift or carry the machine safely. They shall be designed in such a way that they can be used while wearing personal protective equipment (PPE) in accordance with ISO 15383.

Compliance is checked by inspection.

22 Construction

22.GG.201 The **MWF vacuum cleaner** shall be equipped with a pump for a continuous disposal of the sucked up liquid. It shall be possible that suction unit and pump operate at the same time. The machine shall be equipped with a fluid shut-off device to prevent overflowing. There shall be no interference between this fluid shut-off device, the containment and any water level sensing control.

NOTE Examples of water level sensing controls are float switches and level sensors containing moving parts.

Compliance is checked by inspection and measurement.

22.GG.202 The **MWF vacuum cleaner** shall be capable to dispose a liquid stream of 50 l/min minimum when connected to a hose of 15 m length and 42 mm internal diameter, with the hose outlet positioned at a height of 2,5 m above ground level of the vacuum cleaner.

NOTE Such a hose is e.g. C-42-15-K in accordance with DIN 14811.

The **MWF vacuum cleaner** shall be capable to suck up a liquid volume of 35 l without disposal of the liquid and without overflow.

Compliance is checked by inspection and measurement.

22.GG.203 This document does not contain any requirements for inlet and outlet connection couplings.

NOTE For inlet and outlet connection couplings, national regulations apply. It would be beneficial to agree on the design at the time of ordering between purchaser and the manufacturer or manufacturer's authorized representative.

Compliance is checked by inspection.

22.GG.204 The **MWF vacuum cleaner** shall be equipped with a debris filtration system to avoid impairing the pump system by coarse dirt. The filtration system shall be easy to clean.

Compliance is checked by inspection.

22.GG.205 The **MWF vacuum cleaner** shall be equipped with accessories as follows:

- a suction hose with a nominal diameter of at least 35 mm and a length of at least 2,5 m;
- a floor nozzle with a working width of at least 30 cm;
- a suction tube with a total length of at least 800 mm;

NOTE To enabling the storage of the tube in the box as described below it is of advantage to be designed as telescopic tube, as tube to be stuck of different parts, or similar.

- a crevice nozzle.

Compliance is checked by inspection.

22.GG.206 The **MWF vacuum cleaner** shall be equipped with a **PRCD** in accordance with IEC 61540 either incorporated into the plug or mounted at a distance of less than 250 mm from the plug.

The **MWF vacuum cleaner** may be equipped alternatively with a Switched Protective Earth – Portable Residual Current Device (SPE-PRCD) in accordance with IEC 62335, in case this is required by the end-user explicitly.

NOTE 1 Both the **PRCD** and the SPE-PRCD are acceptable with regard to safety requirements while the SPE-PRCD may cause problems when used in combination with a mobile power generator.

The **MWF vacuum cleaner** may be equipped alternatively without any **PRCD** in case this is required by the end-user explicitly and if it is ensured that the **MWF vacuum cleaner** is connected by a separate **PRCD** or by a mobile power generator, where equal safety functions are included. In this case, the operator is responsible for the safe operation of the appliance.

NOTE 2 Attention is drawn to the fact that in many countries additional requirements on the safe use of the equipment covered may be specified by the national firefighting and rescue service authorities, the national authorities responsible for the protection of labour, and similar authorities.

NOTE 3 Attention is drawn to the fact that in many countries, special national conditions might be necessary with regard to application of **PRCDs** or mobile power generators.

*Compliance is checked by inspection, including one of the alternative **PRCDs**.*

24 Components

24.2 *Delete the first dashed item.*

24.GG.201 The pump shall comply with IEC 60335-2-41, except for the following subclauses:

- 25.1 (supply cords fitted with a plug),
- 25.7 1st paragraph, last sentence (types of supply cords),
- 25.8 (conductors of supply cords).

25 Supply connection and external flexible cords

Addition:

25.6 *Add the following note after first sentence:*

NOTE Attention is drawn to the fact that in many countries special national conditions might be necessary with regard to the supply connections.

25.7 *Replacement:*

Supply cords shall have a length of at least 10 m and shall be of the following type.

- Polychloroprene sheathed

Their properties shall be at least those of heavy polychloroprene sheathed flexible cords (code designation 60245 IEC 66).

NOTE 201 These cords are suitable for machines intended to be used in low temperature applications.

Compliance is checked by inspection.

31 Resistance to rusting

The safety of the **MWF vacuum cleaner** shall not be impaired when sucking up fuel oil water emulsions.

Compliance is checked by the test of GG.22.202.



Figure GG.1 – MWF symbol: wet vacuum cleaners intended for rescue and firefighting services



IEC

Figure GG.2 – Warning label for flammable or combustible liquids

Bibliography

The bibliography of Part 1 is applicable except as follows.

Addition:

IEC 60050 (all parts), *International Electrotechnical Vocabulary* (available at <http://www.electropedia.org/>)

IEC 60079-0:2011, *Explosive atmospheres – Part 0: Equipment – General requirements*

IEC 60079-10-2, *Explosive atmospheres – Part 10-2, Classification of areas – Explosive dust atmospheres*

IEC 60079-14, *Explosive atmospheres – Part 14: Electrical installations design, selection and erection*

IEC 60079-31, *Explosive atmospheres – Part 31: Equipment dust ignition protection by enclosure “T”*

IEC TS 60079-32-1:2013, *Explosive atmospheres – Part 32-1: Electrostatic hazards, guidance*

IEC 60335-2-2, *Household and similar electrical appliances – Safety – Part 2-2: Particular requirements for vacuum cleaners and water suction cleaning appliances*

IEC 60335-2-67, *Household and similar electrical appliances – Safety – Part 2-67: Particular requirements for floor treatment machines, for commercial use*

IEC 60335-2-68, *Household and similar electrical appliances – Safety – Part 2-68: Particular requirements for spray extraction appliances, for commercial use*

IEC 60335-2-72, *Household and similar electrical appliances – Safety – Part 2-72: Particular requirements for floor treatment machines with or without traction drive, for commercial use*

IEC 60335-2-100, *Household and similar electrical appliances – Safety – Part 2-100: Particular requirements for hand-held mains-operated garden blowers, vacuums and blower vacuums*

IEC 60584-1, *Thermocouples – Part 1: EMF specifications and tolerances*

IEC 60601-1, *Medical electrical equipment – Part 1: General requirements for basic safety and essential performance*

IEC 61241-1-1, *Electrical apparatus for use in the presence of combustible dust – Part 1-1: Electrical apparatus protected by enclosures and surface temperature limitation – Specification for apparatus¹*

IEC TR 62335, *Circuit breakers – Switched protective earth portable residual current devices for Class I and battery powered vehicle applications*

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

¹ This document has been replaced by IEC 61241-0 and IEC 61241-1.

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

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

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

ISO 4225, *Air quality – General aspects – Vocabulary*

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

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

ISO 7731, *Ergonomics – Danger signals for public and work areas – Auditory danger signals*

ISO 9614-2, *Acoustics – Determination of sound power levels of noise sources using sound intensity – Part 2: Measurement by scanning*

ISO 11201, *Acoustics – Noise emitted by machinery and equipment – Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections*

ISO 11203:1995, *Acoustics – Noise emitted by machinery and equipment – Determination of emission sound pressure levels at a work station and at other specified positions from the sound power level*

ISO 11428, *Ergonomics – Visual danger signals – General requirements, design and testing*

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

ISO 15383, *Protective gloves for fire-fighters – Laboratory test methods and performance requirements*

DIN 14811, *Feuerlöschschläuche – Druckschläuche und Einbände für Pumpen und Feuerwehrfahrzeuge (EN: Fire-Fighting Hoses – Non-Percolating Layflat Delivery Hoses and Hose Assemblies for Pumps and Vehicles)*

DIN 49443, *Zweipoliger Stecker mit Schutzkontakt – DC: 10 A 250 V; AC: 16 A 250 V Druckwasserdicht (EN: Watertight Two-pole plug with earthing contacts – DC: 10 A 250 V; AC: 16 A 250 V)*

DIN 54345-5, *Testing of textiles; electrostatic behaviour; determination of electrical resistance of strips of textile fabrics*

EC Directive 79/831/EEC, *Council Directive of 18 September 1979 amending for the sixth time Directive 67/548/EEC on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances*

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Household and similar electrical appliances – Safety –
Part 2-69: Particular requirements for wet and dry vacuum cleaners, including
power brush, for commercial use**

**Appareils électrodomestiques et analogues – Sécurité –
Partie 2-69: Exigences particulières pour les aspirateurs fonctionnant en
présence d'eau ou à sec, y compris les brosses motorisées, à usage commercial**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-69: Particular requirements for wet and dry vacuum cleaners, including power brush, for commercial use

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 60335-2-69 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.

This fifth edition cancels and replaces the fourth edition published in 2012. It constitutes a technical revision.

The principal changes in this edition as compared with the third edition of IEC 60335-2-69 are as follows (minor changes are not listed):

- the scope has been revised editorially to avoid misunderstandings;
- terms and definitions has been revised with regard to the requirements revised;

- the standard has been revised in general and updated regarding state-of-the-art, as far as necessary, in particular some changes have been made to Clauses 15, 22 and 25;
- the standard has been aligned with the newest amendment of IEC 60335-1:2010+A1:2013;
- Annex AA was revised and restructured;
- Annex CC was revised;
- general additions for vacuum cleaners with blowing functions have been introduced;
- a new Annex GG ‘Particular requirements for mobile wet vacuum cleaners for rescue and firefighting services (MWF)’ was added.

The text of this standard is based on the following documents:

FDIS	Report on voting
61J/637/FDIS	61J/646/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

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 fifth edition (2010) of that standard..

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

This part 2 supplements or modifies the corresponding clauses in IEC 60335-1, so as to convert that publication into the IEC standard. Safety requirements for wet and dry vacuum cleaners, including power brush, for commercial use.

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

NOTE 2 The following numbering system is used:

- sub clauses, 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 sub clause;
- 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.

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.

The following differences exist in the countries indicated below.

- 22.207: A mobile power generator in accordance with DIN 14685 is required (Germany)
- 25.6: A safety plug in accordance with DIN 49443 is required. (Germany)

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.

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.

IECNORM.COM: Click to view the full PDF of IEC 60335-2-69:2016 RLV

Withdrawn

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 2-69: Particular requirements for wet and dry vacuum cleaners, including power brush, for commercial use

1 Scope

This clause of Part 1 is replaced by the following.

This part of IEC 60335 deals with the safety of electrical motor-operated vacuum cleaners, including **back-pack vacuum cleaners**, and **dust extractors**, for wet suction, dry suction, or wet and dry suction, intended for commercial indoor or outdoor use with or without attachments. They may be provided with a blowing or inflating function.

It also deals with the safety of **centrally-sited vacuum cleaners**, excluding the installation of the system.

NOTE 101 Attention is drawn to the fact that additional requirements on the safe installation of **centrally-sited vacuum cleaners** are not addressed by this standard but need to be taken into account.

NOTE 102 This standard applies to machines for **commercial use**. The following list, although not comprehensive, gives an indication of locations that are included in the scope:

- public use areas such as hotels, schools, hospitals;
- industrial locations, for example factories and manufacturing shops;
- retail outlets, for example shops and supermarkets;
- business premises, for example offices and banks;
- all uses other than normal housekeeping purposes.

They are not equipped with a traction drive. The following power systems are covered:

- mains powered motors up to a **rated voltage** of 250 V for single-phase appliances and 480 V for other appliances,
- battery powered motors.

This standard also applies to machines handling **hazardous dust**, such as asbestos.

NOTE 103 Additional requirements for machines handling **hazardous dust** are given in Annex AA. Attention is drawn to the fact that in many countries additional requirements on hazardous substances might apply.

NOTE 104 Radioactive substances are not covered by definition of **hazardous dust** for the purposes of this standard.

This standard does not apply to

- vacuum cleaners and water-suction cleaning appliances for household use (IEC 60335-2-2);
- floor treatment machines for **commercial use** (IEC 60335-2-67, IEC 60335-2-72);
- spray extraction machines for **commercial use** (IEC 60335-2-68);
- hand-held mains-operated electrical garden blowers, vacuums and blower vacuums (IEC 60335-2-100);
- hand-held and transportable motor-operated electric tools (IEC 60745 series, IEC 61029 series, IEC 62841 series);
- appliances for medical purposes (IEC 60601-1);

- machines designed for use in corrosive environments;
- machines designed for picking up liquids with a flash point below 55 °C;
- machines designed for use in explosive environments (dust, vapour or gas), except those designed for use in zone 22.

NOTE 105 The flash point temperature limit may vary in different countries. National regulations will need to be taken into account.

NOTE 106 Additional requirements for vacuum cleaners designed for collecting **combustible dust** in zone 22 are given in Annex CC.

NOTE 107 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 60312-1, *Vacuum cleaners for household use – Part 1: Dry vacuum cleaners – Methods for measuring the performance*

IEC 60335-2-41, *Household and similar electrical appliances – Safety – Part 2-41: Particular requirements for pumps*

IEC 61540, *Petit appareillage – Dispositifs différentiels mobiles sans dispositif de protection contre les surintensités incorporé pour usages domestiques et analogues (PCDM)*

ISO 2602, *Statistical interpretation of test results – Estimation of the mean – Confidence interval*

ISO 6344-2, *Coated abrasives – Grain size analysis – Part 2: Determination of grain size distribution of macrogrits P12 to P220*

ISO 7731, *Ergonomics – Danger signals for public and work areas – Auditory danger signals*

ISO 11428, *Ergonomics – Visual danger signals – General requirements, design and testing*

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1.9 Replacement:

normal operation

conditions under which the machine is operated in normal use, obtained at the following power input P_m of the vacuum motor:

$$P_m = 0,5 (P_f + P_i)$$

where

P_f is the input, in watts, when the machine has been operated for 3 min, fitted with the nozzle and hose giving the highest input;

P_i is the input, in watts, when the machine has been operated for 20 s with the nozzle sealed, immediately following the 3-minute-period with the nozzle open. Any valve or

similar device used to ensure a flow of air to cool the motor in the event of a blockage of a main air inlet is rendered ineffective.

P_f and P_i are measured with the supply voltage adjusted to **rated voltage**, or to a voltage equal to the mean value of the **rated voltage range** if the difference between the limits of the **rated voltage range** does not exceed 10 % of the mean value of the range. If the difference between the limits of the **rated voltage range** exceeds 10 % of the mean value, the tests are carried out with the supply voltage set to the upper limit of the range.

The measurements are made with the machine fitted with a clean dust bag and filter and with the water container, if any, empty. If the machine is intended for use only with a hose, detachable nozzles are removed and the hose is laid out straight. If the machine is provided with a hose as an optional accessory, it is operated without the hose.

Electrically driven devices, if any, are in operation but are not in contact with the floor or any other surface or with the means used to seal the air inlet.

The normal load is equal to the mean load P_f for the electrically driven agitating device such as a motor driven brush determined in accordance with the following:

- the agitating device operates on a carpet as specified in IEC 60312-1;
- the mean load P_f is determined when using the device in the following way:

After setting the device, the device is moved twice over a distance of 5 m in the direction giving the highest load;
- the motor responsible for the airflow operates under the same conditions as for determining P_f , i.e. no airflow restrictions, and measurements are taken after 3 min;
- the device is adjusted to the carpet pile height;
- it is necessary to move the agitating device slowly across the carpet to avoid carpet damage.

Soiled water discharge pumps, if applicable, are operated as follows.

The pump delivers a continuous flow of water without any soiled water discharge hose attached to the soiled water outlet of the machines unless the discharge hose is permanently attached to the machine. The vacuum motor works during the test, unless an interlock device is provided to prevent combined operation of both motors.

Machines equipped with an inflating function are also operated whilst equipped with the hose as described in the instructions for use. The hose is placed in a straight line away from the machine. Power adjustment controls are set to the highest input power.

Machines equipped with a blowing function are also operated whilst equipped with the two hoses or as described in the instructions for use. Both hoses are placed in a straight line away from the machine. Power adjustment controls are set to the highest input power. The blowing hose is not equipped with any attachments, e.g. nozzles.

3.101 **water-suction cleaning machine**

machine for sucking up a water-based cleaning solution

3.102 **back-pack vacuum cleaner**

vacuum cleaner designed to have the power source and collector carried on the **operator's** back by means of a supporting device

3.103 **motorized cleaning head**

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

Note 1 to entry: The permanently attached main cleaning head is not regarded as a **motorized cleaning head**.

3.104 hazardous dust

non-radioactive dust which is hazardous to health if inhaled, ingested or in contact with the skin

Note 1 to entry: IEC Directive 79/831/EEC amending 67/548/EEC lists dusts for which the general indication of nature of risk is specified as very toxic, harmful, corrosive or irritant; some dusts can be subject to an exposure limit in the country of use; micro-organisms can be considered as dusts creating a hazard to the health of a person.

Note 2 to entry: Requirements for machines intended to pick up **hazardous dust** are specified in Annex AA.

3.105 combustible dust

finely divided solid particles, 500 µm or less in nominal size, which may be suspended in air, may settle out of the atmosphere under their own weight, may burn or glow in air, and may form explosive mixtures with air at atmospheric pressure and normal temperatures

Note 1 to entry: This includes dust and grit as defined in ISO 4225.

Note 2 to entry: The term solid particles is intended to address particles in the solid phase and not the gaseous or liquid phase, but does not preclude a hollow particle.

[SOURCE: IEC 60050-426:2008, 426-02-18]

3.106 explosive dust atmosphere

mixture with air, under atmospheric conditions, of flammable substances in the form of dust, fibres or flyings which, after ignition, permits self-sustaining propagation

Note 1 to entry: Minimum ignition energy values for common dusts can be found in Annex BB.

Note 2 to entry: Requirements for machines intended to pick up **combustible dust** in an **explosive atmosphere** are specified in Annex CC.

[SOURCE: IEC 60050-426:2008, 426-01-08, modified: the notes to entry have been added]

3.107 ESD protected area EPA

area with a minimum risk for electrostatic discharge that could damage electronic devices, and in which people present in that area are not subjected to any additional risk

Note 1 to entry: Requirements for machines intended to pick up dust in **ESD protected areas** are specified in Annex DD.

3.108 dust extractor

stationary or portable equipment specifically designed to be connected to dust-generating machines

Note 1 to entry: A vacuum cleaner is designed to pick up already settled dust.

3.109 centrally-sited vacuum cleaner

vacuum cleaner that is connected to a ducting system installed in the building

Note 1 to entry: During use, the nozzle and its associated hose are connected to one of the suction inlets of the ducting system.

3.110 guard

part of the machine specifically designed to provide protection by means of a physical barrier, such as, for example, 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, such as, 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.

3.111 operator

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

3.112 test solution

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 $C_{12}H_{25}NaSO_4$

3.113 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.

3.114 mobile machine

machine capable of being moved from one location to another

Note 1 to entry: This includes portable and hand-held appliances, and excludes fixed and stationary appliances.

[SOURCE: IEC 60050-151:2001, 151-16-45, modified: term modified, deletion of the mention of the use of vehicles in the definition and addition of the note to entry]

3.115 MWF vacuum cleaner

vacuum cleaner for picking up liquids, intended to be used by rescue and firefighting services, integrating a pump for a continuous disposal of the sucked up liquid

Note 1 to entry: **MWF** is the abbreviation of Mobile Wet vacuum cleaners for rescue and Firefighting and rescue services.

3.116 inflating function

operation mode with the clean air exhaust used to inflate objects with the standard suction hose connected to the air outlet of the machine

Note 1 to entry: Only one hose is connected to the machine at a time.

3.117

blowing function

operation mode with the clean air exhaust connected to an air exhaust hose as specified in the instructions for use, the purpose being to transport the clean exhaust air away from the working location

Note 1 to entry: In this case, two hoses are connected to the vacuum cleaner simultaneously.

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 purpose 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 is to be stored in a cool atmosphere and used within seven days after its preparation.*

6 Classification

This clause of Part 1 is applicable, except as follows.

6.1 Replacement:

Vacuum cleaners and their attachments shall be of one of the following classes with respect to the protection against electric shock:

- class I,
- class II, or
- class III.

Metal parts that may continuously contact the body shall be considered as handles for which 22.36 applies.

Compliance is checked by inspection and by the relevant tests.

6.2 Addition:

Water suction cleaning machines and products intended for outdoor use and storage shall be at least IPX4.

7 Marking and instructions

This clause of Part 1 is applicable, except as follows.

7.1 Replacement of the 4th 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.
- year of construction, i.e. the year in which the manufacturing process is completed;
NOTE 102 The year of construction can be part of the serial number.
- machines equipped with wheels and other mobile machinery shall be marked with the mass of the most usual configuration in kg.

When permitted by Table 101, the appliance may be marked adjacent to the air outlet with:

- the substance of “CAUTION: Hot surface”, or
- symbol IEC 60417-5041 (2002-10).

7.1.101 Motorized cleaning heads shall be marked with

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

7.1.102 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 60417-5935 (2012-09)]

motorized cleaning head for water-suction cleaning

[symbol IEC 60417-5041 (2002-10)]

caution, hot surface

7.12 Modification:

Replace the 4th 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 instruction manual before using the machine.

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

If symbol IEC 60417-5041 (2002-10) is marked on appliances, its meaning shall be explained.

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 series or type of the machine as marked on the machine itself, except for the serial number;

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 **motorized cleaning heads** and lights.

- the meaning of the symbols used on the machine and in the instructions;
- 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;
- information regarding putting into service, safe operation, handling, transportation, and storage of the machine taking into account its weight;
- 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;
- the substance of the following:

This machine is intended for commercial use, for example in hotels, schools, hospitals, factories, shops, offices and rental businesses.

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

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

- for battery powered machines, instructions regarding the precautions to be taken for safe charging;
- precautions to be taken when changing brushes or other attachments;
- information on the detergents or other liquids that may be used including the choice and use of personal protective equipment (PPE);
- essential characteristics of auxiliary equipment which may be fitted to the machine;
- information regarding safe disposal of batteries;
- purposes of the socket outlet on the machine;
- the precautions to be taken when using the machine under specific conditions such as handling flammable liquids or dusts and dusts hazardous to health;
- wet filters and the interior part of the liquid container shall be dried before storage.
- the intended use of the brushes specified for the machine.

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, it shall include the substance of the following warnings, if applicable.

- **WARNING** Operators shall be adequately instructed on the use of these machines.
- **WARNING** This machine is not suitable for picking up hazardous dust.
- **WARNING** This machine is for dry use only.
- **CAUTION** This machine is for indoor use only.
- **CAUTION** This machine shall be stored indoors only.
- 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 powered machines, by safely disconnecting at least the B+ or B– pole of the battery or an equivalent method (disconnecting device); for non-SELV both poles shall be disconnected.

Instructions for mains operated machines shall also include the substance of the following:

- **WARNING** Do not allow the supply cord to come into contact with the rotating brushes.
- **WARNING** Only use the socket outlet on the machine for purposes specified in the instructions.

Instructions for water suction cleaning machines shall also include the substance of the following:

- **WARNING** If foam or liquid escapes from the machine, switch off immediately.
- **CAUTION** Clean the water level limiting device regularly and examine it for signs of damage.

Instructions for machines having a current-carrying hose for dry suction, 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.

Compliance is checked by inspection.

7.12.102 Information on noise

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

7.12.103 Information on vibration

NOTE The instructions can include information on the vibration total value as indicated in Clause FF:2.

7.12.104 The instructions for use of vacuum cleaners with **blowing or inflating functions** shall include information concerning the use of these functions and the nominal overpressure.

The instructions for use of vacuum cleaners with inflating functions shall include this function is not intended for blowing away deposited dust.

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.

The height of symbol IEC 60417-5041 (2002-10) shall be at least 10 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.

9 Starting of motor-operated appliances

This clause of Part 1 is not applicable.

10 Power input and current

This clause of Part 1 is applicable.

11 Heating

This clause of Part 1 is applicable except as follows.

11.3 Addition:

If it is necessary to dismantle the machine for fitting thermocouples or other wiring, the input shall be measured before and after fitting at the lowest possible load, for example, with closed suction openings, with brushes not in contact with the floor, with declutched drive, etc. to check that the assembling has been accomplished properly.

Where the accessible external surfaces are suitably flat and access permits, then the test probe of Figure 106 may be used to measure the temperature rises of accessible external surfaces specified in Table 101. The probe is applied with a force of $4\text{ N} \pm 1\text{ N}$ to the surface in such a way that the best possible contact between the probe and the surface is ensured.

NOTE 102 The probe may be held in place using a laboratory stand clamp or similar device. Any measuring instrument giving the same results as the probe may be used.

11.4 Not applicable.

11.5 Addition:

For the heating test, the normal load P_r on the motor driving the moving brushes can be simulated by a brake or other means.

11.6 Not applicable.

11.7 Addition:

Machines are operated until steady conditions are established.

11.8 Modification:

During the test, the temperature rises are monitored continuously and shall not exceed the values shown in Table 101.

The temperature rise limits in Table 3 specified for “External enclosure of motor-operated appliances, except handles held in normal use” and the corresponding footnotes are not applicable.

Add the following new table:

Table 101 – Maximum temperature rises for specified accessible external surfaces under normal operating conditions

Surface	Temperature rise of external surfaces	
	K	
	Surfaces of hand-held appliances ^e	Surfaces of other appliances ^d
Bare metal	42	48
Coated metal ^a	49	59
Glass and ceramic	56	65
Plastic and plastic coating > 0,4 mm _{b,c}	62	74

NOTE Some limit less than 2X is surely achievable for process air outlets of wet vacuum cleaners.

- ^a Metal is considered coated when a coating having a minimum thickness of 90 µm made by enamel or non-substantially plastic coating is used.
- ^b The temperature rise limit of plastic also applies for plastic material having a metal finish of thickness less than 0,1 mm.
- ^c When the thickness of the plastic coating does not exceed 0,4 mm, the temperature rise limits of the coated metal or of glass and ceramic material apply.
- ^d Within 25 mm from air outlets the above values can be twice the limit but the product shall be marked with the wording as stated in 7.1 .
- ^e Within 25 mm from air outlets the above values can be increased by 5 K.

12 Void

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable except as follows.

13.2 Addition:

For class I appliances where several motors operate at the same time, the leakage current shall not exceed 3,5 mA.

14 Transient overvoltages

This clause of Part 1 is applicable.

15 Moisture resistance

This clause of Part 1 is applicable except as follows.

15.1.2 Addition:

Water-suction cleaning machines are operated for 10 min on a level surface wetted by the test solution.

In practice, the pick-up consists largely of air such that there is no overloading of the suction motor; the input load should be observed to avoid overloading.

15.2 Replacement:

Machines having a liquid container shall be so constructed that

- spillage of liquid due to **normal operation**,
- filling including overfilling, and
- overturning of unstable machines

do not affect their electrical insulation.

Compliance is checked by the following tests:

The machine is placed on a support inclined at an angle of 10° to the horizontal, the liquid container being 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 having a liquid container and provided with an appliance inlet are fitted with an appropriate connector and flexible cable or cord; machines having a liquid container and **type X attachment** are fitted with the lightest cross-sectional area specified in Table 11. Other machines are tested as delivered.

The liquid container of the machine is 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 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 be

Substance	Parts by mass %
Plurafac ® LF 221 ¹	15,0
Cumene sulfonate (40 % solution)	11,5
Citric acid (anhydrous)	3,0
Deionized water	70,5
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.	

Machines which are unstable are then, with the container completely filled and with the cover or 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.

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

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

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

15.3 Modification:

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

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

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

Compliance is checked by the following four tests.

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

It is then subjected to the free fall test procedure 1 of IEC 60068-2-31. It is dropped 4 000 times from a height of 100 mm onto a steel plate having a thickness of not less than 15 mm. It is dropped

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

The **motorized cleaning head** is then subjected to the test described in 14.2.4 of IEC 60529, using the **test solution**.

The **motorized cleaning head** is to 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:

- without connection to the vacuum cleaner for 15 min, if applicable; and
- connected to the vacuum cleaner until the vacuum cleaner has picked up as much water as its capacity holds or for 5 min, whichever occurs sooner.

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 the **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 not applicable.

19 Abnormal operation

This clause of Part 1 is applicable except as follows.

19.1 Addition:

Machines are also subjected to the test of 19.101.

*The test of 19.7 is only carried out on **motorized cleaning heads** and fan motors of **centrally-sited vacuum cleaners**.*

NOTE 101 Separate fan motors are not intended for vacuuming, but for cooling the equipment. These motors are independent from the main vacuum motor.

***Dust extractors** are also subjected to the tests of 19.102 and 19.103, if applicable.*

***Centrally-sited vacuum cleaners** are also subjected to the tests of 19.104 and 19.105, if applicable.*

19.2 Addition:

The machine is tested without liquid in the container.

NOTE 101 The term restricted heat dissipation of Part 1 means without liquid in the container.

19.7 Addition:

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

*Unattended **dust extractors** are operated until steady conditions are reached.*

*Separate fan motors of **centrally-sited vacuum cleaners** are operated until steady conditions are reached.*

NOTE 101 Separate fan motors are not intended for vacuuming, but for cooling the equipment. These motors are independent from the main vacuum motor.

19.9 Not applicable.

19.10 Addition:

For this test, the lowest possible load for radial turbines is obtained with the air inlet sealed. For other types of turbines, the characteristics shall be taken into account.

In the case of cleaners driving a brush or agitator, the belt is removed.

19.13 Modification:

In the second paragraph, add “and 22.104” after “20.2”.

19.101 *Machines having liquid containers that are provided with shut-off device(s) or valve(s) are again subjected to the test of 15.2.*

Stop valves or other fluid shut-off devices are made inoperative. If two or more independent shut-off devices are provided, only one of them is made inoperative at a time, provided that

they have passed the test of operating 3 000 times satisfactorily. Otherwise all devices that failed are made inoperative.

Care should be taken to suck up an air-liquid mixture to prevent overloading of the motor of the suction unit. The input power should be observed to avoid overloading.

*After this test, the machine shall be subjected to the electrical strength test of 16.3. Inspection shall show that water has not entered the machine to any dangerous extent. In particular, there shall be no trace of water on the electrical insulation that reduces the **clearance** or **creepage distances** below the limits specified in Clause 29.*

19.102 Dust extractors for which 30.2.3 applies are supplied at **rated voltage** and operated with the inlet for the suction hose closed.

The temperatures of the windings shall not exceed the values specified in 19.9.

19.103 Dust extractors for which 30.2.3 applies with separate ventilation for the motor are supplied at **rated voltage** and operated with the airflow through the motor blocked.

The temperatures of the windings shall not exceed the values specified in 19.9.

19.104 Centrally-sited vacuum cleaners are supplied at **rated voltage** and operated with the inlet for the suction hose open and then closed.

The temperatures of the windings shall not exceed the values specified in 19.9.

19.105 Centrally-sited vacuum cleaners with separate ventilation for the motor are supplied at **rated voltage** and operated with the airflow through the motor blocked.

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.1 Modification:

Add to the existing NOTE:

Aluminium oxide paper (grain size 80) or similar material may be used to prevent sliding.

Addition:

Motorized cleaning heads are not subjected to this test.

20.2 Addition:

These requirements do not apply to rotating brushes and similar devices, or to moving parts exposed during the fitting of accessories that allow conversion from one application to another.

20.101 Shaft ends and similar rotating parts shall be protected if they protrude by more than a quarter of their diameter. Shafts up to 50 mm diameter do not need to be protected if they are rotating at less than 5 revolutions per second, and their ends are rounded and smooth.

*Compliance is checked by inspection and measurement, the machine having all pads, brushes etc. in place for **normal operation**.*

The unintentional closing and lowering of doors, lids, covers etc., which could cause injury, shall be prevented.

Machines heavier than 20 kg (empty weight), except stationary machines and **back-pack vacuum cleaners**, shall be equipped with wheels or rollers for transport, which shall be located or protected so as to prevent injury to the feet of the **operator**.

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

21 Mechanical strength

This clause of Part 1 is applicable except as follows.

21.1 Replacement of the first paragraph:

Machines and their **components** and fittings shall have adequate mechanical strength and be constructed to withstand such rough handling as 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 Those parts of the machine that are subjected to impact in normal use are tested as follows:

*If failure of the part subjected to impact would cause a failure to comply with this specification, any spot of the machine which may be exposed during **normal operation** to impacts or blows shall be subjected to a single blow with an impact energy of 6,75 Nm. The impact stress on the free-standing machines shall be exerted by a steel sphere with a diameter of 50,8 mm and a mass of 0,535 kg dropped from a height of 1,3 m or hanging on a string acting as a pendulum, falling from a height of 1,3 m.*

21.102 Current-carrying hoses shall be resistant to crushing.

Compliance is checked by the following test.

The hose is placed between two parallel steel plates each having a length of 100 mm, a width of 50 mm and the edges of the longer sides rounded with a radius of 1 mm. The axis of the hose is positioned at right angles to the longer sides of the plates. The plates are placed at a distance of approximately 350 mm from one end of the hose.

The steel plates are pressed together at a rate of $50 \text{ mm/min} \pm 5 \text{ mm/min}$ until the applied force is 1,5 kN. The force is then released and the electric strength test of 16.3 is carried out between the conductors connected together and the saline solution.

21.103 Current-carrying hoses shall be resistant to abrasion.

Compliance is checked by the following test.

One end of the hose is attached to the connecting rod of the crank mechanism shown in Figure 102. The crank rotates at 30 revolutions per minute resulting in the end of the hose moving horizontally backwards and forwards over a distance of 300 mm.

The hose is supported by a rotating smooth roller over which a belt of abrasive cloth moves at a speed of 0,1 m/min. The abrasive is corundum grit size P100, as specified in ISO 6344-2.

A mass of 1 kg is suspended from the other end of the hose, which is guided to avoid rotation.

In the lowest position, the mass has a maximum distance of 600 mm from the centre of the roller.

The test is carried out for 100 revolutions of the crank.

After the test, **basic insulation** shall not be exposed and the electric strength test of 16.3 is carried out between the conductors connected together and the saline solution.

21.104 Current-carrying hoses shall be resistant to flexing.

Compliance is checked by the following test.

The end of the hose intended to be connected to the **motorized cleaning head** is attached to the pivoting arm of the test equipment shown in Figure 103. The distance between the pivot axis of the arm and the point where the hose enters the rigid part is $300 \text{ mm} \pm 5 \text{ mm}$. The arm can be raised from the horizontal position by an angle of $40^\circ \pm 1^\circ$. A mass of 5 kg is suspended from the other end of the hose or from a convenient point along the hose so that when the arm is in the horizontal position, the mass is supported and there is no tension on the hose.

NOTE It may be necessary to reposition the mass during the test.

The mass slides against an inclined plate so that the maximum deflection of the hose is 3° .

The arm is raised and lowered by means of a crank that rotates at a speed of 10 r/min ± 1 r/min.

The test is carried out for 2 500 revolutions of the crank after which the fixed end of the hose is turned through 90° and the test continued for a further 2 500 revolutions. The test is repeated in each of the other two 90° positions.

After 10 000 revolutions, the hose shall withstand the electric strength test of 16.3.

If the hose ruptures before 10 000 revolutions are achieved, the flexing test is terminated. The hose shall still withstand the electric strength test of 16.3.

21.105 Current-carrying hoses shall be resistant to torsion.

Compliance is checked by the following test.

One end of the hose is held in a horizontal position with the remainder of the hose freely suspended. The free end is rotated in cycles, each cycle consisting of five turns in one direction and five turns in the opposite direction, at a rate of 10 turns per minute.

The test is carried out for 2 000 cycles.

After the test, the hose shall withstand the electric strength test of 16.3 and shall not be damaged to such an extent that compliance with this standard is impaired.

21.106 Current-carrying hoses shall be resistant to cold conditions.

Compliance is checked by the following test.

A 600 mm length of hose is bent as shown in Figure 104 and the ends are tied together over a length of 25 mm. The hose is then placed for 2 h in a cabinet having a temperature of $-15\text{ °C} \pm 2\text{ °C}$. Immediately after the hose is removed from the cabinet it is flexed three times, as shown in Figure 105, at a rate of one flexing per second.

The test is carried out three times.

There shall be no cracks or breaks in the hose and it shall withstand the electric strength test of 16.3. Any colour change of the hose is not considered as a failure.

22 Construction

This clause of Part 1 is applicable except as follows.

22.6 Addition:

Water-suction cleaning machines shall be so constructed that neither water nor foam from detergents can penetrate into the motor or come in contact with **live parts**.

22.35 Addition:

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

A sample of the covered part is conditioned at a temperature of $70\text{ °C} \pm 2\text{ °C}$ for seven 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 101. The weight "A", having a mass of 0,3 kg, falls from a height of 350 mm on to the chisel "B" of hardened steel, the edge of which is placed on the sample.

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

After this test, it shall be shown 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.

For **centrally-sited vacuum cleaners**, this subclause of Part 1 is applicable.

22.54 This subclause is not applicable.

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

Live parts of machines for wet use shall be at least 30 mm distance from the surface of the floor, measured in vertical direction through existing holes. This requirement does not apply to **motorized cleaning heads**.

Compliance is checked by inspection and measurements.

22.102 Class I appliances or class II appliances shall be equipped with a mains isolating switch that ensures **all-pole disconnection** according to overvoltage category III conditions.

For built-in battery chargers, this **all-pole disconnection** can be realised by pulling the plug.

Other switches may be of single pole construction.

The following circuits need not be disconnected by the supply disconnecting device:

- plug and socket-outlets;
- undervoltage protection circuits that are only provided for automatic tripping in the event of supply failure;
- phase rotating indicators;
- control circuits for interlocking.

It is recommended, however, that such circuits be provided with their own disconnecting device.

Compliance is checked by inspection.

22.103 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.

22.104 If machines are provided with shut-off devices, the devices shall prevent the liquid level from exceeding the maximum allowed level.

Compliance is checked by inspection.

22.105 Harness of back-pack vacuum cleaners

All measurements are made with all filters in place, empty dust containers and without the weight of the **supply cord**.

Back-pack vacuum cleaners with a mass exceeding 6 kg shall be equipped with at least a single shoulder harness. A double shoulder harness shall be provided for **back-pack vacuum cleaners** exceeding a mass of 7,5 kg.

Single shoulder harnesses shall be designed so that the machine can be released quickly from the **operator** in the event of emergency. One way to fulfil this is to have a quick release mechanism on the harness.

Double shoulder harnesses shall always have a quick release mechanism. The quick release mechanism shall only allow separation by a deliberate action.

All harnesses shall be adjustable to the size of the **operator**. The harness shall distribute the load evenly on the **operator's** back, shoulders, waist and/or hip.

Back-pack vacuum cleaners exceeding a mass of 7,5 kg shall be supplied with a pad at the points of contact between the machine and the body.

Compliance is checked by inspection and functional test.

22.106 Handgrip of back-pack vacuum cleaners

Back-pack vacuum cleaners shall be equipped with a handgrip with a surface or structure specifically designed for the **operator's** hand to allow the **operator** to grasp the **back-pack vacuum cleaner** to place it on his back or take it off.

Compliance shall be checked by inspection and functional test.

22.107 Interlock switches

Interlock switches that prevent access to live parts shall be located to prevent unintentional operation.

Compliance is checked by inspection and by applying test probe B of IEC 61032.

23 Internal wiring

This clause of Part 1 is applicable.

24 Components

This clause of Part 1 is applicable except as follows.

24.1.3 Addition:

The main switch in vacuum cleaners shall be tested for 50 000 cycles of operations.

This test specification does not apply for **centrally-sited vacuum cleaners**.

Interlock switches are operated 10 000 times.

If the interlock switch operates a relay or contactor or is operated by a mechanical actuation system, the complete switching system is subjected to the test.

24.2 Addition:

For **back-pack vacuum cleaners** with a switching device located at the end of an interconnecting cord, the switching device shall be designed so that it cannot come into contact with the floor in normal use.

The strain relieves on both sides of the interconnecting cord shall comply with 25.15.

24.101 Machines with motors 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 locked rotor conditions so as to cause the **thermal cut-out** to operate within a few minutes, until the **thermal cut-out** has performed 200 cycles of operation.*

After the test, the machine shall withstand the tests of Clause 16.

24.102 Interlock switches that prevent access to **live parts** shall

- disconnect all poles, unless the secondary circuit is supplied through an isolating transformer;
- if a single switching action is obtained by a switching device, the switching device shall provide full disconnection and the clearances for full disconnection specified in 20.1.5.3 of IEC 61058-1:2000 shall be obtained from Table 22 of IEC 61058-1:2000 using a rated impulse withstand voltage of 4 000 V.

Compliance is checked by inspection.

25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows.

25.1 *Addition:*

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 an appliance inlet shall also be provided with an appropriate cord set.

25.7 *Replacement:*

Supply cords shall be one of the following types:

- Rubber sheathed

Their properties shall be at least those of ordinary tough rubber sheathed cords (code designation 60245 IEC 53);

NOTE 101 These cords are not suitable for machines intended to be used outdoors or when they are liable to be exposed to significant amounts of ultraviolet radiation.

- Polychloroprene sheathed

Their properties shall be at least those of ordinary polychloroprene sheathed cords (code designation 60245 IEC 57);

NOTE 102 These cords are suitable for machines intended to be used in low temperature applications.

- Polyvinyl chloride sheathed

These cords shall not be used if they are likely to touch metal parts having a temperature rise exceeding 75 K during the test of Clause 11. Their properties shall be at least those of ordinary polyvinyl chloride sheathed cord (code designation 60227 IEC 53);

- Heat resistant polyvinyl chloride sheathed

These cords shall not be used for **type X attachments** other than specially prepared cords. Their properties shall be at least those of heat-resistant polyvinyl chloride sheathed cord (code designation 60227 IEC 57).

Compliance is checked by inspection.

25.14 *Addition:*

For machines incorporating a **type X attachment** or **type Y attachment**, the number of flexings is 20 000.

25.15 Modification:

Replace Table 12 by the following:

Table 12 – Pull force and torque

Mass of machine 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.

29.2 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 Addition:

For **centrally-sited vacuum cleaners**, 30.2.3 is 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, except as follows.

Addition:

For machines intended to pick up **hazardous dust**, additional requirements are specified in Annex AA.

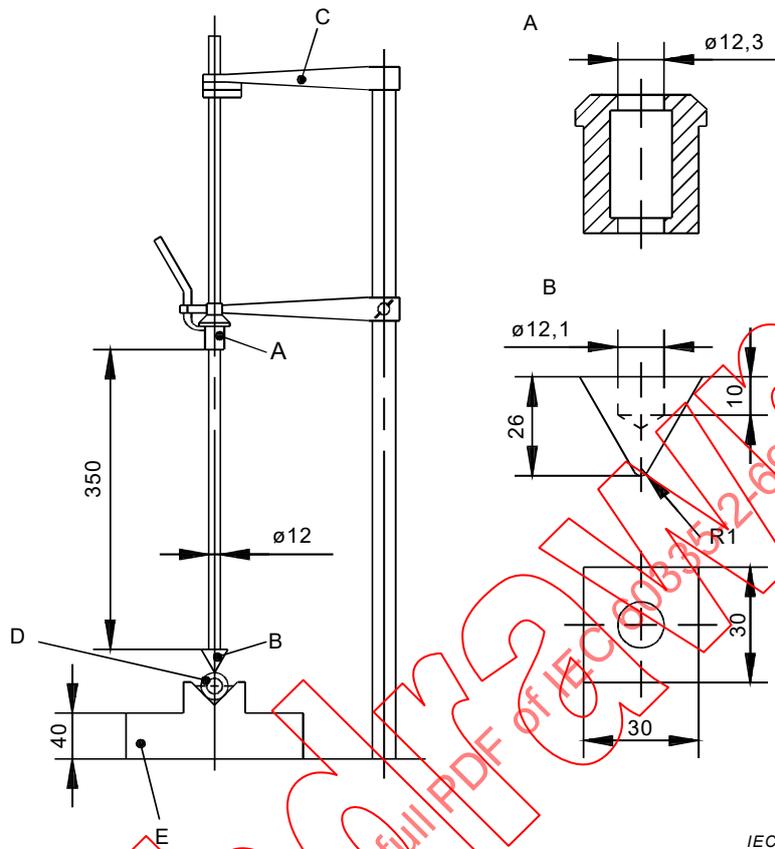
NOTE 101 Information on the explosion risk of certain dusts is given in Annex BB.

For machines intended to pick up **combustible dust** in an **explosive atmosphere**, additional requirements are specified in Annex CC.

For machines intended to pick up dust in **ESD protected areas**, additional requirements are specified in Annex DD.

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Dimensions in millimetres

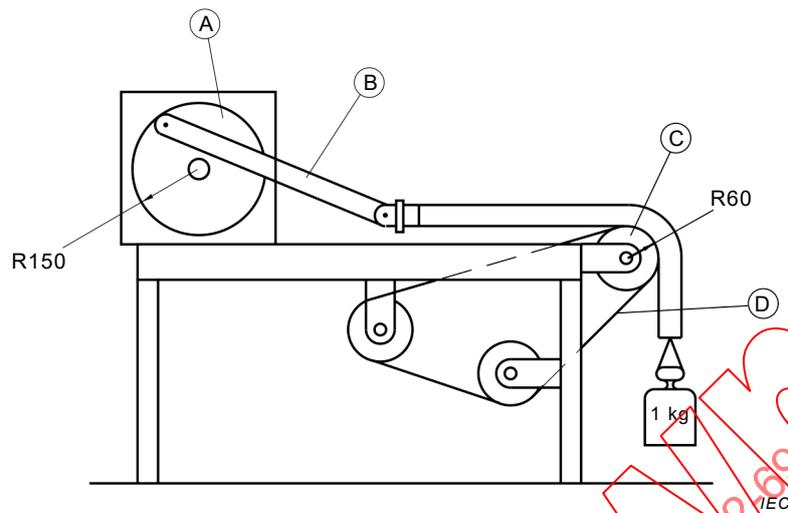


IEC

Key

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

Figure 101 – Impact test apparatus

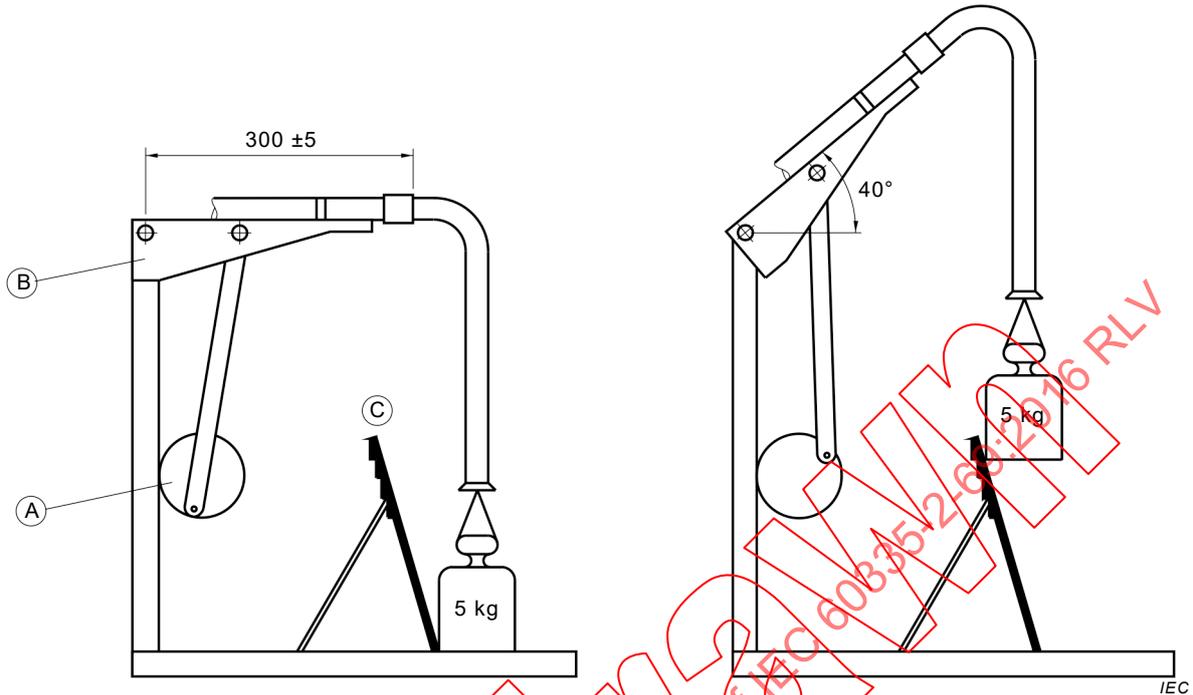
Dimensions in millimetres**Key**

- A crank mechanism
- B connecting rod
- C roller, diameter 120 mm
- D abrasive cloth belt

Figure 102 – Apparatus for testing the abrasion resistance of current-carrying hoses

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Dimensions in millimetres



Key

- A crank mechanism
- B arm
- C inclined plane

Figure 103 – Apparatus for testing the resistance to flexing of current-carrying hoses

Dimensions in millimetres

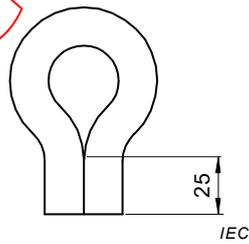


Figure 104 – Configuration of the hose for the freezing treatment

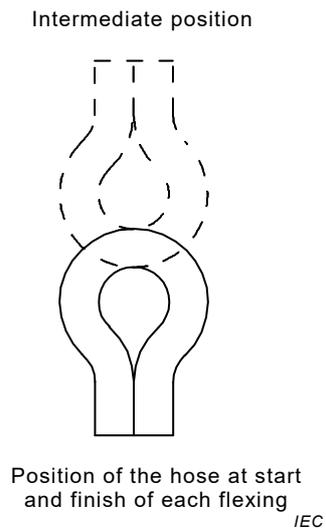
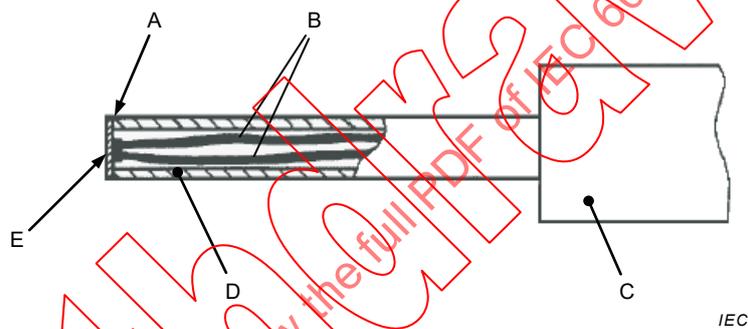


Figure 105 – Flexing positions for the hose after removal from the freezing cabinet



Key

- A adhesive
- B thermocouple wires 0,3 mm diameter to IEC 60584-1 Type K (chrome alumel)
- C handle arrangement permitting a contact force of $4\text{ N} \pm 1\text{ N}$
- D polycarbonate tube: inside diameter 3 mm, outside diameter 5 mm
- E tinned copper disc: 5 mm diameter, 0,5 mm thick

The contact face of the disc is to be flat.

Figure 106 – Probe for measuring surface temperatures

Annexes

The annexes of Part 1 are applicable except as follows.

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Withdrawn

Annex A (normative)

Routine tests

For the purpose of this standard, this annex of Part 1 is considered normative.

Annex A of Part 1 is applicable except as follows.

A.3 Functional test

Addition:

For machines of dust class H, compliance with the **penetration** requirement of Table AA.1 shall be shown either for the complete machine or for the **essential filter** element.

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Withdawn

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 the following:*

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.*

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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.

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Withdrawn

Annex AA (normative)

Particular requirements for vacuum cleaners and dust extractors for the collection of hazardous dusts

The following modifications to this standard are applicable to vacuum cleaners and **dust extractors** specifically designed for wet and/or dry suction for **commercial use** and specify the requirements for collecting non-explosive **hazardous dusts**.

NOTE 1 In this annex, subclauses and notes that are numbered starting from 201 are additional to those in this part 2.

NOTE 2 When power sources other than electricity (e.g. compressed air, internal combustion engine etc.) or a **negative pressure unit** are used, the use of classification for filtration of dust given in this annex can be useful.

3 Terms and definitions

3.AA.201 penetration

D

degree of **penetration** of a filter material, a filter or a machine, determined as follows:

$$D = \frac{\dot{m}_{\text{out}}}{\dot{m}_{\text{in}}} \times 100 \%$$

where

\dot{m}_{out} is the average mass concentration of the test aerosol in the downstream air during the sampling time;

\dot{m}_{in} is the average mass concentration of the test aerosol in the upstream air during the sampling time.

3.AA.202 air change rate

acr

number of hourly fresh air changes, calculated as follows:

$$acr = \frac{Q}{V} [1/h]$$

where

V is the room air volume (m^3);

Q is the flow rate of the air exchanger of the room (m^3/h).

3.AA.203 safe change filter

filter which can be changed without atmospheric or **operator** contamination, such as by means of handling the filter from the exterior of an impervious membrane and by the use of a double sealing method of withdrawal, removal and replacement without exposing the interior of the filter housing

3.AA.204**dust class x machine**

machine designed to comply with requirements specified for dust class L, M or H in accordance with 6.AA.201

3.AA.205**essential filter**

principal filter in a system which may use multiple filters and is a filter which ensures that the **penetration** limits of Table AA.1 are met

3.AA.206**dust collection means**

container having means of safe dust disposal to be undertaken when handled in accordance with the manufacturer's instructions

3.AA.207**negative pressure unit**

extraction unit used to ensure that the pressure within a working enclosure is below atmospheric

6 Classification

6.AA.201 The machines are classified according to dust classes:

- L (light hazard) suitable for separating dust with a limit value of occupational exposure of greater than 1 mg/m³;
- M (medium hazard) for separating dust with a limit value of occupational exposure not less than 0,1 mg/m³;
- H (high hazard) for separating all dusts with all limit values of occupational exposure, including carcinogenic and pathogenic dusts.

NOTE 1 The use of an **essential filter** of a specified dust class does not allow the complete machine to be classified with that dust class.

NOTE 2 In some countries, national regulations exist concerning disposal of **hazardous dusts**.

7 Marking and instructions**7.1 Addition.**

The model or type reference marked on the machine shall include the dust class letter. Safety relevant spare parts, such as filters, **dust collection means** and disposable devices (e.g. rigid containers or plastic bags), when provided with the machine, shall be marked with an indication to ensure use of the correct spare parts.

7.12 Addition:

In addition, the instructions shall include the substance of the following:

- The most important operational data of the machine as specified in 3.1.9 of this part 2, its dust class, its intended use and, if applicable, any limitations of use.
- Specification of spare parts relating to safety, such as filters and **dust collection means**, and information of where they can be obtained.
- Maximum flow rate (m³/h) and maximum underpressure (hPa).
- Before use, **operators** shall be provided with information, instruction and training for the use of the machine and the substances for which it is to be used, including the safe method of removal and disposal of the material collected.

- For user servicing, the machine shall be dismantled, cleaned and serviced, as far as is reasonably practicable, without causing risk to the maintenance staff and others. Suitable precautions include decontamination before dismantling, provision for local filtered exhaust ventilation where the machine is dismantled, cleaning of the maintenance area and suitable personal protection.
- The manufacturer, or an instructed person, shall perform a technical inspection at least annually, consisting of, for example, inspection of filters for damage, air tightness of the machine and proper function of the control mechanism. In addition, on class H machines, the machine filtration efficiency should be tested at least annually, or more frequently as may be specified by national requirements. The test method that can be used to verify the machine's filter efficiency is specified in 22.AA.201.2. If the test fails, it shall be repeated with a new **essential filter**.
- When carrying out service or repair operations, all contaminated items which cannot be satisfactorily cleaned are to be disposed of; such items shall be disposed of in impervious bags in accordance with any current regulation for the disposal of such waste.
- The method by which covers of non-dust proof compartments should be removed for cleaning.

In addition, the instructions shall include the substance of the following, if applicable.

- for class M and class L machines, the meaning of the relevant warning label according to Figure AA.2;
- for class H and class M machines, the outside of the machine should be decontaminated by vacuum cleaning methods and wiped clean or treated with sealant before being taken out of a hazardous area. All the machine parts shall be regarded as contaminated when removed from the hazardous area and appropriate action taken to prevent dust dispersal;
- for class H machines, the meaning of the warning label according to Figure AA.1, including the corresponding warning text according to 7.14;
- for vacuum cleaners with an inflating function, that the use of the **inflating function** is not permitted in areas where hazardous dusts are present;
- for **dust extractors**, it is necessary to provide for an adequate **air change rate** *acr* in the room if the exhaust air is returned to the room. Reference to National regulations is necessary.

In addition, the instructions may recommend the following:

- **operators** should observe any safety regulations appropriate to the materials being handled.

7.14 Addition:

Class H machines shall be fitted with the label according to Figure AA.1.

Class M and class L machines shall be fitted with the relevant label according to Figure AA.2.

The following warning shall be given on the label for class H machines:

WARNING: This machine contains dust hazardous to health. Emptying and maintenance operations, including removal of the dust collection means, must only be carried out by authorised personnel wearing suitable personal protection. Do not operate without the full filtration system fitted.

For class L, class M and class H machines, covers and **guards** which do not require **tools** for removal shall be fitted with an additional label worded: REMOVE FOR CLEANING.

7.15 Addition:

Lettering in warning notices on the machine shall have a minimum height of 3 mm.

The warning notices shall be so positioned that they can easily be seen by the **operator** when switching the machine on or off.

22 Construction

22.AA.201 Dust collecting machines shall be designed and constructed in accordance with the dust classes given in 6.AA.201 and meet the values given in Table AA.1.

Table AA.1 – Penetration limits

Dust class	Suitability for hazardous dust with limit values for occupational exposure $\text{mg} \times \text{m}^{-3}$	Degree of penetration <i>D</i> %	Essential filter material test	Essential filter element test	Assembled machine test method
L (light hazard)	> 1	< 1	22.AA.201.1 or 22.AA.201.2	Not required	22.AA.201.3 if essential filter material test is not carried out
M (medium hazard)	$\geq 0,1$	< 0,1	22.AA.201.1 or 22.AA.201.2	Not required	22.AA.201.3
H (high hazard)	< 0,1 including carcinogenic dusts and dusts contaminated with carcinogens and/or pathogens	< 0,005	Not required	22.AA.201.2	22.AA.201.3

Machines of similar construction and with identical **essential filter** and mountings and with an identical airflow velocity may be treated equally.

Machines designed for picking up wood dust and mineral dust (containing quartz) shall be at least of dust class M.

Compliance is checked by the following tests, if applicable as stated in Table AA.1, and taking into account the flow chart as shown in Figure AA.6.

22.AA.201.1 Essential filter material test

For dust class L and M machines, the degree of **penetration** of the filter material is determined as follows:

Compliance is tested using apparatus similar to Figure AA.3. An integrally measuring photometer or a suitable particle measuring system can be used. The test is carried out using 6 new material samples.

The dust laden air is sucked through the filter material for 1 h, the air flow velocity at the measuring point P being the same as the air flow velocity at the filter in the machine.

The test dust used is a wide spectrum quartz dust in a concentration of $(200 \pm 20) \text{ mg/m}^3$, where 90 % of the particle diameters at the measuring point P are between $0,2 \mu\text{m}$ and $2 \mu\text{m}$, based on Stokes diameter.

The degree of **penetration** is calculated by means of the following formula:

$$D = \frac{C_H - C_o}{C_V - C_o} \times 100 \% \quad [\text{AA.1}]$$

where

C_H is the light-scattering signal downstream of the filter;

C_o is the blank value of the apparatus for ambient air;

C_V is the light scattering signal upstream of the filter.

The degree of **penetration** is averaged over the duration of the test, the first readings being taken 5 min after the commencement of the flow of dust laden air through the filter sample material.

The degree of **penetration** D is determined for 6 samples.

The arithmetic mean of the 6 values, plus twice the standard deviation, shall be less than the required value of D according to Table AA.1.

22.AA.201.2 Essential filter element test

For dust class H machines, the degree of **penetration** of the **essential filter** element shall be determined as follows:

Compliance is checked by using apparatus similar to Figure AA.4.

On machines with a ducted outlet, Figure AA.3 can be used.

All dust filters are removed, except the **essential filter** element.

It shall be ensured that the **essential filter** element is evenly loaded with the test aerosol.

The test is carried out with a new **essential filter** element.

The test aerosol is a narrow spectrum mist of paraffin oil, dispersed oil particulate (DOP) or NaCl, in a concentration between 10 mg/m^3 and 200 mg/m^3 . To maintain the concentration between these limits, adjustments may be made after 5 min, if necessary.

According to Stokes diameter, 90 % of the number of particles is below $1 \mu\text{m}$.

An integrally functioning photometer or a suitable particle counter is used to measure D continually.

After a second delay of 20 min, D is calculated with equation [AA.1]. The effect of carbon brush dust shall be taken into consideration.

D is not allowed to exceed the limit value given in Table AA.1.

22.AA.201.3 Assembled machine test

For dust class M and class H machines, a polydisperse limestone dust of particle size distribution 10 % < 1 μm , 22 % < 2 μm , 75 % < 5 μm is used for testing, in an apparatus as specified in Figure AA.5.

For machines equipped with a built-in filter cleaning mechanism, before this test, carry out a minimum of 1 cleaning cycles as described under 22.AA.202.

For machines equipped with collection bags, replace any clogged bags to restore the airflow rate.

When the airflow velocity has fallen to 20 m/s in the nominal suction hose diameter, with a maximum measuring time of 8 h, D is determined, either gravimetrically with a 95 % one-sided confidence level according to ISO 2602, or with an equivalent measuring system.

If the fan of the vacuum cleaner under test is strong enough to maintain the required airflow rate, QE may be reduced to zero.

The upstream concentration of the test substance during the entire test shall be 5 g/m³ airflow.

The influence of air temperature, humidity and density shall be taken into consideration.

D shall not exceed the values given in Table AA.1.

22.AA.201.4 Burst strength test

If the machine is equipped with a safety switch to protect the motor and filter system, the safety switch shall be made inoperable.

Any parts, with the exception of the **essential filter** itself, shall be dried to facilitate the flow of the clogging medium. All pre-filters that can be removed without the use of a **tool** shall be removed from the machine to ensure that the **essential filter** is subjected to the full loading of the clogging medium and to the pulsing effect of blocking the inlet as described below.

Suck up a clogging medium (e.g. French chalk) until a differential pressure corresponding to 90 % of the maximum vacuum generated by the machine has been reached, or until the differential pressure stabilises for a minimum of 2 h. Cover the inlet to the machine for 5 s followed by opening for 1 s to achieve a pulsing effect.

The pulsing test shall be repeated 30 times over a period of 3 min.

The **essential filter** shall not show any damage (e.g. rip up, loosening, holes cracking).

22.AA.202 Filtration efficiency

Dust class M and dust class H machines may be provided with a **safe change filter** if a dust free filter exchange cannot be guaranteed. If dust class M and dust class H machines are provided with a built-in filter cleaning mechanism for the **essential filter**, the cleaning process shall not affect the filtration efficiency.

Compliance is checked by the following test.

Collect a suitable dust so that the airflow velocity is reduced below 20 m/s. The filter cleaning is carried out 50 times according to the instructions. The clogged bags are then emptied if necessary to restore the airflow according to 22.AA.203.

22.AA.203 Suction performance

If machines are provided with a built-in cleaning mechanism, it shall restore the required suction performance.

Compliance is checked by comparing the suction airflow with the desired value after operating the cleaning device according to the instructions. The cleaning operation shall be performed when the minimum suction airflow has been reached. The following performance, after the cleaning, shall be reached:

- for suction-sweeping machines, the reduction of pressure in the brush area is at least 50 N/m²;
- for other machines, the suction airflow is 20 % greater than the minimum airflow volume as specified in 22.AA.205.

22.AA.204 'Upholstery tacks' test

Dust class M and dust class H machines shall be designed and constructed so that the **essential filter** will not be damaged when collecting sharp objects such as broken glass or nails which may be sucked up.

Compliance is checked during normal operation by collecting 1 kg per kW rated power input, with a maximum of 1 kg, of upholstery tacks, 13 mm long. The filter shall show no damage.

If there is no visible damage, the tests of 22.AA.201 shall be carried out.

22.AA.205 Indication regarding dust removal

All machines shall be capable of achieving an adequate removal of dust, and an indication shall be given as follows.

- a) Vacuum cleaners of dust class M and class H shall be provided with an indicator which operates before the air velocity, through the largest hose (or tube) supplied by the manufacturer, falls below 20 m/s, referring to the largest section in the hose. If airflow indicator adjustments are necessary, they shall be adjustable without **tools**.
- b) For suction-sweeping machines, the indicator shall operate before the reduction of pressure in the suction region of the brush area becomes less than 50 N/m². This also applies to the side brush area.
- c) For **dust extractors** (excluding **negative pressure units** and dust class L machines), the indicator shall operate before the suction velocity becomes less than that stated by the manufacturer or 20 m/s, whichever is greater, referring to the largest section in the hose, or the dust source is shut off by a mechanism in the dust collector. If airflow indicator adjustments are necessary, they shall be adjustable without **tools**. If the dust source cannot be shut off automatically (e.g. when the **dust extractor** is connected to a circular saw), then at least one of the following warning signals shall be given:
 - an acoustic warning signal, if used, shall comply with ISO 7731;
 - a visual warning signal, if used, shall comply with ISO 11428;
 - a pair of voltage-free contacts and installation instructions for their use as a warning signal switching device.

Compliance is checked by inspection and the following test.

*Operate the machine at nominal voltage, at **rated voltage** +6 %, and at **rated voltage** –10 %; and, if necessary, compare the values with the specified values. No leaking of dust shall occur.*

22.AA.206 Disposable collection means

Dust class M machines (except suction sweeping machines) and dust class H machines shall be fitted with a disposable collection means.

For dust class M and dust class H machines, it shall be possible to remove the collection means with a minimum of dust release.

Compliance is checked by inspection and functional test.

22.AA.207 Removability of the essential filter

In dust class H machines, the **essential filter** shall only be removable by the use of a **tool**. This requirement does also apply to filter elements which are relevant for the first numeral of the IP protection designation.

Compliance is checked by inspection.

22.AA.208 Air speed of the dust exhaust

The air speed of the exhaust of dust class M and dust class H machines shall not unduly disturb dust lying on the floor.

Compliance is checked by the following test:

The machine shall be at least 2 m from any wall or vertical surface. The humidity of the air in the test area shall not exceed 60 % and the test shall be carried out in still air conditions. The working hose shall be fitted to the inlet and the intake end shall be positioned in an upward direction at a minimum height of 2 m above floor level. The exhaust velocity shall not exceed 1 m/s at a height of 50 mm above floor level.

22.AA.209 Upstream location of the essential filter

In dust class H machines, the **essential filter** shall be at less than atmospheric pressure.

For dust class L machines, if the **essential filter** is on the positive side, then the **penetration** test of 22.AA.201.3 shall be conducted.

Compliance is checked by the relevant test.

22.AA.210 Guard

Dust class M and dust class H machines shall be constructed so as to **guard** against accidental entry and the release of **hazardous dust** from any part of the machine when not in use.

Compliance is checked by inspection and the use of test probe B of IEC 61032.

22.AA.211 Easy cleaning

Dust class H machines and dust class M machines shall be designed and constructed in such a way that they can be easily cleaned, without impairing their safety. They shall comply with the following:

- covers which are not protecting against both mechanical and electrical hazards and behind which dust can deposit shall be removable without **tools**;
- **guards** which are protecting against mechanical and electrical hazards shall have electrical interlocks which disconnect the mains supply on removal, or shall be removable

only by using **tools**. **Guards** fitted with electrical interlocks shall be removable without **tools**. The interlock shall be double pole if protecting against electrical hazard, and double or single pole if protecting against mechanical hazard only.

Compliance is checked by inspection.

22.AA.212

Machines of dust classes M or H shall not be equipped with an **inflating function**.

For machines equipped with a **blowing function**, the hoses for suction and for the **blowing function** shall not be interchangeable.

Compliance is checked by inspection.

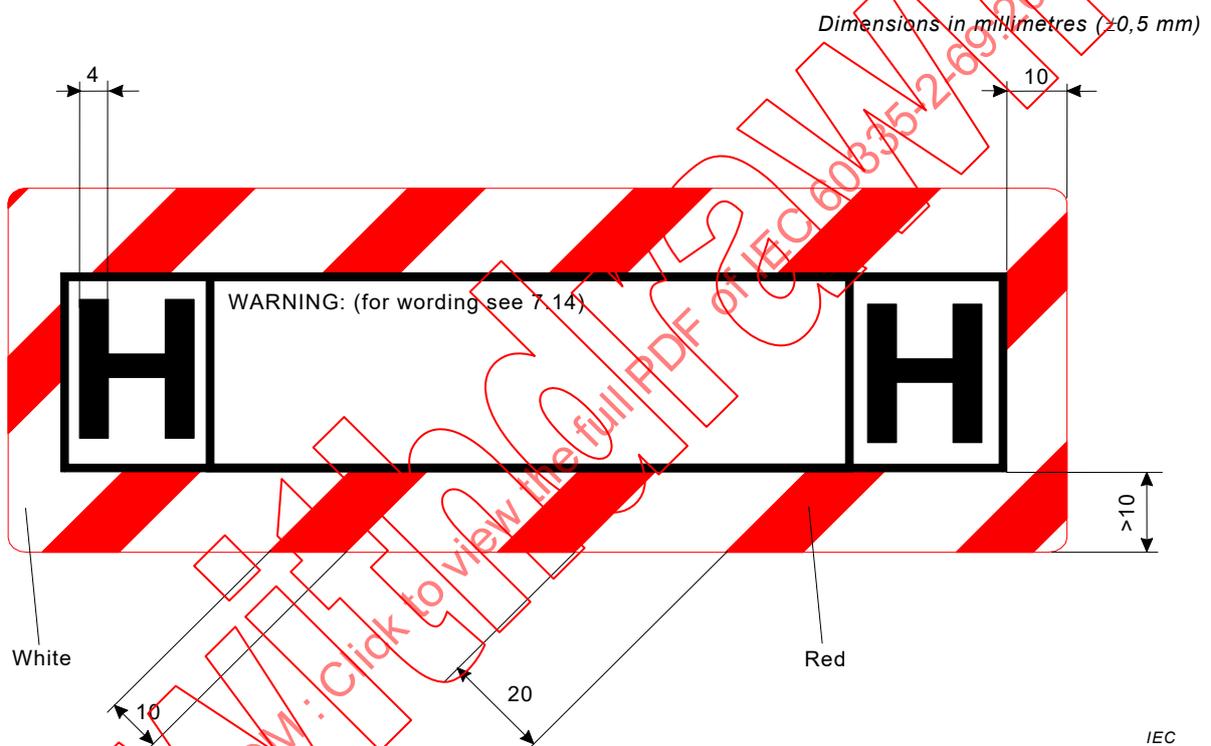


Figure AA.1 – Warning label for dust class H machines

Dimensions in millimetres ($\pm 0,5$ mm)



Figure AA.2 – Warning label for dust class L and dust M machines

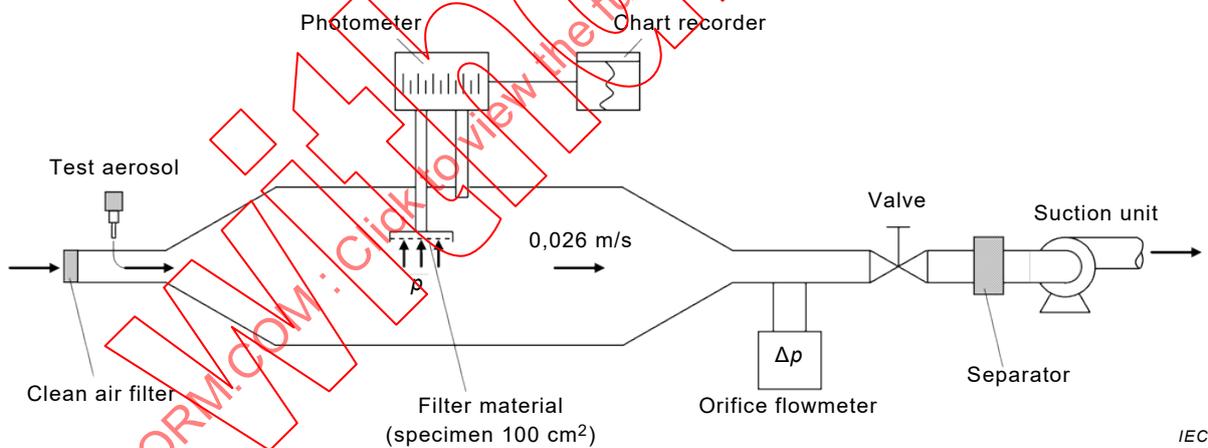
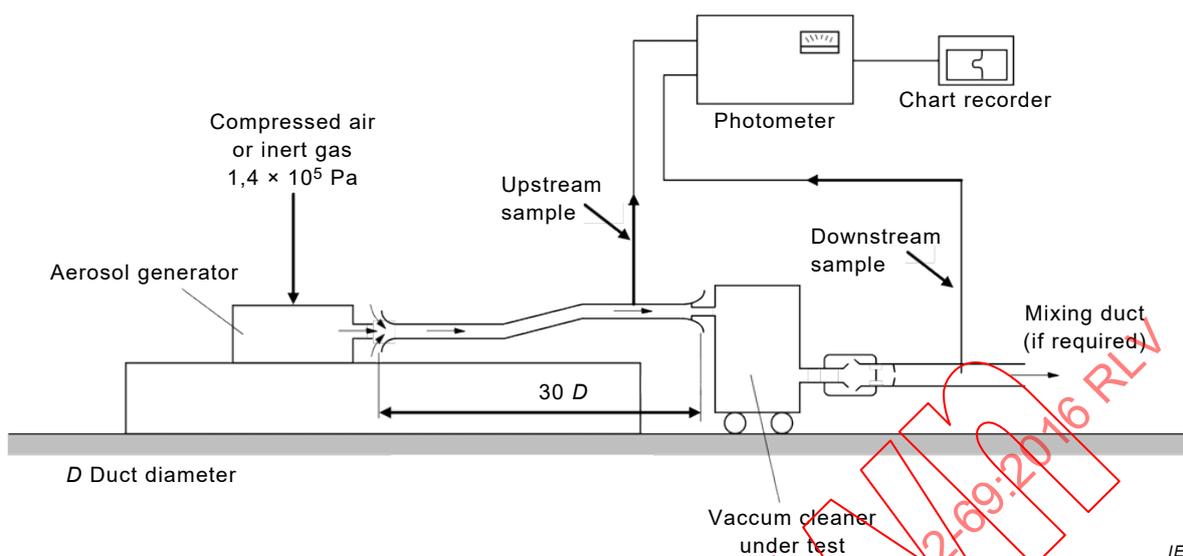
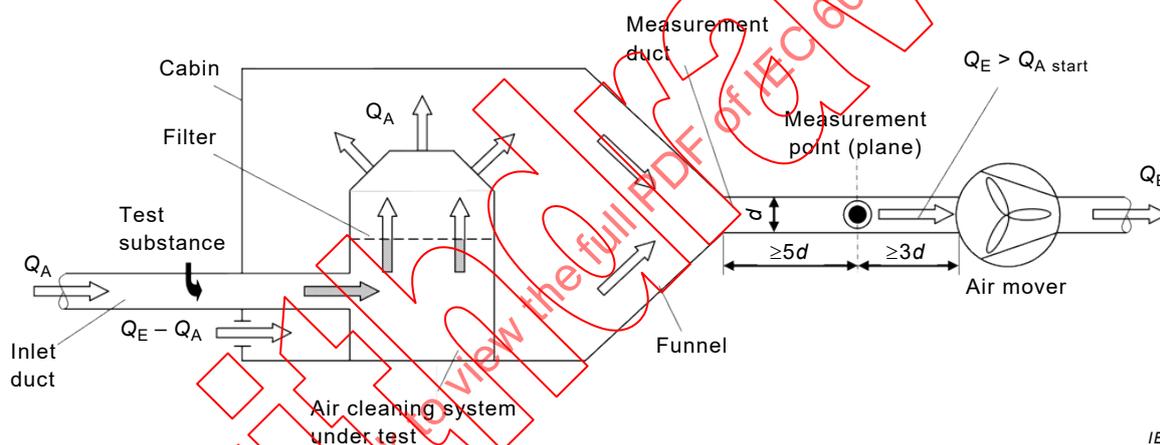


Figure AA.3 – Test method for essential filter material



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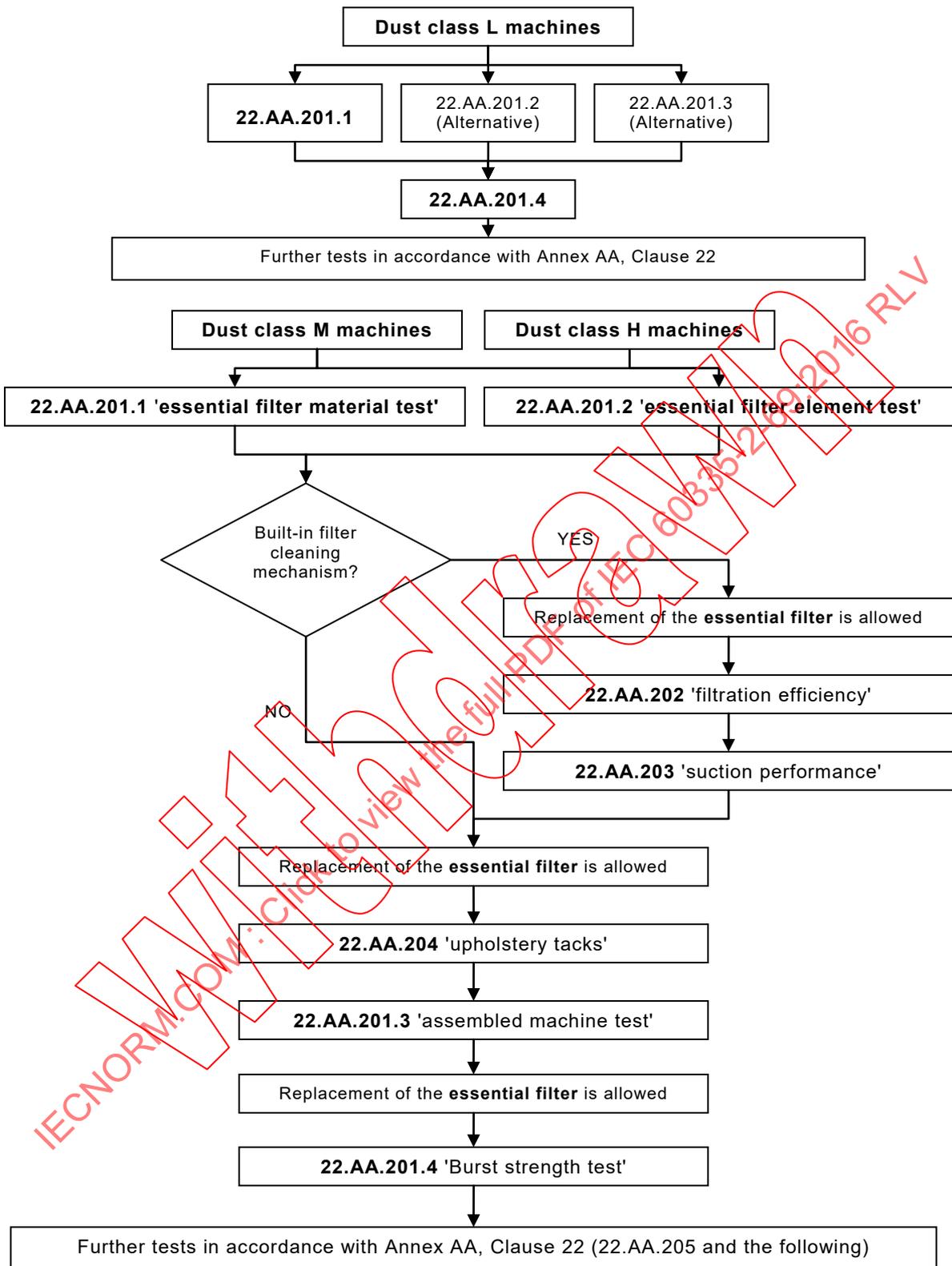
Figure AA.4 – In situ essential filter element test



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The air entering at Q_E should be filtered. The filter used shall be of dust class M.

Figure AA.5 – Assembled machine test



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Figure AA.6 – Sequence and selection of tests according to Clause 22

Annex BB
(informative)

**List of dusts which present an explosion risk
when subject to ignition conditions**

Values of explosion parameters are given in Table BB.1 as a guide for those concerned with the design and operation of dust-handling machines. The dust samples are not necessarily in the most hazardous form that could arise in industry. In addition, the design of the machine, the quantity of material and the methods for handling should all be taken into account when considering explosion hazards.

NOTE Attention is drawn to the fact that in many countries particular information on explosion parameters may be specified by the national health authorities, the national authorities responsible for the protection of labour, or similar authorities. This information might be available online, e.g.

– for Germany [cited 2016-03-14]: <http://www.dguv.de/ifa/GESTIS/GESTIS-Stoffdatenbank/index.jsp>

Table BB.1 – Explosion parameters

Dust	Minimum ignition temperature °C	Minimum explosible concentration kg/m ³	Minimum ignition energy mJ
Acetamide	560	-	-
Acetoparaphenetidine	-	-	11,5
Acetyl-p-nitro-o-toludine	450	-	-
Acetyl salicylic acid (Aspirin)	550	0,015	16
Acrylonitrile-butadiene-styrene copolymer	400	-	-
Acrylonitrile-vinylidene chloride copolymer	-	0,05	70
Alkyd powder coatings	360	0,028	22
Aluminium, 6 µm	-	0,03	13
Aluminium, <1 400 µm	420	-	-
Aluminium, cuttings and buffings	480	-	-
Aluminium, fibres	610	-	-
Aluminium, finishings	600	-	-
Aluminium, polishings	460	-	-
Aluminium, swarf	590	-	-
Aluminium octoate	460	-	-
Animal feed stuff	450	-	-
Anthracene	-	-	7
Anthraquinone	670	-	-
Asbestos, resinated	480	-	-
Azodicarbonamide	-	0,6	130
Barley, milled	370	-	-
Battery case dust	400	-	-
Benzoic acid	600	0,011	12
Benzoyl peroxide	-	-	31
Benzoyl peroxide 44 %, gypsum 56 %	-	-	12
Bleach powder, 60/100 µm	580	-	-

Dust	Minimum ignition temperature °C	Minimum explosible concentration kg/m ³	Minimum ignition energy mJ
Bone flour, steamed	540	-	-
Boron carbide	640	-	-
Bread	450	-	-
Bronze	440	-	-
Brunswick green	360	-	-
Cadmium sulphide	700	-	-
Cadmium sulphoselenide	710	-	-
Cadmium yellow	390	-	-
Cadmium zinc sulphide	660	-	-
Calcium citrate	470	-	-
Calcium gluconate	550	-	-
Calcium pantothenate	430	-	-
Calcium propionate	530	-	-
Calcium silicide	-	-	< 4,6
Calcium stearate	450	-	24
Caprolactam	430	0,07	60
Carbon, 13 % volatile	590	-	45
Casein	460	-	-
Casein meal, steamed	460	-	-
Cellulose, bleached	410	-	-
Cellulose acetate	340	-	-
Cellulose acetate, fibres	430	-	-
Cellulose acetate butyrate	380	-	-
Cellulose triacetate	390	-	-
Charcoal, wood	470	-	-
Chicken manure	680	-	-
Chloro-amino-toluene sulphonic acid	650	-	-
p-Chloro o-toluidine hydrochloride	650	-	-
Coal, 30 % volatile	530	-	-
Coal, 36 % volatile	490	-	-
Coal, anthracite < 63 µm	530	-	-
Coal, Pittsburgh < 74 µm	530	0,03	-
Coal, pulverized < 150 µm	550	-	-
Coal, silkstone	490	-	-
Cocoa, bean husk	400	-	-
Coconut shell	490	-	-
Coffee	360	-	-
Coffee 55 %, chicory 45 %	370	0,1	140
Cork	400	-	-
Cornflour	390	-	-
Cornstarch	380	0,15	-

Dust	Minimum ignition temperature °C	Minimum explosible concentration kg/m ³	Minimum ignition energy mJ
Cyclohexanone peroxide	-	-	21
Detergent, high non-ionic	410	-	-
Detergent, low non-ionic	560	-	-
Detergent, standard ABS	520	-	-
Dextrine	440	-	-
Dextrose monohydrate	350	-	-
Diamino stilbene disulphonic acid	450	-	-
Dibutyl tin maleate	600	-	-
Dibutyl tin oxide	530	0,012	7
Dihydro streptomycin sulphate	670	-	-
Dimethyl acridan	540	-	-
Dimethyl diphenyl urea	490	-	-
Dinitroaniline	470	-	-
Dinitrobenzoyl chloride	380	-	-
Dinitro stilbene disulphonic acid	450	-	-
Diphenyl guanidine + 1,5 % de-dusting powder	540	-	28
Diphenyl propane	-	0,012	11
Epoxide resin	-	-	9
Epoxy powder, semi-gloss coating	-	0,013	-
Epoxy resin	490	0,012	12
Esparto grass	-	-	-
Face powder	440	-	-
Farina starch, 20 % H ₂ O	-	-	-
Ferrochrome	600	-	-
Fish meal	520	-	-
Flour, English 13 % H ₂ O	-	-	-
Flour, wheat	390	-	100
Grain, distillers dried solubles	420	0,06	128
Grain, dried brewers	440	0,009	-
Grass	380	-	-
Gum, arabic, 250/1 400 µm	550	-	-
Hoof and horn, hydrolysed	460	-	-
Hops, ground	340	-	-
Hydroxy ethyl cellulose	420	-	-
Hydroxy ethyl methyl cellulose	410	-	-
Irish moss	540	-	-
Isinglass	520	-	-
Jaborandi leaf	470	-	-
Lauryl peroxide	-	-	12
Lead stearate, dibasic	-	-	12
Leather, < 420 µm	520	-	-

Dust	Minimum ignition temperature °C	Minimum explosible concentration kg/m ³	Minimum ignition energy mJ
Liquorice root	-	0,2	-
Magnesium swarf	610	-	-
Maize gluten meal	430	-	-
Maize husk	430	-	-
Male fern, crushed	510	-	-
Malt, coarse	390	-	-
Manganese ethylene bis-dithio carbamate	270	0,07	35
Manioc flour	430	-	-
Meat meal	500	-	-
Meat and bone meal	440	-	-
Melamine formaldehyde resin	410	0,02	68
Methyl cellulose	480	-	-
2,2 Methylene bis-4-ethyl-6-tertiary butyl phenol	310	-	-
Methyl methacrylate	-	-	13
Milk powder	440	-	-
Milk powder, skimmed	-	-	-
Monochloroacetic acid	620	-	-
Monosodium salt of tri-chloroethyl phosphate	540	-	-
β-Naphthol	670	-	-
Nigrosine hydrochloride	630	-	-
p-Nitro o-anisidine	400	-	-
Nitrocellulose	-	-	30
Nitrodiphenylamine	480	-	-
Nitrofurfural semi-carbazone	240	-	-
m-Nitro p-toluidine	470	-	-
p-Nitro o-toluidine	470	-	-
Nylon, ground flock	450	-	-
Nylon 11	-	0,005	32
Paper	400	0,03	-
Paper tissue, < 1 400 μm	-	-	39
Peat	450	-	-
Peat, dried	-	0,1	-
Pectin, powdered	390	-	-
Penicillin, N-ethyl, piperidine salt of	310	-	-
Phenol formaldehyde	520	-	-
Phenol formaldehyde resin	450	0,015	-
Phenothiazine	590	-	-
Polyester resin < 1 400 μm	400	-	-
Polyethylene	390	0,02	38
Polyethylene, commercial	-	-	57
Polyethylene, ground	400	-	-

Dust	Minimum ignition temperature °C	Minimum explosible concentration kg/m ³	Minimum ignition energy mJ
Polyethylene glycol	320	-	-
Polyethylene high density < 90 µm	-	-	17
Polypropylene	380	-	43
Polyurethane	460	-	-
Polyvinyl acetate	450	-	-
Polyvinyl acetate, beads	-	-	70
Polyvinyl chloride	510	-	-
Polyvinyl chloride, dispersion resin	550	-	-
Polyvinylidene chloride	670	-	-
Poppy flower	410	0,4	600
Potato, dried, < 200 µm	450	-	-
Propyl iodine	470	-	-
Protein	480	-	-
Protein, groundnuts	460	-	-
Protein concentrate	390	-	-
Provender	370	-	-
Quillaia bark	450	-	-
Rag, < 1 400 µm	470	-	-
Rayon, viscose	420	-	-
Rayon flock	-	0,03	-
Rayon flock, 8 denier, 1,5 mm	425	0,15	-
Resin, rubber	400	-	-
Resin, synthetic	400	-	-
Rubber	380	-	-
Rubber, latex	450	-	-
Rubber, synthetic	410	-	-
Rubber accelerator	310	-	-
Rubber crumb	440	-	-
Sawdust	430	-	-
Senna	440	0,01	105
Silicon	900	-	-
Soap	570	0,02	25
Sodium acetate	560	0,15	-
Sodium carboxy methyl cellulose	320	1,1	440
Sodium salt of 2,2 dichloropropionic acid	520	-	-
Sodium salt of 2,2 dihydroxy naphthalene disulphonic acid	510	-	-
Sodium glucaspaldrate	600	-	-
Sodium glucoheptonate, dried	600	-	-
Sodium monochloracetate	550	-	-
Sodium propionate	470	-	-

Dust	Minimum ignition temperature °C	Minimum explosible concentration kg/m ³	Minimum ignition energy mJ
Sodium toluene sulphonate	530	-	-
Sodium xylene sulphonate	490	-	-
Sorbic acid	440	-	-
Soya bean	390	0,23	370
Soya meal	410	0,18	330
Starch	470	-	-
Starch, cold water	490	-	-
Starch, maize 10 % H ₂ O	-	0,15	-
Stearic acid	330	-	-
Steel	450	-	-
Streptomycin sulphate	700	-	-
Sugar	330	0,015	48
Sulphur	220	0,02	-
Tallow, hydrogenated	620	-	-
Tartaric acid	350	-	-
Tea	500	-	-
Tobacco, dried	320	-	-
Urea	900	-	-
Urea formaldehyde moulding powder	450	0,04	-
Urea formaldehyde moulding powder, paper filled	430	0,07	49
Wax, paraffin	340	-	-
Whey flour	480	-	-
Wood	360	-	-
Wood, flour	380	0,06	100
Wood, flour, < 1 400 µm	410	-	100
Wood, ground fluffed	450	-	-
Wood, shavings	400	0,1	-
Wood pulp, dehydrated	450	-	-
Wood pulp, flock	470	-	-
Zinc stearate	420	-	14

Annex CC (informative)

Particular requirements for vacuum cleaners and dust extractors providing equipment protection level Dc for the collection of combustible dusts

NOTE 1 This annex will be withdrawn after the publication of IEC 62784: Particular requirements for vacuum cleaners and dust extractors providing equipment protection level Dc for the collection of combustible dusts.

The following modifications to the relevant clauses in this part 2 are applicable to vacuum cleaners and **dust extractors** providing **equipment protection level Dc (EPL Dc)** for the collection of **combustible dusts**.

NOTE 2 In this annex, subclauses and notes that are numbered starting from 201 are additional to those in this part 2.

1 Scope

Replacement of the first paragraph:

This standard deals with the safety of mobile electrical motor-operated vacuum cleaners, including **dust extractors**, for wet suction or dry suction, intended for commercial indoor or outdoor use with or without attachments, to collect **combustible dust** in an **explosive dust atmosphere** and providing **EPL Dc**.

NOTE 201 Machines as covered by these annex are also suitable for use in **non-hazardous areas**. The presence of combustible dust does not automatically imply the presence of zone 22, as referred in IEC 60079-10-2.

Addition:

This standard does not cover specific hazards associated with extreme ambient temperatures (less than -20°C or higher than 40°C).

This standard does not cover motorized cleaning heads for which additional requirements are under consideration.

This standard does not apply to **back-pack vacuum cleaners**.

3 Terms and definitions

This clause of this part 2 is applicable, together with IEC 60079-0, 60079-31, 60079-10-2, except as follows.

3.CC.201 type 22 machine

vacuum cleaner or **dust extractor**, together with suction hoses, nozzles and other accessories, suitable for collection of **combustible dust** and providing **EPL Dc**

3.CC.202 electrostatic earthing

connection to earth with a maximum resistance of $1\text{ M}\Omega$

3.CC.203 conductive part

part made of materials with a specific resistance of not more than $10\ 000\ \Omega\text{m}$

3.CC.204**flow through turbine**

turbine where the suction air is also used to cool the electric motor

3.CC.205**antistatic filter material**

filter material with a surface resistance of not more than $10^8 \Omega$

Note 1 to entry: The surface resistance was limited in accordance with IEC TS 60079-32-1.

Note 2 to entry: A measurement method can be found in DIN 54345-5.

4 General requirement

Addition:

4.CC.201 The requirements given in this standard apply to each **type 22 machine**, including all accessories, such as nozzles, hoses, unless otherwise stated.

The type 22 machines complying with the requirements of this annex are intended for use in areas requiring EPL Dc. This does not imply that the internal of the machine is required to be EPL Da or that it should be classified in accordance with IEC 60079-10-2. The internal parts of a type 22 machine shall comply with all of the requirements of this annex in order to meet the minimum safety requirements to process combustible dust.

Any electrical accessories, used inside the vacuum cleaner and in contact with combustible dust, that comply with EPL Da are considered to meet the requirement of this standard.

4.CC.202 Machines of **type 22** shall comply with dust class L, class M or class H according to Annex AA. In addition, machines of **type 22** and class L shall comply with the requirements of 22.AA.204 [upholstery tacks test] and of 22.AA.208 [speed of exhaust air], and shall be provided with an indicator in accordance with 22.AA.205. For all machines, **flow-through turbines** are not permitted. For all machines, motors with commutators or other potential sparking sources are not permitted, unless provided with explosion protection level to EPL Da.

4.CC.203 Non-metallic enclosures and non-metallic parts of enclosures shall meet the requirements of IEC 60079-0 for thermal endurance to heat (IEC 60079-0:2011, Subclause 26.8), thermal endurance to cold (IEC 60079-0:2011, Subclause 26.9) and resistance to impact (Clause 24), in that order.

4.CC.204 For materials used for cementing the requirements of 'materials used for cementing' of IEC 60079-0 shall be fulfilled additionally.

4.CC.205 For battery powered machines the requirements of IEC 60079 series shall be fulfilled additionally.

6 Classification

6.2 *Addition:*

The degree of protection against harmful ingress of water to reach EPL Dc for **type 22 machines of group IIIA, IIIB, and IIIC** shall be at least IPX4, as specified for the second numeral of the IP code in IEC 60529.

The protection against harmful ingress of dust to reach EPL Dc for **type 22 machines of group IIIA, IIIB and IIIC** is checked according to IEC 60529, taking into account the

modifications described by the following test procedure, after carrying out the tests as described in 4.CC.203 where applicable.

Compliance is checked by the following tests:

The vacuum cleaner is operated at rated power in the dust test chamber as specified in 13.4 of IEC 60529:1989, and is exposed to the dust atmosphere of the required concentration and dust type.

Its suction hose is laid through a suitable opening of the chamber so that fresh air from outside the chamber is vacuumed to the cleaner, as functional vacuum air stream. Air of any separate motor cooling stream is taken from the inside of the dust test chamber.

Depending on the geometry of the exhaust opening(s) of the cleaner, its functional exhaust air may be conducted through another hose to the outside of the dust chamber.

The air pressure inside the chamber shall be held equal to the ambient air pressure, which may be achieved by means of an auxiliary vacuum cleaner attached to the test chamber.

The vacuum cleaner is operated during 8 hours. If the cooling air stream becomes restricted by blocked cooling air filters, resulting in tripping of temperature protection devices, the test can be interrupted to exchange the blocked filter with a clean filter. Inspection shall show that clearances and creepage distances shall not be reduced below the values specified in Clause 29.

The test is repeated for another 8 hours, with the vacuum cleaner non-energized.

In addition, for **type 22 machines of group IIIC**, internal components with any arcing or sparking contacts shall be protected IP6X according to IEC 60529.

Compliance is checked by inspection and the relevant tests.

Alternatively to the test described, in case machines are too big to be placed in the dust test chamber, all parts and components that might create an ignition risk shall be independently protected IP6X (for **type 22 machines of group IIIC**) or respectively IP5X (for **type 22 machines of group IIIA and IIIB**) and verified to comply with IEC 60529.

Compliance is checked by inspection and tests according to IEC 60529.

7 Marking and instructions

7.1 Addition:

Machines shall be marked at least with the following:

- the letters Ex;
- reference to this document (IEC 60335-2-69 Annex CC);
- Group IIIA, IIIB, or IIIC;
- the maximum surface temperature T , marked as a temperature value in °C;
- the EPL.

NOTE 201 An example for this marking may be "Ex IEC 60335-2-69 Annex CC IIIB T135°C Dc".

The equipotential bonding connector shall be marked with symbol IEC 60417-5021 (2002-10) on the connector or close to it.

7.12 Addition:

In addition, the instructions shall include the substance of the following for all **type 22 machines**:

- The dust container has to be emptied when necessary, but also at the end of a working shift and before each transport;
- The machine shall only be operated when all filters are in position and undamaged. If the machine is equipped with filters for motor cooling air, they also shall be in position and undamaged. This is to be checked before every use;
- Extension cords shall not be used unless verified as suitable for the hazardous area;
- The correct rotation direction shall be ensured if necessary, to avoid blowing and high temperatures caused by rotation in the wrong direction.
- The user shall be aware of all relevant characteristics of the combustible dusts within the zone in which the machine is used and to determine the safety issues associated.
- The user shall be aware of the fact that this machine is not suitable for picking up liquids with a flash point below 55 °C.

NOTE 201 The flash point temperature may vary in different countries. National regulations will need to be taken into account.

- For dusts with ignition energy less than 1mJ, additional restrictions of the labour authorities may apply. The machine is not intended to be used for dusts with ignition energy less than 1 mJ.

NOTE 202 Typical values for ignition energy can be found in Annex BB.

- **WARNING** – Only use accessories approved by the manufacturer. The use of other accessories may cause explosion hazard.
- The machine shall only be used in ambient temperatures higher than –20 °C and less than 40 °C.
- **WARNING** – Attention is drawn to the issues associated with handling metallic dusts and the possibility of exothermic reaction (e.g. fire, explosion).
- An equipotential bonding connector is provided to enable the temporary bonding requirements of IEC 60079-14.
- The hazardous area classification (zone 22) is not changed with the use of type 22 vacuum cleaner.
- It has to be ensured that no potential ignition sources will be picked up.
- **WARNING** – Picking up of hot particles or glowing material can trigger fire and explosion in the ducts and the container. For this case additional safety measures are needed.

NOTE 203 Those additional safety measures are not covered by this standard.

In addition, the instructions shall include the substance of the following for wet or wet and dry vacuum cleaners:

- The user shall be aware of all relevant characteristics of liquids and mixtures of combustible dusts with liquids for which the type 22 machine shall be used and to determine the safety issues associated.

NOTE 204 E.g. textile fibres may auto-ignite when contaminated with certain oils.

In addition, the instructions shall include the substance of the following for vacuum cleaners:

- Type 22 vacuum cleaners are suitable for picking up combustible dust in areas requiring **EPL Dc**. They are not suitable to be connected with dust-generating machines.

In addition, the instructions shall include the substance of the following for **dust extractors**:

- Type 22 dust extractors are suitable to be connected to dust-generating machines in areas requiring EPL Dc.

- Conductive machine parts, including suction hoods and conductive parts of Class II machines that generate dust, shall be electrostatically earthed. Electrostatic earthing can be accomplished through the dust extractor or through a separate electrostatic earthing means.

NOTE 205 Examples for machines that generate dust are orbital sanders, circular saws, drills.

- Type 22 dust extractors are not suitable to be used in conjunction with machines that can produce ignition sources.

Information shall be given about additional national regulations that may apply to the installation of data lead wiring and power sockets in areas requiring **EPL Dc**.

11 Heating

Addition to Table 3:

NOTE 201 For parts that come into contact with **combustible dust**, the values in the table are based on an ambient temperature of 40 °C.

11.8 Addition:

The maximum surface temperature on any external part of a **type 22 machine** shall be according to the 'maximum surface temperature' requirements of IEC 60079-0. The maximum surface temperature shall not exceed 135 °C. Lower temperatures can be stated by the manufacturer.

The maximum surface temperature on any internal part of a **type 22 machine** shall be according to the 'maximum surface temperature' requirements of IEC 60079-0. The maximum surface temperature shall not exceed 135 °C.

The temperature limits as specified in 11.8, Table 3 shall be taken into account.

Compliance is checked in accordance with IEC 60079-0.

19 Abnormal operation

19.7 Modification:

Delete Note 101.

Addition:

The machine shall be tested until stable conditions are reached.

Addition:

19.8 Addition:

The test is repeated after interchanging two of the three-phase leads in the plug to induce rotation in the wrong sense, if possible, and if there is no warning signal for incorrect rotation sense.

22 Construction

22.CC.201 The suction fan shall be on the clean air side and shall be protected against intake of particles greater than 8 mm.

Compliance is checked by inspection and measurement.

22.CC.202 Machines shall be so constructed that dust will deposit on the machine as minimum as possible, or that the dust deposition on the machine can be easily removed.

Compliance is checked by inspection.

22.CC.203 Outer parts of the machine, parts enclosing collected dust, nozzles and dust conduits shall not be made from aluminium containing more than 7,5 % of magnesium and not be coated with aluminium coating.

Nozzles made of cast aluminium containing more than 7,5 % of magnesium have to be protected against impact by non-sparking metals such as bronze, monel-metal or low tensile strength austenitic stainless steel.

Compliance is checked by inspection.

22.CC.204 Dust deflectors shall not be made of materials that generate sparks on impact.

Examples are non-sparking metals such as bronze, monel-metal, low tensile strength austenitic stainless steel, or thermoplastics.

Compliance is checked by inspection.

22.CC.205 The **essential filter** shall be located upstream of the suction unit.

Compliance is checked by inspection.

22.CC.206 If a data connection is provided, then it shall be suitably explosion protected in accordance with a recognised protection technique as given in the IEC 60079 series.

Compliance is checked by inspection.

23 Internal wiring

23.CC.201 Cables and wires not within the IP54 compartment shall not be lighter than 60245 IEC 66.

This requirement does not apply to external data wiring.

NOTE For external data wiring, national regulations can apply.

Compliance is checked by inspection.

24 Components

Addition:

24.1 Addition:

Components that may introduce a potential ignition source should, as far as reasonably practicable, be located outside the dust collection enclosure.

Components located within enclosures containing collected **combustible dust** and which may produce an explosion risk shall be suitable for use in areas in which **explosive dust atmospheres** caused by air/dust mixtures are present continuously, for long periods or frequently. Components in this area shall ensure the requisite level of protection, even in the event of rare incidents relating to equipment, and are characterized by means of protection such that either

- in the event of failure of one means of protection, at least an independent second means provides the requisite level of protection; or
- the requisite level of protection is assured in the event of two faults occurring independently of each other.

The possible existence of excessive layers of dust shall be considered.

The air is considered to be free of **combustible dust** either

- downstream of the **essential filter**
- or
- downstream of the first filter that allows at least the L Class penetration level on the machine (see Figure CC.2).

NOTE 201 Requirements are given in Annex AA, 22.204.

Essential filters are not considered to produce an explosion risk, as long as either

- a) their time constant (resistance to earth times capacity) is less than 0,02 s, or
- b) they are built with **antistatic filter material** and **electrostatically earthed**, or
- c) they are located downstream of another main filter that allows at least the L Class penetration level on the machine (see Figure CC.2). In this case the other main filter should either respect condition a) or b).

Compliance is checked by inspection.

24.CC.201 If filters for cooling air are needed to comply with 6.2 of Annex CC, they shall be removable only by using **tools**.

Compliance is checked by inspection.

24.CC.202 Machine socket outlets shall comply with the requirements of IEC 60079-0 and IEC 60079-31.

Compliance is checked by inspection.

25 Supply connection and external flexible cords

25.1 Addition:

Type 22 machines shall not be supplied with detachable supply cords, unless the appliance inlet complies with the requirements of IEC 60079-0 and IEC 60079-31.

Compliance is checked by inspection.

25.7 Replacement:

Power supply cords for **type 22 machines** shall not be lighter than code designation 60245 IEC 66. The conductors shall be stranded and shall have a minimum cross-sectional area of 1,0 mm².

This requirement does not apply to external data wiring.

NOTE 201 For external data wiring, national regulations may apply.

Compliance is checked by inspection.

25.23 Addition:

Interconnection cords for **type 22 machines** shall not be lighter than code designation 60245 IEC 66.

This requirement does not apply to external data wiring.

NOTE 201 For external data wiring, national regulations may apply.

Compliance is checked by inspection.

25.CC.201 The supply cord shall have a length of at least 7,5 m.

NOTE In some countries other limits regarding the length of the supply cord exist.

27 Provision for earthing

27.CC.201 An additional external connection facility for an equipotential bonding conductor shall be provided in accordance with IEC 60079-0.

Compliance is checked by inspection.

30 Resistance to heat and fire

30.2 Addition:

Non-metallic parts enclosing collected **combustible dust** (i.e. covering or supporting, see Figure CC.1) shall be resistant to ignition and spread of fire. This requirement does not apply to removable dust-collection media placed within the flame-resistant enclosure, e.g. paper disposal bags.

Compliance is tested as follows:

The following test is not carried out on machines exclusively intended to pick up wood dust, having a maximum rated power of 1 200 W and with the volume of the dust container not exceeding 50 dm³.

*Non-metallic parts covering but not supporting the collected **combustible dust** are subjected to the glow-wire test according to IEC 60695-2-11, the test being made at a temperature of 550 °C.*

*Non-metallic parts supporting the collected **combustible dust** shall have a glow-wire flammability index of at least 850 °C according to IEC 60695-2-12, the test sample being no thicker than the relevant part and are subjected to the glow-wire test according to IEC 60695-2-11, the test being made at a temperature of 750 °C. Parts that withstand the glow-wire test of IEC 60695-2-11, but which, during the test, produce a flame that persists for longer than 2 s, are subjected to the needle-flame test of Annex E.*

The needle-flame test is not carried out on parts which are made of material classified as V-0 or V-1 according to IEC 60695-11-10, provided that the test sample was not thicker than the relevant part.

30.CC.201 Type 22 machines shall not create any ignition source.

All **conductive parts** that are in contact with **combustible dust** shall be **electrostatically earthed**.

The requirement for **electrostatic earthing** does not apply to small **conductive parts**, when their time constant (resistance to earth times capacity) is below 0,02 s.

The requirements for non-conductive parts of equipment and non-conductive layers on metal parts, not enclosing electrical components, only apply if they are exposed to the **explosive dust atmosphere** and if there is a foreseeable electrostatic charging.

Compliance is checked as follows:

*The **electrostatic earthing** is measured with minimum 100 V DC, with an electrode surface not exceeding 20 cm². The electrode is applied with a force of 10 N ± 2 N.*

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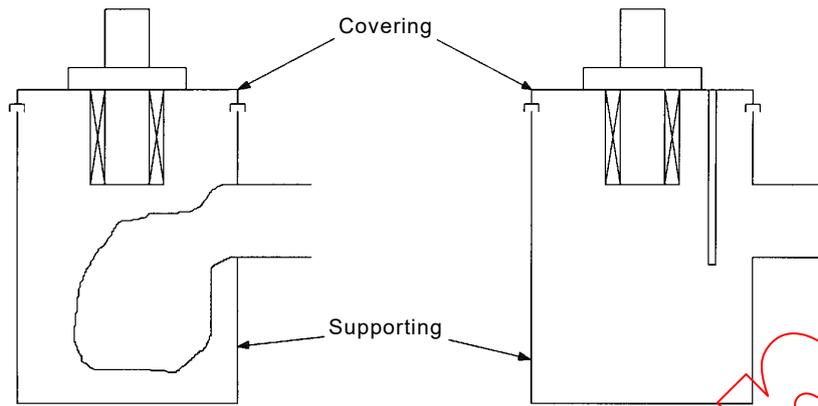


Figure CC.1 – Non-metallic parts enclosing collected combustible dust

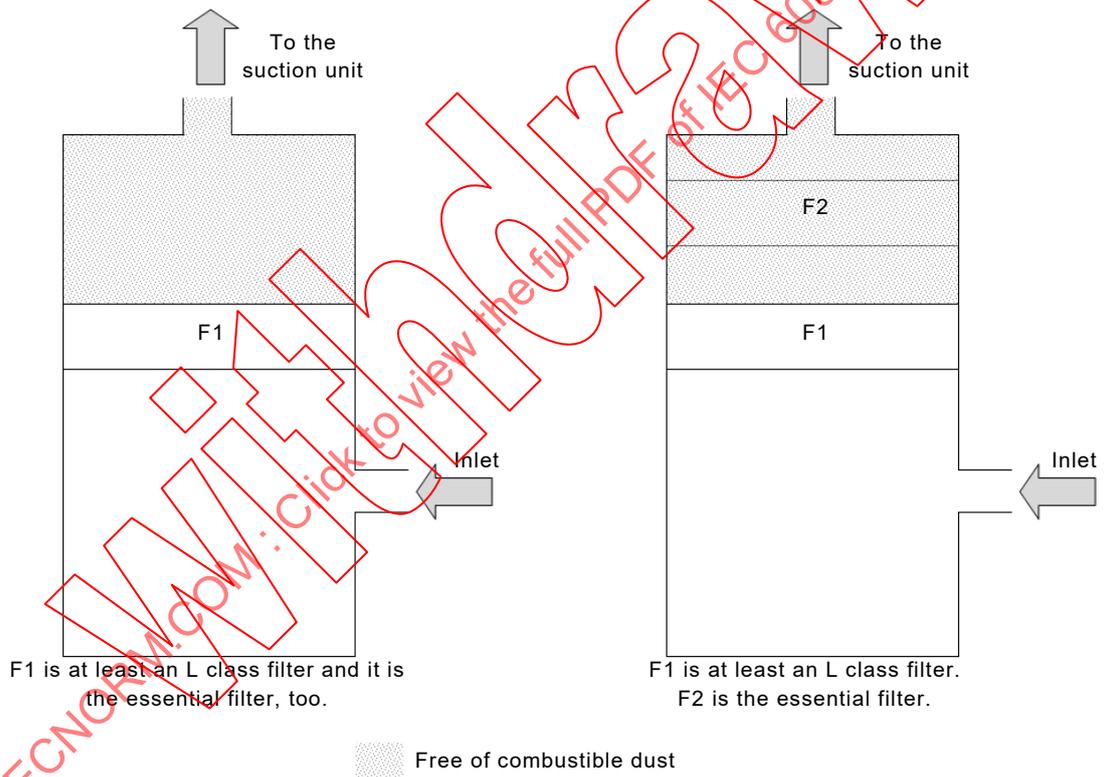


Figure CC.2 – Areas considered free of combustible dust

Annex DD (normative)

Particular requirements for vacuum cleaners for use in ESD protected areas

The following modifications to this part 2 are applicable to vacuum cleaners for use in **ESD protected areas**.

NOTE In this annex, subclauses and notes that are numbered starting from 201 are additional to those in this part 2.

1 Scope

Replacement of the first paragraph:

This standard deals with the safety of electrical motor-operated vacuum cleaners, including **back-pack vacuum cleaners**, for wet suction, dry suction, or wet and dry suction, intended for **commercial use** with or without attachments in **ESD protected areas**.

3 Terms and definitions

3.DD.201

type ESD vacuum cleaner

vacuum cleaner for use in **ESD protected areas**

3.DD.202

electrostatic earthing

connection to earth with a maximum resistance of 1 M Ω

3.DD.203

conductive parts

parts made of materials with a specific resistance of not more than 10 000 Ω ·m

4 General requirement

Addition:

Type ESD vacuum cleaners shall comply with dust class L, class M or class H according to Annex AA.

6 Classification

6.1 *Addition:*

Type ESD vacuum cleaners shall be **class I**.

6.2 *Addition:*

Type ESD vacuum cleaners shall be at least IP54 according to IEC 60529.

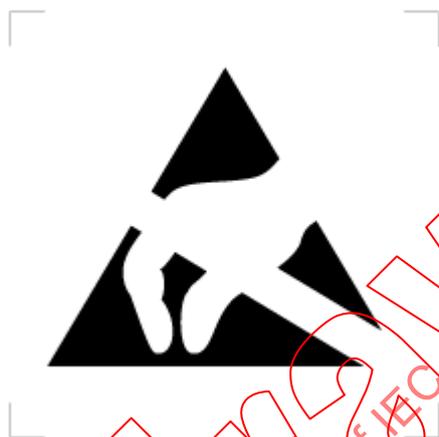
The test is carried out with air moving fans working.

Compliance is checked by inspection and by the relevant tests.

7 Marking and instructions

7.1 Addition:

Type ESD vacuum cleaners shall be clearly and permanently marked with the following symbol or symbol IEC 60417-5134 (2003-04):



7.12 Addition:

In addition, the instructions shall include the substance of the following for all **type ESD vacuum cleaners**:

- Extension cords shall be **Class I**.
- **Type ESD vacuum cleaners** are not suitable to pick up dusts or liquids of high explosion risk, nor mixtures of **combustible dust** with liquids.
- **WARNING** – Only use accessories approved for Type ESD use. The use of other accessories may cause electrostatic discharges.
- The machine shall only be operated when all filters, including filters for motor cooling air, are in position and undamaged.

NOTE National regulations may contain requirements for the installation of data lead wiring and power sockets in EPAs.

22 Construction

22.DD.201 Machines shall be so constructed that a minimum of dust will deposit in or on the machine.

22.DD.202 Type ESD vacuum cleaners shall not generate or keep electrostatic charge. All **conductive parts** shall be electrostatically earthed.

The requirement for **electrostatic earthing** does not apply to small **conductive parts**, when their time constant (resistance to earth times capacity) is below 0,02 s.

Compliance is checked as follows.

The **electrostatic earthing** is measured with 100 V DC, with an electrode surface not exceeding 20 cm². The electrode is applied with a force of 10 N ± 2 N.

22.DD.203 The surface resistance of chargeable shell parts and accessories shall not exceed $10^9 \Omega$.

Compliance is checked as follows.

The surface resistance is measured between 2 parallel electrodes, each 100 mm long, in a distance of 10 mm to each other, making contact to the measuring surface. The applied voltage shall be $500 \text{ V} \pm 10 \text{ V}$. The measurement shall be done on standard conditions ($23 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$; $50 \% \pm 5 \%$ air humidity).

24 Components

24.1 Addition:

Components located within enclosures shall be suitable for **EPA's**.

Compliance is checked by inspection.

24.DD.201 Cooling air filters which are needed to make the machine compliant with 6.2 as specified in this Annex DD shall be removable only by using **tools**.

Compliance is checked by inspection.

30 Resistance to heat and fire

30.2 Addition:

Non-metallic parts surrounding collected dust shall be electrically conductive.

Annex EE (informative)

Emission of acoustical noise

EE.1 Noise reduction

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

The major sound sources of vacuum cleaners are: motors and fans.

EE.2 Noise test code

EE.2.1 Emission sound pressure level determination

The emission sound pressure level for all vacuum cleaners except for **back-pack vacuum cleaners** is determined in accordance with ISO 11203 applying the method described in 6.2.3 d) with the measurement distance $d = 1$ m.

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

The emission sound pressure level for **back-pack vacuum cleaners** is determined in accordance with ISO 11201, grade 2. The microphone is placed at a height of $1,65 \text{ m} \pm 0,05 \text{ m}$, and at a distance of $0,10 \text{ m} \pm 0,025 \text{ m}$ in y direction from the ear of the **operator** on the louder side, and at a distance of $0,00 \text{ m} \pm 0,025 \text{ m}$ in x direction from the ear of the **operator**. The microphone shall be pointed towards the ear.

EE.2.2 Sound power level determination

The sound power level is measured in accordance with ISO 3744, or with ISO 3743-1 if a suitable hard-walled test room is available, or with ISO 9614-2. The direction of the x-axis in Figures EE.1 and EE.2 shall be the same as the x-axis defined for the microphone configurations in ISO 3744.

EE.2.3 Operating and mounting conditions

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

In addition to **normal operation** in accordance with 3.1.9, the following requirements for different types of vacuum cleaners shall be taken into account. The measurement time shall be at least 15 s.

EE.2.3.1 Canister vacuum cleaners

The vacuum cleaner shall be installed on the reflecting plane.

Immediately before each series of measurements, the machine shall be operated for at least 10 min; battery powered machines shall be operated for at least 2 min, starting with a fully charged battery. The noise emission of the non-motorised suction nozzle shall be excluded

from measurement so that it does not interfere with the measurement result, e.g. by placing the nozzle outside of the measurement area.

NOTE 201 Figures are not considered to be necessary for **canister vacuum cleaners** without **motorized cleaning head**. Figures EE.1 and EE.2 show the **motorized cleaning head** as well as the upright vacuum cleaners according to EE.2.3.2.

EE.2.3.2 Upright vacuum cleaners and motorized cleaning heads

Before starting the measurement procedure, the cleaning head shall be adjusted correctly in accordance with the manufacturer's instructions for cleaning carpets.

If the cleaning head is equipped with a device to put out brushes or other retractable parts for cleaning carpets, the cleaning head shall be adjusted so that the bristles of rotating brushes or other retractable parts go beyond the theoretical supporting plane of the cleaning head on a hard floor from $(2_{-0}^{+0,2})$ mm or, if not possible, from at least 2 mm.

All parts intended for hard floor treatment only shall be removed or retracted. For upright vacuum cleaners, crevice nozzles or similar accessories, if applicable, shall not be taken into account.

The upright vacuum cleaner shall be fixed directly without any resilient means on the Wilton carpet (according to IEC 60312-1) of a size 2 m × 1 m, placed on the floor of the test room. If the measurement is done in a reverberation test room or a hard-walled test room, a minimum **clearance** of 1 m between any part of the machine or attachments and the nearest wall shall be observed. The vacuum cleaner shall be positioned in accordance with Figures EE.1 or EE.2.

The hose and connecting tube(s) or the handles of hand-supported and upright vacuum cleaners shall be resiliently suspended or supported in normal position of use (middle of the handles at (80 ± 5) cm above the carpet, if possible), the cleaning head being in full contact with the carpet.

If necessary, the cleaning head shall be resiliently fastened to prevent self-propulsion.

Sound radiation due to possible vibrations of the standard test carpet shall be prevented.

The test carpet is considered to be a part of the machine to be tested and its possible influence on the acoustical characteristics of the test environment, for example of the hard reflecting plane, or on the absorption (reverberation time) of the reverberant test room or hard-walled room shall not be taken into account.

EE.2.3.3 Back-pack vacuum cleaners

Before starting the measurement procedure, the nozzle intended for cleaning carpets shall be adjusted correctly in accordance with the manufacturer's instructions for cleaning carpets.

If the nozzle is equipped with a device to put out brushes or other retractable parts for cleaning carpets, the nozzle shall be adjusted so that the bristles or other retractable parts go beyond the theoretical supporting plane of the nozzle on a hard floor from $(2_{-0}^{+0,2})$ mm or, if not possible, from at least 2 mm.

All parts intended for hard floor treatment only shall be removed or retracted. Crevice nozzles or similar accessories, if applicable, shall not be taken into account.

The **back-pack vacuum cleaner** shall be carried by an **operator**. The **operator** shall stand upright and look straight ahead. The **operator** shall be $1,75 \text{ m} \pm 0,05 \text{ m}$ tall. The harness of the **back-pack vacuum cleaner** shall be adjusted to the size of the **operator**.

The handle is held by the **operator** in the right hand in $0,80 \text{ m}$ height with inclination of 45° to the floor and the suction nozzle is placed with no pressure on the Wilton carpet (according to IEC 60312-1) of a size $2 \text{ m} \times 1 \text{ m}$, placed on the floor of the test room. The vacuum cleaner and the **operator** shall be positioned in accordance with Figure EE.3.

If the measurement is done in a reverberation test room or a hard-walled test room, a minimum **clearance** of 1 m between any part of the machine or attachments and the nearest wall shall be observed.

Sound radiation due to possible vibrations of the standard test carpet shall be prevented.

The test carpet is considered to be a part of the machine to be tested and its possible influence on the acoustical characteristics of the test environment, for example of the hard reflecting plane, or on the absorption (reverberation time) of the reverberant test room or hard-walled room shall not be taken into account.

EE.2.3.4 Centrally-sited vacuum cleaners

The airflow through the machine shall be adjusted so that the power consumption is according to the rated power.

When carrying out free field measurements, the machine may be operated with the mounting side on the reflecting floor. A suction hose shall be used, long enough to avoid measuring suction noise. Carpets are not required.

EE.2.4 Measurement uncertainties

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

EE.2.5 Information to be recorded

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

EE.2.6 Information to be reported

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

EE.2.7 Declaration and verification of noise emission values

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

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

The sound power level shall be given as a dual-number noise emission declaration according to ISO 4871, where the emission sound pressure level exceeds 80 dB(A) .

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

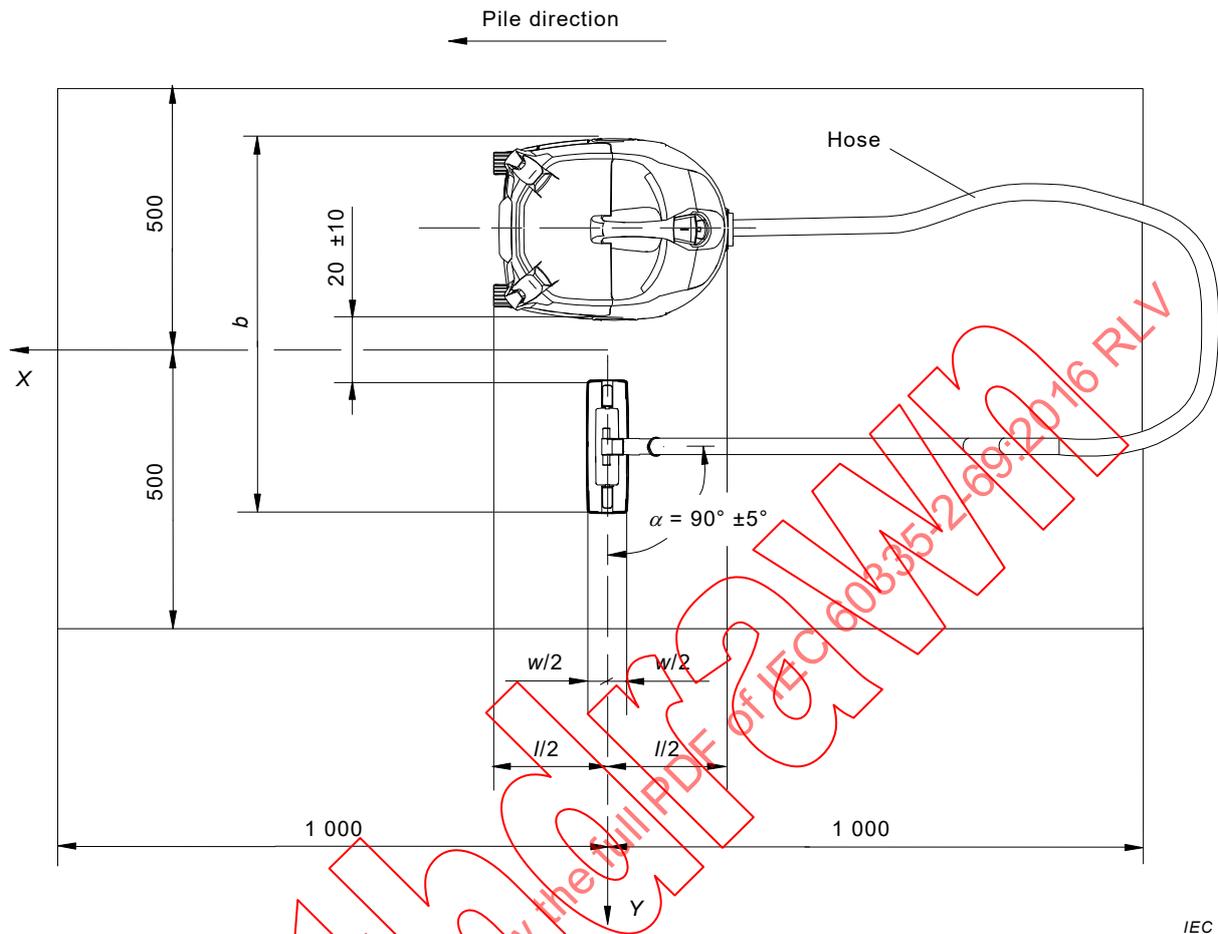
NOTE K_{pA} and K_{WA} are expected to be 2 dB.

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

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

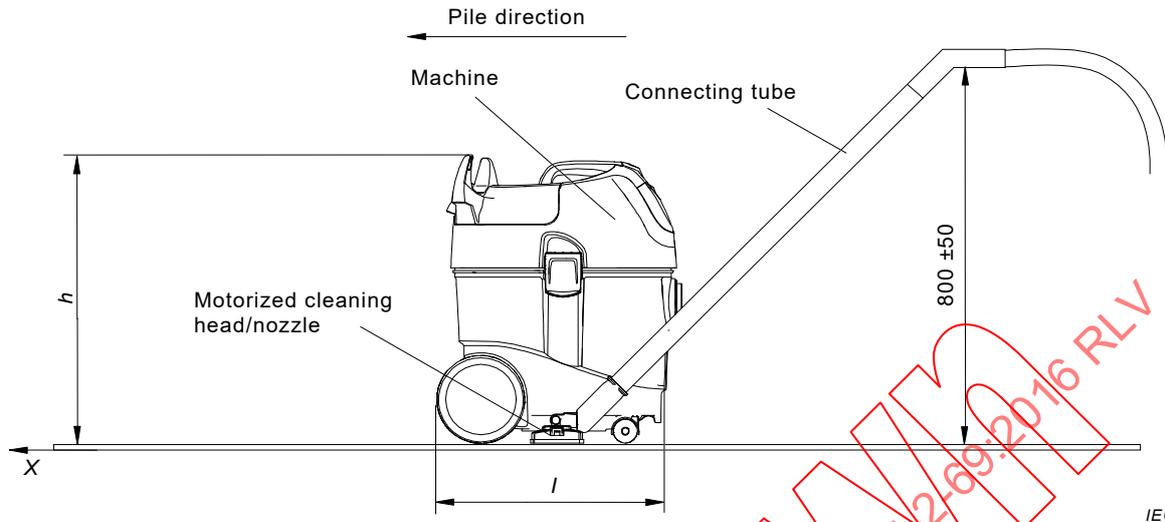
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Withdrawn

Dimensions in millimetres

**Key** w = depth of the motorized cleaning head/nozzle l = length of the machine b = width of machine including nozzle

**a) Machine with cleaning head
connected by hose and connecting tube (top view)**

Dimensions in millimetres



Key

l = length of the machine

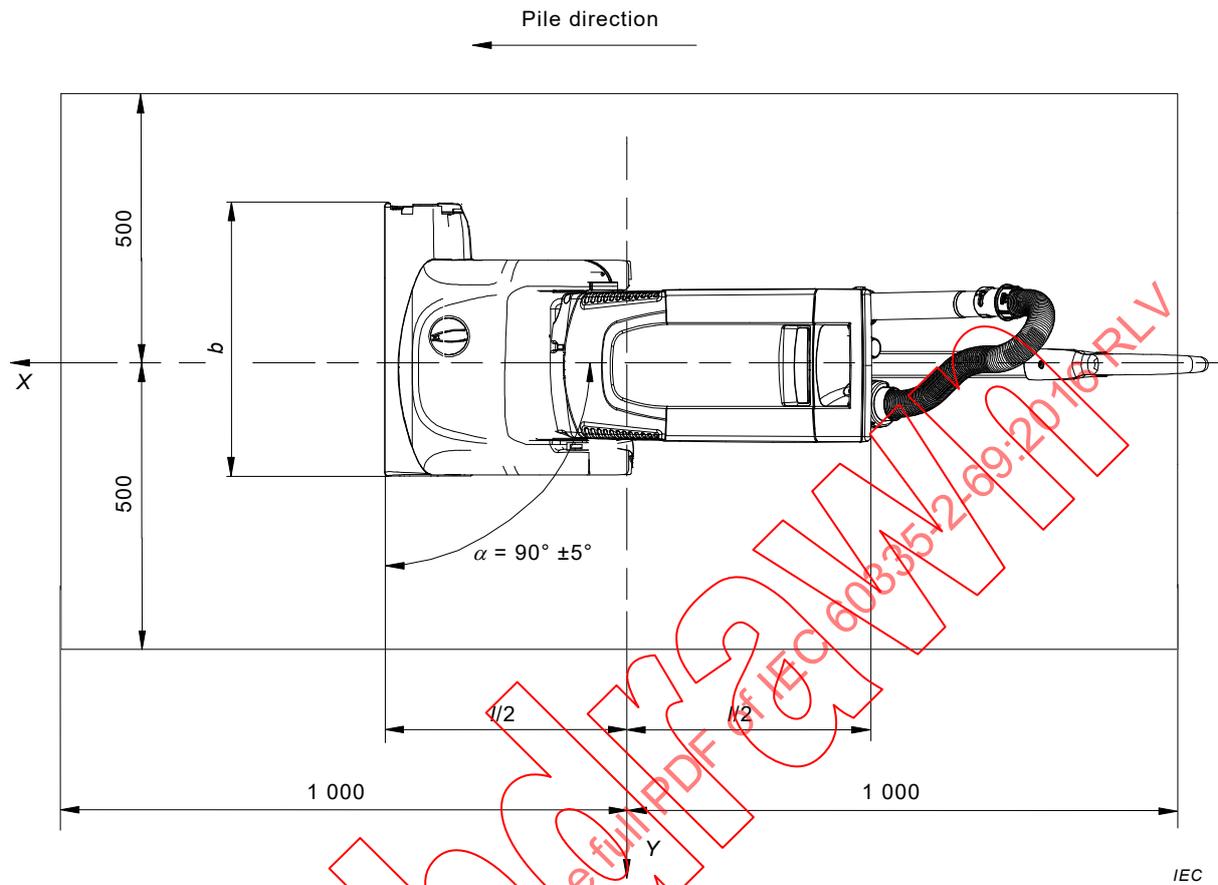
h = height of the machine

b) Machine with cleaning head connected by hose and connecting tube (side view)

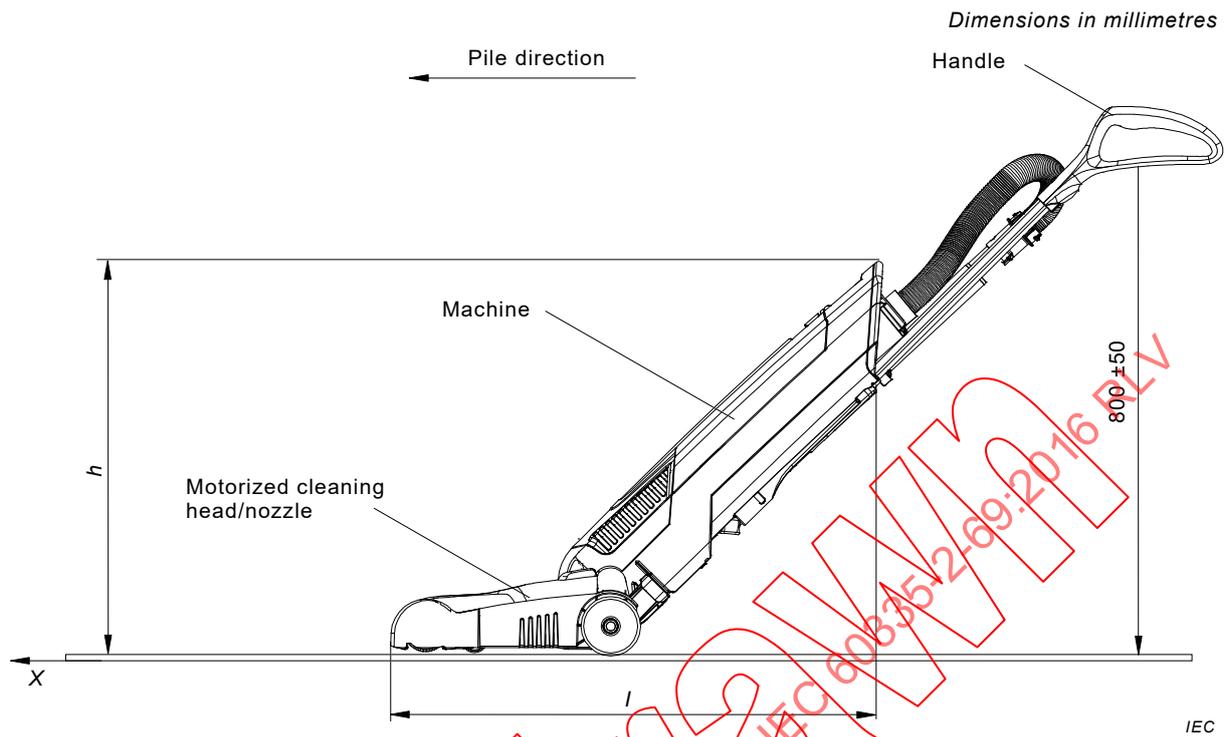
Figure EE.1 – Position of vacuum cleaners and its accessories

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Dimensions in millimetres

**Key** l = length of the machine

a) Machine with cleaning head connected directly (top view)

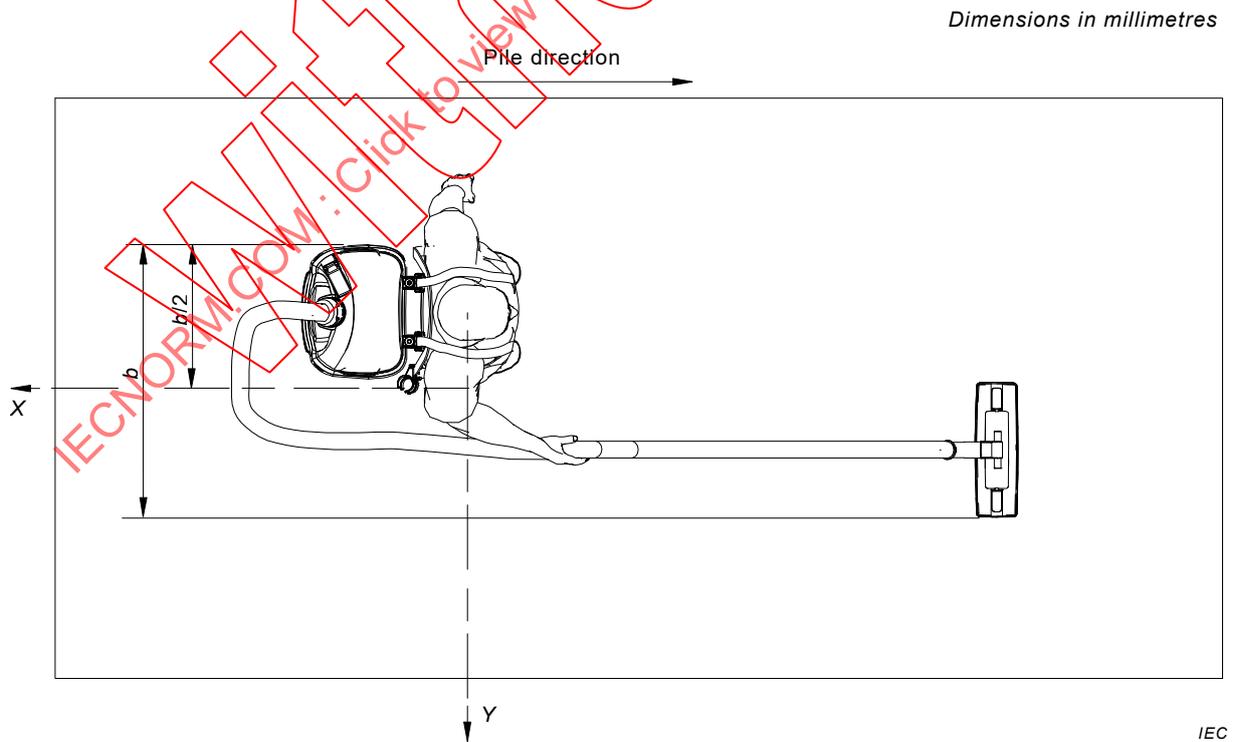


Key

l = length of the machine

b) Machine with cleaning head connected directly (side view)

Figure EE.2 – Position of upright machines

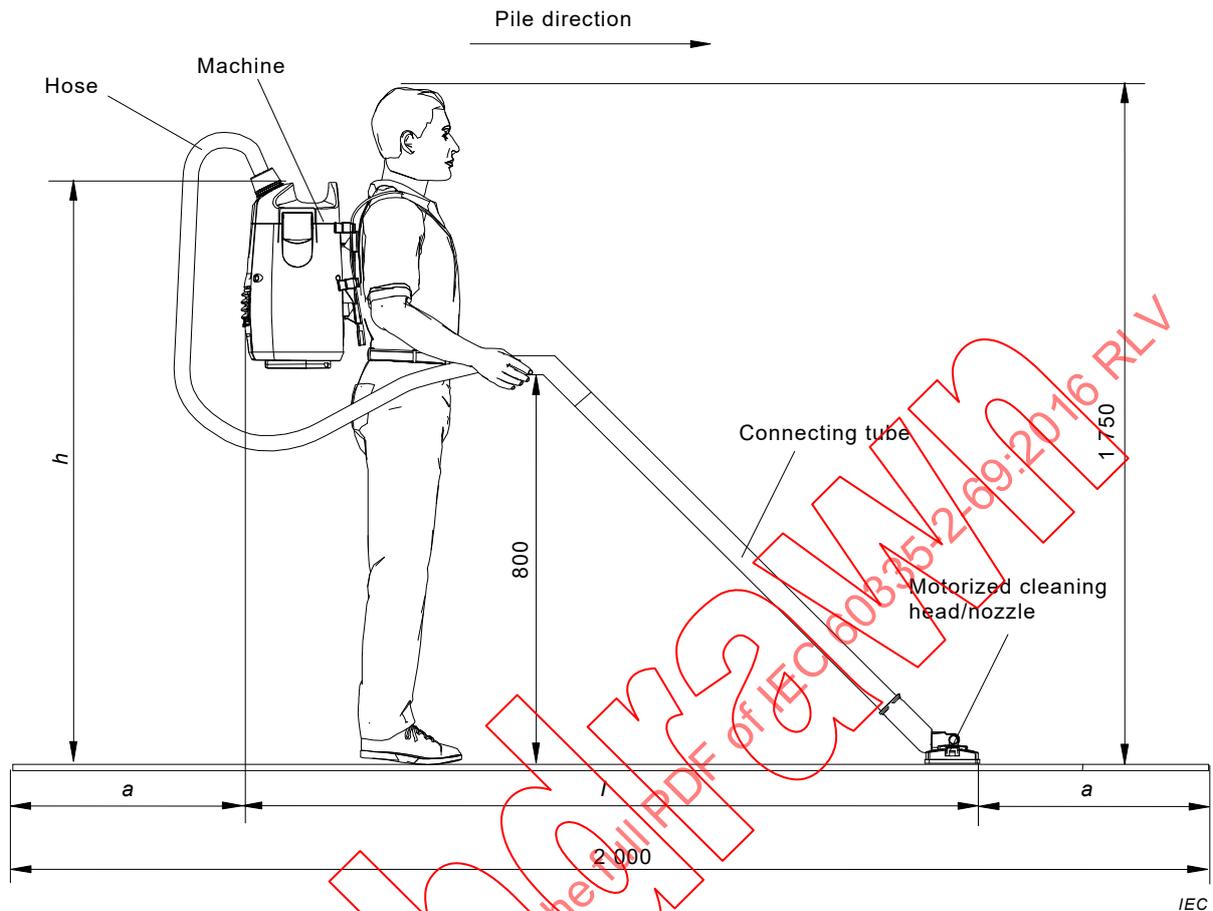


Key

b = width of machine including nozzle

a) Back-pack vacuum cleaners (top view)

Dimensions in millimetres

**Key** h = height of machine l = length of the machine including nozzle a = distance to carpet border**b) Back-pack vacuum cleaners (side view)****Figure EE.3 – Position of back-pack vacuum cleaners**

Annex FF (informative)

Emission of vibration

FF.1 Reduction of vibration

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

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

FF.2 Information on vibration emission

The instructions for hand-held and walk-behind machines and hand-held parts of other machines shall give the following information:

- the vibration total value to which the hand-arm system is subjected, measured in accordance with ISO 5349-1 for arm vibrations, the machine being supplied at **rated voltage** or at the maximum **rated voltage** for machines with a range of voltages, if the vibration total value exceeds 2,5 m/s². Where this value does not exceed 2,5 m/s², this fact may be stated in place of the emission value and uncertainty, e.g. by declaring $a_h \leq 2,5 \text{ m/s}^2$;
- the uncertainty surrounding these values, in accordance with the above given standards.

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

Regarding operating conditions during measurement and the methods used for measurement, the reference of the standard applied (IEC 60335-2-69) shall be specified.

NOTE Experience has shown that for these machines the magnitude of hand-arm vibration is in general significantly below 2,5 m/s². Therefore, unless the equipment concerned has a technical specification that renders this experience inapplicable, it is sufficient to mention that the emission value is below 2,5 m/s².

Annex GG (normative)

Particular requirements for mobile wet vacuum cleaners for rescue and firefighting services (MWF)

The following modifications to the relevant clauses in this part 2 are applicable to mobile wet vacuum cleaners for rescue and firefighting services.

NOTE In this annex, subclauses and notes that are numbered starting from 201 are additional to those in this part 2.

1 Scope

Replacement of the first paragraph:

This standard deals with the safety of electrical motor-operated vacuum cleaners for wet suction or wet and dry suction, for picking up dusts or liquids including water emulsions, intended to be used by rescue and firefighting services.

Replacement of the second paragraph:

They are not equipped with a traction drive. The following power systems are covered:

- mains powered motors up to a **rated voltage** of 250 V for single-phase appliances.

3 Terms and definitions

GG.3.201

portable residual current device PRCD

a portable mechanical switching device designed to make, carry and break currents under normal service conditions and to cause the opening of the contacts when the residual current attains a given value under specified conditions

Note 1 to entry: A **PRCD** may be also called ground fault circuit interrupter (**GFCI**).

[SOURCE: IEC 60050-442:1998, 442-05-02, modified – "portable" has been added to the term defined and the note to entry has been changed]

6 Classification

6.1 *Replacement:*

MWF vacuum cleaners shall be of **class I** with respect to the protection against contact with live parts.

Compliance is checked by inspection and by the relevant tests.

7 Marking and instructions

7.1 *Addition:*

The model or type reference marked on the machine shall include the letters MWF.

MWF vacuum cleaners shall be marked in addition with the symbol according to Figure GG.1 and the symbol according to Figure GG.2.

7.12 Addition:

In addition, the instructions shall include the substance of the following for all **MWF vacuum cleaners**:

- WARNING – Flammable fluids and their emulsions or mixtures can only be picked up when their flash-point is 55 °C or higher. If the flash-point is lower (e.g. gasoline), precautions are necessary to avoid risk of explosion.
 - WARNING – Do not use to pick up flammable or combustible liquids, such as gasoline, or use in areas where they may be present.
 - before use, operators shall be provided with information regarding the applicable **PRCD** system;
- NOTE 201 The SPE-PRCD according to 24.201 may not work in combination with a mobile power generator. If the MWF vacuum cleaner is equipped without any **PRCD**, the operator takes care of the appropriate protection before using the MWF vacuum cleaner.
- before use, operators shall be provided with information, instruction and training for the use of the MWF vacuum cleaner and the substances for which it is to be used, including the safe method of removal and disposal of the material collected;
 - the container shall be emptied and cleaned when necessary, but also after every use and before storage.

In addition, the instructions shall include the substance of the following warning for those **MWF vacuum cleaners** which are equipped without any **PRCD**:

- WARNING – The MWF vacuum cleaner must not be used without **PRCD**. The use without **PRCD** may cause severe hazard.

19 Abnormal operation

19.1 Modification:

Replace the first sentence by the following:

Machines are again subjected to the test of 15.2. Disposal pumps are made inoperative.

20 Stability and mechanical hazards

20.GG.201 **MWF vacuum cleaners** shall be equipped with adequate devices to lift or carry the machine safely. They shall be designed in such a way that they can be used while wearing personal protective equipment (PPE) in accordance with ISO 15383.

Compliance is checked by inspection.

22 Construction

22.GG.201 The **MWF vacuum cleaner** shall be equipped with a pump for a continuous disposal of the sucked up liquid. It shall be possible that suction unit and pump operate at the same time. The machine shall be equipped with a fluid shut-off device to prevent overflowing. There shall be no interference between this fluid shut-off device, the containment and any water level sensing control.

NOTE Examples of water level sensing controls are float switches and level sensors containing moving parts.

Compliance is checked by inspection and measurement.

22.GG.202 The **MWF vacuum cleaner** shall be capable to dispose a liquid stream of 50 l/min minimum when connected to a hose of 15 m length and 42 mm internal diameter, with the hose outlet positioned at a height of 2,5 m above ground level of the vacuum cleaner.

NOTE Such a hose is e.g. C-42-15-K in accordance with DIN 14811.

The **MWF vacuum cleaner** shall be capable to suck up a liquid volume of 35 l without disposal of the liquid and without overflow.

Compliance is checked by inspection and measurement.

22.GG.203 This document does not contain any requirements for inlet and outlet connection couplings.

NOTE For inlet and outlet connection couplings, national regulations apply. It would be beneficial to agree on the design at the time of ordering between purchaser and the manufacturer or manufacturer's authorized representative.

Compliance is checked by inspection.

22.GG.204 The **MWF vacuum cleaner** shall be equipped with a debris filtration system to avoid impairing the pump system by coarse dirt. The filtration system shall be easy to clean.

Compliance is checked by inspection.

22.GG.205 The **MWF vacuum cleaner** shall be equipped with accessories as follows:

- a suction hose with a nominal diameter of at least 35 mm and a length of at least 2,5 m;
- a floor nozzle with a working width of at least 30 cm;
- a suction tube with a total length of at least 800 mm;

NOTE To enabling the storage of the tube in the box as described below it is of advantage to be designed as telescopic tube, as tube to be stuck of different parts, or similar.

- a crevice nozzle.

Compliance is checked by inspection.

22.GG.206 The **MWF vacuum cleaner** shall be equipped with a **PRCD** in accordance with IEC 61540 either incorporated into the plug or mounted at a distance of less than 250 mm from the plug.

The **MWF vacuum cleaner** may be equipped alternatively with a Switched Protective Earth – Portable Residual Current Device (SPE-PRCD) in accordance with IEC 62335, in case this is required by the end-user explicitly.

NOTE 1 Both the **PRCD** and the SPE-PRCD are acceptable with regard to safety requirements while the SPE-PRCD may cause problems when used in combination with a mobile power generator.

The **MWF vacuum cleaner** may be equipped alternatively without any **PRCD** in case this is required by the end-user explicitly and if it is ensured that the **MWF vacuum cleaner** is connected by a separate **PRCD** or by a mobile power generator, where equal safety functions are included. In this case, the operator is responsible for the safe operation of the appliance.

NOTE 2 Attention is drawn to the fact that in many countries additional requirements on the safe use of the equipment covered may be specified by the national firefighting and rescue service authorities, the national authorities responsible for the protection of labour, and similar authorities.

NOTE 3 Attention is drawn to the fact that in many countries, special national conditions might be necessary with regard to application of **PRCDs** or mobile power generators.

*Compliance is checked by inspection, including one of the alternative **PRCDs**.*

24 Components

24.2 *Delete the first dashed item.*

24.GG.201 The pump shall comply with IEC 60335-2-41, except for the following subclauses:

- 25.1 (supply cords fitted with a plug),
- 25.7 1st paragraph, last sentence (types of supply cords),
- 25.8 (conductors of supply cords).

25 Supply connection and external flexible cords

Addition:

25.6 *Add the following note after first sentence:*

NOTE Attention is drawn to the fact that in many countries special national conditions might be necessary with regard to the supply connections.

25.7 *Replacement:*

Supply cords shall have a length of at least 10 m and shall be of the following type.

- Polychloroprene sheathed

Their properties shall be at least those of heavy polychloroprene sheathed flexible cords (code designation 60245 IEC 66).

NOTE 201 These cords are suitable for machines intended to be used in low temperature applications.

Compliance is checked by inspection.

31 Resistance to rusting

The safety of the **MWF vacuum cleaner** shall not be impaired when sucking up fuel oil water emulsions.

Compliance is checked by the test of GG.22.202.



Figure GG.1 – MWF symbol: wet vacuum cleaners intended for rescue and firefighting services



IEC

Figure GG.2 – Warning label for flammable or combustible liquids

Bibliography

The bibliography of Part 1 is applicable except as follows.

Addition:

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IEC 60079-0:2011, *Explosive atmospheres – Part 0: Equipment – General requirements*

IEC 60079-10-2, *Explosive atmospheres – Part 10-2, Classification of areas – Explosive dust atmospheres*

IEC 60079-14, *Explosive atmospheres – Part 14: Electrical installations design, selection and erection*

IEC 60079-31, *Explosive atmospheres – Part 31: Equipment dust ignition protection by enclosure “T”*

IEC TS 60079-32-1:2013, *Explosive atmospheres – Part 32-1: Electrostatic hazards, guidance*

IEC 60335-2-2, *Household and similar electrical appliances – Safety – Part 2-2: Particular requirements for vacuum cleaners and water suction cleaning appliances*

IEC 60335-2-67, *Household and similar electrical appliances – Safety – Part 2-67: Particular requirements for floor treatment machines, for commercial use*

IEC 60335-2-68, *Household and similar electrical appliances – Safety – Part 2-68: Particular requirements for spray extraction appliances, for commercial use*

IEC 60335-2-72, *Household and similar electrical appliances – Safety – Part 2-72: Particular requirements for floor treatment machines with or without traction drive, for commercial use*

IEC 60335-2-100, *Household and similar electrical appliances – Safety – Part 2-100: Particular requirements for hand-held mains-operated garden blowers, vacuums and blower vacuums*

IEC 60584-1, *Thermocouples – Part 1: EMF specifications and tolerances*

IEC 60601-1, *Medical electrical equipment – Part 1: General requirements for basic safety and essential performance*

IEC 61241-1-1, *Electrical apparatus for use in the presence of combustible dust – Part 1-1: Electrical apparatus protected by enclosures and surface temperature limitation – Specification for apparatus¹*

IEC TR 62335, *Circuit breakers – Switched protective earth portable residual current devices for Class I and battery powered vehicle applications*

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

¹ This document has been replaced by IEC 61241-0 and IEC 61241-1.

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

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

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

ISO 4225, *Air quality – General aspects – Vocabulary*

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

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

ISO 7731, *Ergonomics – Danger signals for public and work areas – Auditory danger signals*

ISO 9614-2, *Acoustics – Determination of sound power levels of noise sources using sound intensity – Part 2: Measurement by scanning*

ISO 11201, *Acoustics – Noise emitted by machinery and equipment – Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections*

ISO 11203:1995, *Acoustics – Noise emitted by machinery and equipment – Determination of emission sound pressure levels at a work station and at other specified positions from the sound power level*

ISO 11428, *Ergonomics – Visual danger signals – General requirements, design and testing*

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

ISO 15383, *Protective gloves for fire-fighters – Laboratory test methods and performance requirements*

DIN 14811, *Feuerlöschschläuche – Druckschläuche und Einbände für Pumpen und Feuerwehrfahrzeuge (EN: Fire-Fighting Hoses – Non-Percolating Layflat Delivery Hoses and Hose Assemblies for Pumps and Vehicles)*

DIN 49443, *Zweipoliger Stecker mit Schutzkontakt – DC: 10 A 250 V; AC: 16 A 250 V Druckwasserdicht (EN: Watertight Two-pole plug with earthing contacts – DC: 10 A 250 V; AC: 16 A 250 V)*

DIN 54345-5, *Testing of textiles; electrostatic behaviour; determination of electrical resistance of strips of textile fabrics*

EC Directive 79/831/EEC, *Council Directive of 18 September 1979 amending for the sixth time Directive 67/548/EEC on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances*

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

APPAREILS ÉLECTRODOMESTIQUES ET ANALOGUES – SÉCURITÉ –

Partie 2-69: Exigences particulières pour les aspirateurs fonctionnant en présence d'eau ou à sec, y compris les brosses motorisées, à usage commercial

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La Norme internationale IEC 60335-2-69 a été établie par le sous-comité 61J: Appareils de nettoyage à moteur électrique pour usage commercial, du comité d'études 61 de l'IEC: Sécurité des appareils électrodomestiques et analogues.

Cette cinquième édition annule et remplace la quatrième édition parue en 2012. Elle constitue une révision technique.

Les principales modifications de cette édition, par rapport à la quatrième édition de l'IEC 60335-2-69, sont les suivantes (les modifications mineures ne sont pas mentionnées):

- le domaine d'application a été révisé sur le plan rédactionnel afin d'éviter toute incompréhension;
- les termes et définitions ont été révisés conformément à la révision des exigences;
- la norme a été révisée de manière générale et mise à jour concernant l'état de l'art, dans la mesure du nécessaire, en particulier quelques modifications ont été apportées aux Articles 15, 22 et 25;
- la norme a été alignée avec l'amendement le plus récent de l'IEC 60335-1:2010+A1:2013;
- l'Annexe AA a été révisée et restructurée;
- l'Annexe CC a été révisée;
- des additions générales pour les aspirateurs avec des fonctions de soufflage ont été introduites;
- une nouvelle Annexe GG 'Exigences particulières relatives aux aspirateurs mobiles fonctionnant en présence d'eau pour les services de sauvetage et de lutte contre l'incendie (MWF)' a été ajoutée.

Le texte de cette norme est issu des documents suivants:

FDIS	Rapport de vote
61J/637/FDIS	61J/646/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette norme.

Cette publication a été rédigée selon les Directives ISO/IEC, Partie 2.

La présente partie 2 doit être utilisée conjointement avec la dernière édition de l'IEC 60335-1 et ses amendements. Elle a été établie sur la base de la cinquième édition (2010) de cette norme.

NOTE 1 L'expression "Partie 1" utilisée dans la présente Norme fait référence à l'IEC 60335-1.

La présente partie 2 complète ou modifie les articles correspondants de l'IEC 60335-1 de façon à transformer cette publication en norme IEC: Exigences de sécurité pour les aspirateurs fonctionnant en présence d'eau ou à sec, y compris les brosses motorisées, à usage commercial.

Lorsqu'un paragraphe particulier de la Partie 1 n'est pas mentionné dans cette partie 2, ledit paragraphe s'applique, pour autant qu'il soit raisonnable. Lorsque la présente Norme indique "addition", "modification" ou "remplacement", le texte correspondant de la Partie 1 doit être adapté en conséquence.

NOTE 2 Le système de numérotation suivant est utilisé:

- les paragraphes, tableaux et figures numérotés à partir de 101 viennent en supplément de ceux de la Partie 1;
- notes: à l'exception de celles qui sont dans un nouveau paragraphe ou de celles qui concernent des notes de la Partie 1, les notes sont numérotées à partir de 101, y compris celles des articles ou paragraphes qui sont modifiés ou remplacés;
- les annexes supplémentaires sont appelées AA, BB, etc.

NOTE 3 Les caractères d'imprimerie suivants sont employés:

- exigences: caractères romains;
- *spécifications d'essai: caractères italiques;*
- notes: petits caractères romains.

NOTE 4 L'attention des Comités Nationaux est attirée sur le fait que les fabricants d'appareils et les organismes d'essai peuvent avoir besoin d'une période transitoire après la publication d'une nouvelle publication IEC, ou d'une

publication amendée ou révisée, pour fabriquer des produits conformes aux nouvelles exigences et pour adapter leurs équipements aux nouveaux essais ou aux essais révisés.

Le comité recommande que le contenu de cette publication soit entériné au niveau national au plus tôt 12 mois et au plus tard 36 mois après la date de publication.

Les différences ci-dessous existent dans les pays indiqués ci-après.

- 22.207: Un générateur portable conforme à la norme DIN 14685 (Allemagne) est exigé
- 25.6: Une prise de sécurité conforme à la norme DIN 49443 est exigée (Allemagne)

Les mots en **gras** sont définis à l'Article 3. Si une définition concerne un adjectif, ce dernier et le nom qui lui est associé sont également présentés en gras.

Une liste de toutes les parties de la série IEC 60335, publiées sous le titre général: *Appareils électrodomestiques et analogues – Sécurité*, peut être consultée sur le site Web de l'IEC.

Le comité a décidé que le contenu de cette publication ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous "<http://webstore.iec.ch>" dans les données relatives à la publication recherchée. A cette date, la publication sera

- reconduite,
- supprimée,
- remplacée par une édition révisée, ou
- amendée.

IMPORTANT – Le logo "colour inside" qui se trouve sur la page de couverture de cette publication indique qu'elle contient des couleurs qui sont considérées comme utiles à une bonne compréhension de son contenu. Les utilisateurs devraient, par conséquent, imprimer cette publication en utilisant une imprimante couleur.

INTRODUCTION

Il a été considéré en établissant la présente Norme internationale que l'exécution de ses dispositions était confiée à des personnes expérimentées et ayant une qualification appropriée.

Cette norme reconnaît le niveau de protection internationalement accepté contre les dangers électriques, mécaniques, thermiques, liés au feu et au rayonnement des appareils lorsqu'ils fonctionnent comme en usage normal en tenant compte des instructions du fabricant. Elle couvre également les situations anormales pouvant être attendues dans la pratique et prend en considération la manière dont les phénomènes électromagnétiques peuvent affecter la sécurité de fonctionnement des appareils.

Cette norme tient compte autant que possible des exigences de l'IEC 60364, de façon à garantir la compatibilité avec les règles d'installation quand l'appareil est raccordé au réseau d'alimentation. Cependant, des règles nationales d'installation peuvent être différentes.

Si un appareil compris dans le domaine d'application de la présente norme comporte également des fonctions qui sont couvertes par une autre partie 2 de l'IEC 60335, la partie 2 correspondante est appliquée à chaque fonction séparément, pour autant qu'il est raisonnable. Si cela est applicable, l'influence d'une fonction sur les autres fonctions est prise en compte.

Si la partie 2 d'une norme n'inclut pas d'exigences supplémentaires pour couvrir les dangers traités dans la Partie 1, la Partie 1 s'applique.

NOTE 1 Cela signifie que les comités d'études responsables pour les parties 2 ont déterminé qu'il n'était pas nécessaire de spécifier des exigences particulières pour l'appareil en question en plus des exigences générales.

Cette norme est une norme de famille de produits traitant de la sécurité d'appareils et prévaut sur les normes horizontales et génériques couvrant le même sujet.

NOTE 2 Les normes horizontales et génériques couvrant un danger ne sont pas applicables puisqu'elles ont été prises en considération lors du développement des exigences générales et particulières pour la série de normes IEC 60335. Par exemple, dans le cas des exigences de température de surface pour de nombreux appareils, des normes génériques, comme l'ISO 13732-1 pour les surfaces chaudes, ne sont pas applicables en plus de la Partie 1 ou des parties 2.

Un appareil satisfaisant au texte de la présente norme ne sera pas nécessairement jugé comme satisfaisant aux principes de sécurité de la norme si, lorsqu'il est examiné et soumis aux essais, il apparaît qu'il présente d'autres caractéristiques qui compromettent le niveau de sécurité visé par ces exigences.

Un appareil utilisant des matériaux ou présentant des modes de construction différents de ceux décrits dans les exigences de cette norme peut être examiné et soumis à essai en fonction de l'objectif visé par ces exigences et, s'il est jugé pratiquement équivalent, il peut être estimé comme satisfaisant à la norme.

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1 Domaine d'application

L'article de la Partie 1 est remplacé par l'article suivant.

La présente partie de l'IEC 60335 traite de la sécurité des aspirateurs électriques à moteur, y compris les **aspirateurs dorsaux** et les **extracteurs de poussière**, pour aspiration d'eau, aspiration à sec, ou aspiration d'eau et à sec, destinés à un usage commercial en extérieur et en intérieur avec ou sans accessoires. Ils peuvent être fournis avec une fonction de soufflage ou de gonflage.

Elle traite également de la sécurité des **aspirateurs à unité centrale d'aspiration**, à l'exception de l'installation du système.

NOTE 101 L'attention est attirée sur le fait que les exigences supplémentaires relatives à l'installation en toute sécurité des **aspirateurs à unité centrale d'aspiration** ne sont pas traitées par la présente norme mais nécessitent d'être prises en compte.

NOTE 102 La présente norme s'applique aux machines destinées à un **usage commercial**. La liste suivante, bien que non exhaustive, fournit une indication des lieux inclus dans le domaine d'application:

- lieux publics tels que des hôtels, des écoles, des hôpitaux;
- sites industriels, par exemple des usines et des ateliers de fabrication;
- commerces de détail, par exemple des boutiques et des supermarchés;
- locaux commerciaux, par exemple des bureaux et des banques;
- toutes utilisations autres que l'entretien domestique normal.

Ces appareils ne sont pas équipés d'un dispositif de transmission. Les systèmes d'alimentation suivants sont couverts:

- moteurs alimentés par secteur avec une **tension assignée** maximale de 250 V pour les appareils monophasés et 480 V pour les autres appareils,
- les moteurs alimentés par batterie.

La présente norme s'applique en outre aux machines manipulant de la **poussière dangereuse**, telle que de l'amiante.

NOTE 103 Des exigences supplémentaires concernant les machines manipulant de la **poussière dangereuse** sont indiquées à l'Annexe AA. L'attention est attirée sur le fait que dans de nombreux pays, des exigences supplémentaires relatives aux substances dangereuses pourraient s'appliquer.

NOTE 104 Les substances radioactives ne sont pas couvertes par la définition de **poussière dangereuse** pour les besoins de la présente norme.

La présente norme ne s'applique pas

- aux aspirateurs et aux appareils de nettoyage à aspiration d'eau à usage domestique (IEC 60335-2-2);
- aux machines de traitement des sols à **usage commercial** (IEC 60335-2-67, IEC 60335-2-72);

- aux machines de nettoyage par pulvérisation et aspiration à **usage commercial** (IEC 60335-2-68);
- aux souffleurs, aspirateurs et aspiro-souffleurs portatifs pour le jardin, alimentés par le secteur (IEC 60335-2-100);
- aux outils électroportatifs à moteur et portables (série IEC 60745, série IEC 61029, série IEC 62841);
- aux appareils destinés à des usages médicaux (IEC 60601-1);
- aux machines destinées à être utilisées dans des environnements corrosifs;
- aux machines destinées à aspirer des liquides dont le point d'éclair est inférieur à 55 °C;
- aux machines destinées à être utilisées dans des environnements explosifs (poussière, vapeur ou gaz), à l'exception de celles destinées à être utilisées en zone 22.

NOTE 105 La limite de température du point d'éclair peut varier dans différents pays. Il est nécessaire de prendre en considération les réglementations nationales.

NOTE 106 Des exigences supplémentaires pour les aspirateurs destinés à recueillir de la **poussière combustible** en zone 22 sont données à l'Annexe CC.

NOTE 107 L'attention est attirée sur le fait que, dans de nombreux pays, des exigences supplémentaires relatives à l'utilisation en toute sécurité de l'équipement couvert peuvent être spécifiées par les organismes sanitaires nationaux, par les organismes nationaux responsables de la protection des travailleurs, par les organismes nationaux responsables de l'alimentation en eau et par des organismes similaires.

2 Références normatives

L'article de la Partie 1 est applicable avec les exceptions suivantes.

Addition:

IEC 60312-1, *Vacuum cleaners for household use – Part 1: Dry vacuum cleaners – Methods for measuring the performance* (disponible en anglais seulement)

IEC 60335-2-41, *Appareils électrodomestiques et analogues – Sécurité – Partie 2-41: Règles particulières pour les pompes*

IEC 61540, *Electrical accessories – Portable residual current devices without integral overcurrent protection for household and similar use (PRCDs)*

ISO 2602, *Interprétation statistique de résultats d'essais – Estimation de la moyenne – Intervalle de confiance*

ISO 6344-2, *Abrasifs appliqués – Granulométrie – Partie 2: Détermination de la distribution granulométrique des macrograins P12 à P220*

ISO 7731, *Ergonomie – Signaux de danger pour lieux publics et lieux de travail – Signaux de danger auditifs*

ISO 11428, *Ergonomie – Signaux visuels de danger – Exigences générales, conception et essais*

3 Termes et définitions

L'article de la Partie 1 est applicable avec les exceptions suivantes.

3.1.9 Remplacement: fonctionnement normal

conditions dans lesquelles la machine fonctionne en utilisation normale, obtenues à la puissance suivante P_m du moteur d'aspirateur:

$$P_m = 0,5 (P_f + P_i)$$

où

P_f est la puissance absorbée, en watts, après 3 min de fonctionnement avec le suceur et le tuyau donnant la puissance la plus élevée;

P_i est la puissance absorbée, en watts, lorsque la machine fonctionne depuis 20 s, avec le suceur obturé, immédiatement après les 3 min de fonctionnement avec le suceur ouvert. Toute soupape ou dispositif analogue assurant la circulation d'air qui refroidit le moteur en cas d'obstruction d'une entrée d'air principale est rendu inopérant.

P_f et P_i sont mesurées avec la tension d'alimentation réglée à la **tension assignée** ou à une tension égale à la valeur moyenne de la **plage de tensions assignées** si la différence entre les limites de la **plage de tensions assignées** n'est pas supérieure à 10 % de la valeur moyenne de la plage. Si la différence entre les limites de la **plage de tensions assignées** dépasse 10 % de la valeur moyenne, les essais sont réalisés avec la tension d'alimentation réglée à la limite supérieure de la plage.

Lors des mesures, la machine est équipée d'un sac à poussière et d'un filtre propres et le récipient d'eau, le cas échéant, est vide. Si la machine est destinée à être utilisée uniquement avec un tuyau, les suceurs amovibles sont enlevés et le tuyau est maintenu droit. Si la machine est fournie avec un tuyau en tant qu'accessoire optionnel, elle est mise en fonctionnement sans le tuyau.

Les éventuels dispositifs mus électriquement sont mis en fonctionnement, sans toutefois être en contact avec le sol ou toute autre surface y compris les éléments utilisés pour obturer l'entrée d'air.

La charge normale est égale à la charge moyenne P_r pour le dispositif d'agitation électrique (une brosse motorisée, par exemple) et est définie comme suit:

- le dispositif d'agitation est mis en fonctionnement sur un tapis comme spécifié dans l'IEC 60312-1;
- la charge moyenne P_r est déterminée lorsque le dispositif est utilisé de la manière précisée ci-dessous:
Après mise en place, le dispositif est déplacé deux fois sur 5 m, dans le sens permettant d'obtenir la charge la plus élevée;
- le moteur générant le débit d'air fonctionne dans les mêmes conditions permettant de déterminer la valeur P_f , c'est-à-dire sans restriction du flux d'air, et les mesures sont effectuées après 3 min de fonctionnement;
- le dispositif est réglé en fonction de la hauteur des poils du tapis;
- le dispositif d'agitation doit être déplacé lentement sur le tapis afin de ne pas endommager ce dernier.

Les pompes d'évacuation de l'eau souillée, le cas échéant, sont mises en fonctionnement comme suit.

La pompe fournit un débit d'eau continu, sans tuyau d'évacuation d'eau souillée fixé à la sortie de l'eau souillée de la machine à moins que le tuyau d'évacuation ne soit fixé de façon permanente à la machine. Le moteur d'aspiration fonctionne pendant l'essai, à moins que la machine ne soit munie d'un dispositif de verrouillage empêchant le fonctionnement simultané des deux moteurs.

Les machines équipées d'une fonction de gonflage sont également mises en fonctionnement équipées du tuyau tel que décrit dans les instructions d'utilisation. Le tuyau est placé en ligne

droite à distance de la machine. Les commandes de puissance sont réglées à la puissance la plus élevée.

Les machines équipées d'une fonction de soufflage sont également mises en fonctionnement équipées des deux tuyaux ou tel que décrit dans les instructions d'utilisation. Les deux tuyaux sont placés en ligne droite à distance de la machine. Les commandes de puissance sont réglées à la puissance la plus élevée. Le tuyau de soufflage n'est équipé d'aucun accessoire (les suceurs, par exemple).

3.101

machine de nettoyage à aspiration d'eau

machine destinée à aspirer une solution de nettoyage à base d'eau

3.102

aspirateur dorsal

aspirateur dont la source d'énergie et le collecteur sont destinés à être portés sur le dos de l'**opérateur** à l'aide d'un dispositif de support

3.103

tête de nettoyage à moteur

dispositif de nettoyage portatif ou à guidage manuel raccordé à la machine, équipé d'un moteur électrique intégré

Note 1 à l'article: La tête de nettoyage principale fixée en permanence n'est pas considérée comme une **tête de nettoyage à moteur**.

3.104

poussière dangereuse

poussière non radioactive qui est dangereuse pour la santé si elle est inhalée, ingérée ou est en contact avec la peau

Note 1 à l'article: La directive CE 79/831/CEE modifiant la directive 67/548/CEE répertorie les poussières pour lesquelles l'indication générale de la nature du risque est spécifiée comme très toxique, dangereuse, corrosive ou irritante; certaines poussières peuvent être soumises à une limite d'exposition dans le pays d'utilisation; les micro-organismes peuvent être considérés comme des poussières constituant un danger pour la santé d'un individu.

Note 2 à l'article: Les exigences relatives aux machines destinées à aspirer de la **poussière dangereuse** sont spécifiées à l'Annexe AA.

3.105

poussière combustible

particules solides fines, de taille nominale 500 µm ou moins, qui peuvent rester en suspension dans l'air, peuvent se déposer du fait de leur propre poids et qui peuvent brûler ou s'embraser et peuvent former des mélanges explosifs avec l'air dans des conditions de pression et température normales

Note 1 à l'article: Cela comprend la poussière et les grains tels que définis dans l'ISO 4225.

Note 2 à l'article: Le terme "particules solides" est destiné à désigner les particules en phase solide et non en phase gazeuse ou liquide, mais n'exclut pas les particules creuses.

[SOURCE: IEC 60050-426:2008, 426-02-18]

3.106

atmosphère explosive de poussière

mélange avec l'air, sous conditions atmosphériques, de substances inflammables sous forme de poussières, ou de fibres qui après inflammation permet une propagation autoentretenue

Note 1 à l'article: Les valeurs minimales pour l'énergie d'inflammation des poussières fréquentes peuvent être consultées à l'Annexe BB.

Note 2 à l'article: Les exigences relatives aux machines destinées à aspirer de la **poussière combustible** dans une **atmosphère explosive** sont spécifiées à l'Annexe CC.

[SOURCE: IEC 60050-426:2008, 426-01-08, modifié: les notes à l'article ont été ajoutées]

3.107

zone protégée contre les DES EPA

zone présentant un risque minimal de décharge électrostatique qui pourrait endommager les dispositifs électroniques et à l'intérieur de laquelle les personnes présentes ne sont soumises à aucun risque supplémentaire

Note 1 à l'article: Les exigences relatives aux machines destinées à aspirer de la poussière dans des **zones protégées contre les DES** sont spécifiées à l'Annexe DD.

Note 2 à l'article: L'abréviation "EPA" est dérivée du terme anglais développé correspondant "ESD protected area".

3.108

extracteur de poussière

équipement fixe ou portatif spécialement conçu pour être raccordé à des machines produisant de la poussière

Note 1 à l'article: Un aspirateur est destiné à aspirer de la poussière déjà installée.

3.109

aspirateur à unité centrale d'aspiration

aspirateur raccordé à un système de conduits installé dans le bâtiment

Note 1 à l'article: Lors de leur utilisation, le suceur et son tuyau associé sont raccordés à l'une des entrées d'aspiration du système de conduits.

3.110

protecteur

partie de l'appareil spécifiquement conçue pour fournir une protection au moyen d'une barrière matérielle, comme, par exemple, un boîtier, un écran, un couvercle, une plaque, une porte, une enveloppe ou une barrière; d'autres parties de l'appareil dont la fonction est essentiellement opérationnelle, comme, par exemple, le cadre de l'appareil, peuvent également avoir une fonction protectrice mais ne sont pas référencées comme des **protecteurs**

Note 1 à l'article: Trois principaux types de **protecteurs** peuvent être distingués: **protecteurs** fixes, **protecteurs** mobiles avec dispositif d'interverrouillage et **protecteurs** réglables. Les **protecteurs** mobiles avec dispositif d'interverrouillage sont nécessaires si un accès fréquent est envisagé, alors que les **protecteurs** fixes peuvent être utilisés si un accès fréquent n'est pas envisagé.

3.111

opérateur

personne chargée de l'installation, du fonctionnement, du réglage, du nettoyage, du déplacement ou de **l'entretien par l'utilisateur** sur la machine

3.112

solution d'essai

solution qui contient 20 g de chlorure de sodium et 1 ml d'une solution contenant elle-même 28 % en masse de sulfate de sodium dodécyle pour 8 l d'eau

Note 1 à l'article: La désignation chimique du sulfate de sodium dodécyle est $C_{12}H_{25}NaSO_4$.

3.113

usage commercial

usage prévu des machines couvertes par la présente norme, c'est-à-dire des machines non destinées à une utilisation domestique normale par des personnes privées, mais pouvant représenter un danger pour le public

Cela signifie, en particulier

- que les machines peuvent être utilisées par le personnel des entreprises de nettoyage, le personnel d'entretien, etc.;
- qu'elles sont utilisées dans des locaux commerciaux ou publics (c'est-à-dire les bureaux, les magasins, les hôtels, les hôpitaux, les écoles, etc.) ou dans les environnements industriels (usines, etc.) et dans l'industrie légère (ateliers, etc.).

Note 1 à l'article: L'**usage commercial** est également appelé utilisation professionnelle.

3.114

machine transportable

machine qui peut être déplacée d'un endroit à un autre

Note 1 à l'article: Cela comprend les appareils portables et portatifs et exclut les appareils fixes et stationnaires.

[SOURCE: IEC 60050-151:2001, 151-16-45, modifié: terme modifié, suppression de la mention de l'utilisation de véhicules dans la définition et ajout de la note à l'article]

3.115

aspirateur MWF

aspirateur permettant d'aspirer des liquides, destiné à être utilisé par des services de sauvetage et de lutte contre l'incendie, intégrant une pompe pour une mise au rebut continue du liquide aspiré

Note 1 à l'article: **MWF** est l'abréviation de Mobile Wet vacuum cleaners for rescue and Firefighting and rescue services (aspirateurs mobiles fonctionnant en présence d'eau pour les services de sauvetage et de lutte contre l'incendie).

3.116

fonction de gonflage

mode de fonctionnement lors duquel la sortie d'air propre est utilisée pour gonfler des objets à l'aide du tuyau d'aspiration normalisé raccordé à la sortie d'air de la machine

Note 1 à l'article: Un seul tuyau à la fois est raccordé à la machine.

3.117

fonction de soufflage

mode de fonctionnement lors duquel la sortie d'air propre est raccordée à un tuyau d'évacuation d'air comme indiqué dans les instructions d'utilisation, le but étant de transporter l'air propre rejeté en dehors du lieu de travail

Note 1 à l'article: Dans ce cas, deux tuyaux sont raccordés simultanément à l'aspirateur.

4 Exigences générales

L'article de la Partie 1 est applicable avec les exceptions suivantes.

Remplacement du premier alinéa par ce qui suit:

Les machines doivent être construites de façon à fonctionner en toute sécurité et ne présenter aucun danger pour les personnes ou l'environnement durant une utilisation normale, même en cas de négligence, et pendant l'installation, le réglage, l'entretien, le nettoyage, la réparation ou le transport.

Addition:

Pour les besoins de la présente norme, le terme "appareil" tel qu'utilisé dans la Partie 1 doit être compris comme "machine".

5 Conditions générales d'essais

L'article de la Partie 1 est applicable avec l'exception suivante.

5.101 *La solution d'essai doit être stockée dans une atmosphère fraîche et utilisée dans un délai de sept jours suivant sa préparation.*

6 Classification

L'article de la Partie 1 est applicable avec les exceptions suivantes.

6.1 Remplacement:

Les aspirateurs et leurs accessoires doivent appartenir à l'une des classes suivantes concernant la protection contre les chocs électriques:

- classe I,
- classe II, ou
- classe III.

Les parties métalliques qui peuvent être en contact continu avec le corps doivent être considérées comme des poignées pour lesquelles 22.36 s'applique

La vérification est effectuée par examen et par les essais correspondants.

6.2 Addition:

Les machines de nettoyage à aspiration d'eau et les produits destinés à une utilisation et à un stockage extérieurs doivent au moins être de classe IPX4.

7 Marquage et instructions

L'article de la Partie 1 est applicable avec les exceptions suivantes.

7.1 Remplacement du 4^e tiret comme suit:

- le nom commercial et l'adresse du fabricant et, le cas échéant, son représentant autorisé; toute adresse doit être suffisamment complète pour garantir un contact par courrier;

Addition:

Les machines doivent comporter en plus les éléments suivants:

- numéro de série, le cas échéant;
- désignation de la machine et série ou type, permettant ainsi l'identification technique du produit. Cela peut être réalisé grâce à une combinaison de lettres et/ou de chiffres;

NOTE 101 La désignation de la machine, la série ou le type incluent la référence du modèle ou du type comme exigé dans la Partie 1.

- l'année de construction, c'est-à-dire l'année durant laquelle a été achevé le processus de fabrication;

NOTE 102 L'année de construction peut faire partie du numéro de série.

- la masse de la configuration la plus fréquente exprimée en kg doit figurer sur les machines équipées de roues et les autres machines transportables.

Lorsque cela est autorisé par le Tableau 101, les informations suivantes peuvent figurer sur l'appareil, à proximité de la sortie d'air:

- la mention "AVERTISSEMENT: surface chaude", ou
- le symbole IEC 60417-5041 (2002-10).

7.1.101 Sur les **têtes de nettoyage à moteur**, les éléments suivants doivent figurer:

- la **tension assignée** ou la **plage de tensions assignées** en volts;
- la **puissance assignée** en watts;
- le nom, la marque commerciale ou la marque d'identification du fabricant ou du vendeur responsable;
- la référence de modèle ou de type;
- la masse de la configuration la plus fréquente en kg.

Les **têtes de nettoyage à moteur** des appareils de nettoyage à aspiration d'eau, à l'exception de ceux de **construction de classe III** dont la **tension de service** atteint 24 V, doivent porter le symbole IEC 60417-5935 (2012-09).

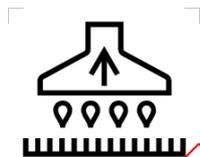
NOTE Ce symbole est un symbole d'information et, à l'exception des couleurs, les règles de l'ISO 3864-1 s'appliquent.

La vérification est effectuée par examen.

7.1.102 La charge maximale en watts doit être indiquée sur le socle de prise de courant ou à proximité.

La vérification est effectuée par examen.

7.6 *Addition:*



[symbole IEC 60417-5935
(2012-09)]

tête de nettoyage à moteur
pour le nettoyage à aspiration
d'eau



[symbole IEC 60417-5041
(2002-10)]

avertissement, surface chaude

7.12 *Modification:*

Remplacer le 4^e alinéa par le texte suivant.

Cette machine n'est pas destinée à être utilisée par des personnes (y compris des enfants) possédant des capacités physiques, sensorielles ou mentales réduites, ou ayant un manque d'expérience et de connaissance.

Addition:

La première page des instructions doit inclure en substance la mise en garde suivante:

AVERTISSEMENT Lire le manuel d'instructions avant toute utilisation de la machine.

Cette formulation peut être remplacée par les symboles ISO 7000-0434A (2004-01) et ISO 7000-0790 (2004-01).

Si le symbole IEC 60417-5041 (2002-10) est marqué sur les appareils, sa signification doit être expliquée.

Les instructions doivent au moins contenir les informations suivantes:

- le nom commercial et l'adresse complète du fabricant et, le cas échéant, son représentant autorisé;
- la désignation de la série ou du type de la machine tel que figurant sur la machine elle-même, à l'exception du numéro de série;

NOTE 101 La désignation de la série ou du type peut être absente, tant que l'identification du produit est garantie.

- la description générale de la machine;
- l'usage prévu de la machine et de l'équipement auxiliaire tels que couverts par le domaine d'application de la présente norme;

NOTE 102 Des exemples d'équipement auxiliaire sont les **têtes de nettoyage à moteur** et les lampes.

- la signification des symboles utilisés sur la machine et dans les instructions;
- les dessins, schémas, descriptions et explications nécessaires à l'utilisation en toute sécurité, l'entretien et la réparation de la machine et afin d'en vérifier le fonctionnement correct;
- les données techniques, y compris les marquages figurant sur la machine;
- les informations relatives à la mise en service, au fonctionnement en toute sécurité, à la manipulation, au transport et au stockage de la machine, en tenant compte de son poids;
- les instructions permettent de réaliser le réglage et l'entretien en toute sécurité, y compris les mesures de protection qu'il convient de prendre pendant ces opérations;
- les conditions dans lesquelles la machine satisfait à l'exigence de stabilité pendant son utilisation, son transport, son assemblage, son démontage lorsqu'elle est hors service, pendant des essais ou des arrêts prévisibles;
- la procédure à suivre afin d'éviter des situations dangereuses en cas d'accident (par exemple contact avec détergents ou déversement de détergents, d'acide de batterie, de carburant ou d'huile) ou panne de l'équipement;
- le contenu de ce qui suit:

Cette machine est destinée à un usage commercial, par exemple dans les hôtels, les écoles, les hôpitaux, les usines, les commerces, les bureaux et les entreprises de location.

Les instructions doivent indiquer le type et la fréquence des examens et de l'entretien exigés pour garantir une utilisation en toute sécurité, y compris les mesures d'entretien préventif. Elles doivent, le cas échéant, fournir les spécifications des pièces de rechange si elles affectent la santé et la sécurité de l'**opérateur** (des éléments de filtre, par exemple).

En outre, les instructions doivent fournir les informations suivantes, si cela est applicable:

- pour les machines alimentées par batterie, des instructions relatives aux précautions à prendre pour un chargement en toute sécurité;
- les précautions à prendre lors du remplacement des brosses ou d'autres accessoires;
- les informations sur les détergents ou d'autres liquides pouvant être utilisés, y compris le choix et l'utilisation d'un équipement de protection individuelle (EPI);

- les caractéristiques essentielles de l'équipement auxiliaire pouvant être installé sur la machine;
- les informations relatives à la mise au rebut des batteries en toute sécurité;
- les objectifs du socle de prise de courant sur la machine;
- les précautions à prendre lors de l'utilisation de la machine dans des conditions spécifiques telles que la manipulation de liquides ou de poussières inflammables et de poussières dangereuses pour la santé;
- les filtres humides et la partie intérieure du réservoir de liquide doivent être séchés avant le stockage.
- l'usage prévu des brosses spécifiées pour la machine.

7.12.101 Les instructions doivent inclure des mises en garde sur les façons dont la machine ne doit pas être utilisée, et qui sont susceptibles de se produire selon l'expérience du fabricant. Elles doivent au moins inclure en substance, si elles sont applicables, les mises en garde suivantes:

- MISE EN GARDE Les opérateurs doivent être informés de façon adaptée de l'utilisation de ces machines.
- MISE EN GARDE Cette machine ne convient pas pour l'aspiration des poussières dangereuses.
- MISE EN GARDE Cette machine est uniquement destinée à une utilisation à sec.
- AVERTISSEMENT Cette machine est uniquement destinée à une utilisation à l'intérieur.
- AVERTISSEMENT Cette machine doit uniquement être stockée à l'intérieur.
- Une mise en garde indiquant que la machine doit être déconnectée de sa source d'énergie au cours du nettoyage ou de l'entretien, et lors du remplacement de parties ou de la conversion de la machine en une autre fonction:
 - pour les machines alimentées par secteur, en retirant la prise du socle de prise de courant;
 - pour les machines alimentées par batterie, en débranchant en toute sécurité au moins le pôle B+ ou B- de la batterie ou selon une méthode équivalente (dispositif de déconnexion), pour des appareils non TBTS, les deux pôles doivent être débranchés.

Les instructions pour les machines alimentées par secteur doivent également inclure, en substance, les indications suivantes:

- MISE EN GARDE Ne pas laisser le câble d'alimentation entrer en contact avec les brosses rotatives.
- MISE EN GARDE N'utiliser le socle de prise de courant de la machine qu'à des fins spécifiées dans les instructions.

Les instructions pour les machines de nettoyage à aspiration d'eau doivent également inclure, en substance, les indications suivantes:

- MISE EN GARDE Si de la mousse ou du liquide s'échappe de la machine, l'arrêter immédiatement.
- AVERTISSEMENT Nettoyer régulièrement le dispositif de limitation du niveau d'eau et l'examiner pour voir s'il présente des signes de détérioration.

Les instructions concernant les machines dont le tuyau parcouru par le courant pour une aspiration à sec fonctionne à d'autres tensions que sur la **très basse tension de sécurité** doivent en outre inclure, en substance, les indications suivantes:

- MISE EN GARDE Ce tuyau contient des connexions électriques: ne pas l'utiliser pour recueillir de l'eau et ne pas l'immerger dans de l'eau pour le nettoyer.

La vérification est effectuée par examen.

7.12.102 Informations relatives au bruit

NOTE Les instructions peuvent inclure des informations relatives aux émissions de bruit aérien telles qu'indiquées en EE.2.7.

7.12.103 Informations relatives aux vibrations

NOTE Les instructions peuvent inclure des informations relatives à la valeur totale des vibrations telle qu'indiquée à l'Article FF.2.

7.12.104 Les instructions d'utilisation des aspirateurs possédant des **fonctions de soufflage ou de gonflage** doivent inclure des informations relatives à l'utilisation de ces fonctions et à la surpression nominale.

Les instructions d'utilisation des aspirateurs équipés de fonctions de gonflage doivent indiquer que ces fonctions ne sont pas destinées à évacuer la poussière déposée.

7.13 Addition:

Les termes "Instructions d'origine" doivent figurer dans la ou les langues vérifiées par le fabricant.

7.14 Addition:

La hauteur du symbole IEC 60417-5935 (2012-09) doit être d'au moins 15 mm.

La hauteur du symbole IEC 60417-5041 (2002-10) doit être d'au moins 10 mm.

La vérification est effectuée par des mesures.

8 Protection contre l'accès aux parties actives

L'Article de la Partie 1 est applicable avec l'exception suivante.

8.1 Addition:

Les agents de nettoyage à base d'eau sont considérés comme conducteurs.

9 Démarrage des appareils à moteur

L'article de la Partie 1 n'est pas applicable.

10 Puissance et courant

L'article de la Partie 1 est applicable.

11 Échauffements

L'article de la Partie 1 est applicable avec les exceptions suivantes.

11.3 Addition:

Si la machine doit être démontée pour mettre en place les thermocouples ou autres conducteurs, la puissance doit être mesurée avant et après avoir appliqué la charge la plus faible possible, par exemple avec l'entrée d'air obturée, les brosses n'étant pas en contact

avec le sol, avec la commande débrayée, etc. afin de s'assurer que l'appareil a été correctement remonté.

Si les surfaces externes accessibles sont plates et si l'accès le permet, le calibre d'essai de la Figure 106 peut alors être utilisé pour mesurer les échauffements des surfaces externes accessibles spécifiées au Tableau 101. Le calibre est appliqué avec une force de $4 \text{ N} \pm 1 \text{ N}$ sur la surface de façon à garantir le meilleur contact possible entre le calibre et la surface.

NOTE 102 Le calibre peut être maintenu en position à l'aide d'une pince de support de laboratoire ou d'un dispositif analogue. Tout instrument de mesure fournissant les mêmes résultats que le calibre peut être utilisé.

11.4 Non applicable.

11.5 Addition:

Pour l'essai d'échauffement, la charge normale P_r du moteur entraînant les brosses motorisées peut être simulée par un frein ou d'autres méthodes.

11.6 Non applicable.

11.7 Addition:

Les machines sont mises en fonctionnement jusqu'à l'établissement des conditions de régime.

11.8 Modification:

Pendant l'essai, les échauffements sont surveillés de façon continue et ne doivent pas dépasser les valeurs présentées au Tableau 101.

Les limites d'échauffement du Tableau 3 spécifiées pour "Enveloppe extérieure des appareils à moteur, sauf les poignées qui sont tenues en usage normal" et les notes de bas de page correspondantes ne sont pas applicables.

Ajouter le nouveau tableau suivant:

Tableau 101 – Échauffements maximaux pour des surfaces externes accessibles spécifiées dans des conditions de fonctionnement normal

Surface	Échauffement des surfaces externes	
	K	
	Surfaces des appareils portatifs ^e	Surfaces des autres appareils ^d
Métal nu	42	48
Métal revêtu ^a	49	59
Verre et céramique	56	65
Plastique et revêtement en plastique > 0,4 mm ^{b,c}	62	74

NOTE Une certaine limite inférieure à 2X est certainement atteignable pour les sorties d'air de processus des aspirateurs fonctionnant en présence d'eau.

^a Le métal est considéré comme revêtu lorsqu'un revêtement présentant une épaisseur minimale de 90 μm fabriqué en émail ou avec du plastique en faibles proportions est utilisé.

^b La limite d'échauffement du plastique s'applique également au matériau en plastique présentant une finition métallique d'une épaisseur inférieure à 0,1 mm.

^c Si l'épaisseur du revêtement en plastique n'est pas supérieure à 0,4 mm, les limites d'échauffement du métal revêtu ou du matériau en verre et en céramique s'appliquent.

- ^d Dans les limites de 25 mm des sorties d'air, les valeurs ci-dessus peuvent être égales à deux fois la limite, mais les termes indiqués en 7.1 doivent figurer sur le produit.
- ^e Dans les limites de 25 mm des sorties d'air, les valeurs ci-dessus peuvent être augmentées de 5 K.

12 Vacant

13 Courant de fuite et rigidité diélectrique à la température de régime

L'article de la Partie 1 est applicable avec l'exception suivante.

13.2 Addition:

*Pour les **appareils de classe I** dont plusieurs moteurs fonctionnent simultanément, le courant de fuite ne doit pas dépasser 3,5 mA.*

14 Surtensions transitoires

L'article de la Partie 1 est applicable.

15 Résistance à l'humidité

L'article de la Partie 1 est applicable avec les exceptions suivantes.

15.1.2 Addition:

*Les **machines de nettoyage à aspiration d'eau** sont mises en fonctionnement pendant 10 min sur une surface horizontale humidifiée à l'aide de la **solution d'essai**.*

Dans la pratique, c'est principalement de l'air qui est aspiré, et de ce fait il n'y a pas de surcharge du moteur d'aspiration, cependant, il convient de surveiller la puissance absorbée afin d'éviter toute surcharge.

15.2 Remplacement:

Les machines équipées d'un réservoir de liquide doivent être construites de telle sorte que

- le déversement de liquide dû au **fonctionnement normal**,
- le remplissage, y compris le remplissage excessif, et
- le renversement de machines instables

n'affectent pas leur isolation électrique.

La vérification est effectuée par les essais suivants:

La machine est placée sur un support incliné selon un angle de 10° par rapport à l'horizontale, le réservoir de liquide étant rempli à la moitié du niveau indiqué dans les instructions. Une machine est considérée comme instable si elle se retourne lorsqu'une force de 180 N est appliquée sur son sommet dans le sens horizontal le plus défavorable.

*Les machines comportant un récipient à liquide et pourvues d'un socle de connecteur sont munies d'une prise mobile de connecteur et d'un câble souple appropriés; les machines comportant un récipient à liquide et munies d'une **fixation du type X** sont équipées de la*

section de câble la plus faible spécifiée au Tableau 11. D'autres machines sont soumises à essai dans l'état de livraison.

Le récipient à liquide de la machine est complètement rempli d'une solution saline d'eau contenant environ 1 % de NaCl et un agent de rinçage 0,6 %, une quantité supplémentaire égale à 15 % de la capacité du récipient ou à 0,25 l, selon la quantité la plus importante, étant versée régulièrement en 1 min.

Tout agent de rinçage disponible dans le commerce peut être utilisé, mais en cas de doute concernant les résultats d'essai, l'agent de rinçage doit présenter les propriétés suivantes:

- viscosité, 17 mPa s;
- pH, 2,2 (1 % dans l'eau)

et sa composition doit être

Substance	Parties en masse %
Plurafac ® LF 221 ¹	15,0
Cumène sulfonate (solution 40 %)	11,5
Acide citrique (anhydre)	3,0
Eau désionisée	70,5
¹ Plurafac ® LF 221 est l'appellation commerciale d'un produit distribué par BASF. Cette information est donnée à l'intention des utilisateurs du présent document et ne signifie nullement que l'IEC approuve ou recommande l'emploi exclusif du produit ainsi désigné.	

Les machines instables sont ensuite renversées, avec le réservoir complètement plein et le couvercle ou capot en place, à partir de la plus défavorable des positions normales d'utilisation, et sont laissées ainsi pendant 5 min, à moins que la machine ne revienne automatiquement à sa position normale d'utilisation.

Les suceurs et les **têtes de nettoyage à moteur des machines de nettoyage à aspiration d'eau** sont placés sur un plateau, dont la base se trouve au niveau de la surface qui supporte la machine. Le plateau est rempli d'une **solution d'essai** à un niveau de 5 mm au-dessus de sa base, en maintenant ce niveau tout au long de l'essai. La machine, y compris la **tête de nettoyage à moteur** est mise en fonctionnement jusqu'à ce que son réservoir de liquide soit complètement rempli et pour une durée supplémentaire de 5 min.

Après chacun de ces essais, la machine doit satisfaire à l'essai de rigidité diélectrique de 16.3.

L'isolation ne doit présenter aucune trace de liquide réduisant les **distances dans l'air** ou les **lignes de fuite** au-dessous des valeurs spécifiées à l'Article 29.

15.3 Modification:

L'humidité relative doit être de (93 ± 6) %.

15.101 Les **têtes de nettoyage à moteur des machines de nettoyage à aspiration d'eau** doivent être résistantes aux liquides qui peuvent entrer en contact avec elles pendant une utilisation normale.

L'essai suivant n'est pas applicable aux **têtes de nettoyage à moteur** de la **classe III** ayant une **tension de service** allant jusqu'à 24 V.

La vérification est effectuée par les quatre essais suivants.

La **tête de nettoyage à moteur** est soumise à un essai de choc décrit dans l'IEC 60068-2-75, la valeur de l'impact étant de 2 J. La **tête de nettoyage à moteur** est fixée de façon rigide et trois coups sont appliqués en chaque point de l'enveloppe susceptible de présenter une faiblesse.

Elle est ensuite soumise à la méthode d'essai 1 de chute libre de l'IEC 60068-2-31. Elle est lâchée à 4 000 reprises d'une hauteur de 100 mm sur une plaque d'acier présentant une épaisseur d'au moins 15 mm. Elle est ensuite lâchée

- 1 000 fois sur le côté droit;
- 1 000 fois sur le côté gauche;
- 1 000 fois sur la face avant;
- 1 000 fois sur la surface de nettoyage.

La **tête de nettoyage à moteur** est ensuite soumise à l'essai décrit en 14.2.4 de l'IEC 60529, à l'aide de la **solution d'essai**.

La **tête de nettoyage à moteur** doit être mise en service dans un récipient à fond plat rempli d'une solution saline d'eau contenant environ 1 % de NaCl de façon à maintenir une profondeur de 3,0 mm d'eau. Le récipient doit être d'une taille telle que la **tête de nettoyage à moteur** se déplace librement, et doit être mis en fonctionnement:

- sans raccordement à l'aspirateur pendant 15 min, le cas échéant; et
- raccordé à l'aspirateur jusqu'à ce que ce dernier ait aspiré autant d'eau que sa capacité le permet ou pendant 5 min, suivant le cas qui survient en premier.

La **tête de nettoyage à moteur** doit ensuite résister à l'essai de rigidité diélectrique de 16.3, la tension étant appliquée entre les **parties actives** et la **solution d'essai**. Il ne doit y avoir sur l'isolation aucune solution saline réduisant les **distances dans l'air** ou les **lignes de fuite** au-dessous des valeurs spécifiées à l'Article 29.

16 Courant de fuite et rigidité diélectrique

L'article de la Partie 1 est applicable avec l'exception suivante.

16.3 Addition:

Les tuyaux parcourus par le courant, à l'exception de leurs connexions électriques, sont immergés pendant 1 h dans une solution saline d'eau contenant environ 1 % de NaCl à une température de $20\text{ °C} \pm 5\text{ °C}$. Tandis que le tuyau est toujours immergé, une tension de 2 000 V est appliquée pendant 5 min entre chaque conducteur et tous les autres conducteurs connectés ensemble. Une tension de 3 000 V est ensuite appliquée pendant 1 min entre tous les conducteurs et la solution saline.

17 Protection contre la surcharge des transformateurs et des circuits associés

L'article de la Partie 1 est applicable.

18 Endurance

L'article de la Partie 1 n'est pas applicable.

19 Fonctionnement anormal

L'article de la Partie 1 est applicable avec les exceptions suivantes.

19.1 Addition:

Les machines sont également soumises à l'essai de 19.101.

L'essai de 19.7 est uniquement effectué sur les **têtes de nettoyage à moteur** et les moteurs de ventilateur des **aspirateurs à unité centrale d'aspiration**.

NOTE 101 Les moteurs de ventilateur séparés ne sont pas destinés à aspirer, mais uniquement à refroidir l'équipement. Ces moteurs sont indépendants du moteur principal de l'aspirateur.

Les **extracteurs de poussière** sont également soumis aux essais de 19.102 et de 19.103, le cas échéant.

Les **aspirateurs à unité centrale d'aspiration** sont également soumis aux essais de 19.104 et de 19.105, le cas échéant.

19.2 Addition:

La machine est soumise à essai sans liquide dans le réservoir.

NOTE 101 Le terme "dégagement de chaleur réduit" de la Partie 1 signifie sans liquide dans le réservoir.

19.7 Addition:

Les **têtes de nettoyage à moteur** sont soumises à essai en verrouillant la brosse rotative ou un dispositif analogue pendant 30 s.

Les **extracteurs de poussière sans surveillance** sont mis en fonctionnement jusqu'à ce que des conditions de régime soient atteintes.

Les moteurs de ventilateur séparés des **aspirateurs à unité centrale d'aspiration** sont mis en fonctionnement jusqu'à l'atteinte de conditions de régime.

NOTE 101 Les moteurs de ventilateur séparés ne sont pas destinés à aspirer, mais uniquement à refroidir l'équipement. Ces moteurs sont indépendants du moteur principal de l'aspirateur.

19.9 Non applicable.

19.10 Addition:

Pour cet essai, la charge minimale possible pour les turbines radiales s'obtient en fermant l'admission d'air. Pour d'autres types de turbines, les caractéristiques doivent être prises en compte.

Dans le cas des batteurs avec brosse ou cylindre, la courroie d'entraînement est retirée.

19.13 Modification:

Au deuxième alinéa, ajouter "et 22.104" après "20.2".

19.101 Les machines avec réservoirs de liquide munis de dispositif(s) d'arrêt ou de soupape(s) sont à nouveau soumises à l'essai de 15.2.

Les soupapes d'arrêt ou d'autres dispositifs d'arrêt de fluide sont rendus inopérants. En présence d'au moins deux dispositifs d'arrêt indépendants, un seul à la fois est rendu inopérant, à condition que chacun d'entre eux ait satisfait à l'essai des 3 000 manœuvres. Dans le cas contraire, tous les dispositifs n'ayant pas satisfait à l'essai sont rendus inopérants.

Afin d'éviter une surcharge du moteur de l'unité d'aspiration, il convient de veiller à aspirer un mélange air-liquide. Il convient de surveiller la puissance absorbée pour éviter toute surcharge.

A l'issue de cet essai, la machine doit être soumise à l'essai de rigidité diélectrique de 16.3. L'examen doit montrer que de l'eau n'a pas pénétré dans la machine dans des proportions dangereuses. En particulier, il ne doit pas y avoir de traces d'eau sur l'isolation électrique qui réduisent les **distances dans l'air** et des **lignes de fuite** au-dessous des limites spécifiées à l'Article 29.

19.102 Les **extracteurs de poussière** pour lesquels 30.2.3 s'applique sont alimentés à la **tension assignée** et mis en fonctionnement avec l'entrée du tuyau d'aspiration fermée.

Les températures des enroulements ne doivent pas dépasser les valeurs spécifiées en 19.9.

19.103 Les **extracteurs de poussière** pour lesquels le 30.2.3 s'applique avec une ventilation séparée du moteur sont alimentés à une **tension assignée** et sont mis en fonctionnement avec le débit d'air dans le moteur bloqué.

Les températures des enroulements ne doivent pas dépasser les valeurs spécifiées en 19.9.

19.104 Les **aspirateurs à unité centrale d'aspiration** sont alimentés à une **tension assignée** et mis en fonctionnement avec l'entrée du tuyau d'aspiration ouverte, puis fermée.

Les températures des enroulements ne doivent pas dépasser les valeurs spécifiées en 19.9.

19.105 Les **aspirateurs à unité centrale d'aspiration** équipés d'une ventilation séparée du moteur sont fournis à une **tension assignée** et sont mis en fonctionnement avec le débit d'air dans le moteur bloqué.

20 Stabilité et dangers mécaniques

L'article de la Partie 1 est applicable avec les exceptions suivantes.

20.1 Modification:

Ajouter à la NOTE existante:

Du papier d'oxyde d'aluminium (granulométrie 80) ou un matériau analogue peut être utilisé pour éviter tout glissement.

Addition:

Les **têtes de nettoyage à moteur** ne sont pas soumises à cet essai.

20.2 Addition:

Ces exigences ne s'appliquent pas aux brosses rotatives et dispositifs analogues, ni aux parties mobiles exposées lors de la mise en place des accessoires qui permettent la conversion d'une application à une autre.

20.101 Les bouts d'arbre d'entraînement ou les parties en rotation analogues doivent être protégés s'ils débordent de plus d'un quart de leur diamètre. Il n'est pas nécessaire de protéger les arbres d'un diamètre allant jusqu'à 50 mm s'ils tournent à moins de cinq tours par seconde, et si leurs extrémités sont rondes et lisses.

*La vérification est effectuée par examen et mesures, tous les patins, brosses, etc. étant en place pour un **fonctionnement normal**.*

L'ouverture et l'abaissement non intentionnels des portes, capots, couvercles, etc., qui pourraient provoquer des blessures, doivent être évités.

Les machines d'un poids supérieur à 20 kg (poids à vide), à l'exception des machines fixes et des **aspirateurs dorsaux**, doivent être équipées de roues ou roulettes de transport, qui doivent être situées ou protégées de façon à éviter toute blessure du pied de l'**opérateur**.

La vérification est effectuée par examen, par des mesures et par un essai fonctionnel.

21 Résistance mécanique

L'article de la Partie 1 est applicable avec les exceptions suivantes.

21.1 Remplacement du premier alinéa:

Les machines et leurs **composants** et accessoires doivent présenter une résistance mécanique adaptée et être construits de façon à résister à une telle manipulation brutale, qui peut être attendue durant une utilisation normale, pendant le transport, l'assemblage, le démontage, la mise au rebut et toute autre action impliquant la machine.

Modification du troisième alinéa:

La valeur d'impact est augmentée pour atteindre $1,0 J \pm 0,04 J$.

21.101 Les parties de la machine qui, pendant une utilisation normale, sont exposées aux chocs, sont soumises à essai comme suit:

*Si la défaillance d'une partie soumise aux chocs peut conduire à une non-satisfaction à la présente spécification, toute partie de la machine pouvant être exposée aux impacts ou aux chocs pendant un **fonctionnement normal** doit être soumise à un choc unique d'une énergie d'impact de 6,75 Nm. La force d'impact sur les machines indépendantes doit être exercée à l'aide d'une sphère en acier de 50,8 mm de diamètre et pesant 0,535 kg, lâchée d'une hauteur de 1,3 m, ou fixée à une corde comme un pendule et tombant d'une hauteur de 1,3 m.*

21.102 Les tuyaux parcourus par le courant doivent être résistants à l'écrasement.

La vérification est effectuée par l'essai suivant.

Le tuyau est placé entre deux plaques parallèles, en acier, mesurant chacune 100 mm de long et 50 mm de large et dont les bords des côtés les plus longs sont arrondis avec un rayon de 1 mm. Le tuyau est placé de telle sorte que son axe soit à angle droit par rapport aux côtés les plus longs des plaques. Les plaques sont placées à une distance d'approximativement 350 mm d'une extrémité du tuyau.

Les plaques en acier sont serrées l'une contre l'autre à une vitesse de 50 mm/min \pm 5 mm/min jusqu'à ce que la force exercée soit de 1,5 kN. La force est ensuite relâchée et l'essai de rigidité diélectrique de 16.3 est effectué entre les conducteurs reliés entre eux et la solution saline.

21.103 Les tuyaux parcourus par le courant doivent être résistants à l'abrasion.

La vérification est effectuée par l'essai suivant.

Une extrémité du tuyau est attachée à la tige de raccordement du mécanisme à bielle (voir la Figure 102). La bielle tourne à trente tours par minute, ce qui a pour résultat de déplacer l'extrémité du tuyau horizontalement d'arrière en avant sur une distance de 300 mm.

Le tuyau est supporté par un rouleau lisse rotatif, au-dessus duquel une sangle de tissu abrasif se déplace à la vitesse de 0,1 m/min. Le tissu abrasif est du grain de corindon de taille P100, comme spécifié dans l'ISO 6344-2.

Une masse de 1 kg est suspendue par l'autre extrémité du tuyau, qui est guidé pour éviter la rotation.

Dans la position la plus basse, la masse se trouve à une distance maximale de 600 mm du centre du rouleau.

L'essai est effectué pendant cent tours du mécanisme à bielle.

Après l'essai, l'**isolation principale** ne doit pas être exposée et l'essai de rigidité diélectrique de 16.3 est effectué entre les conducteurs reliés entre eux et la solution saline.

21.104 Les tuyaux parcourus par le courant doivent être résistants à la flexion.

La vérification est effectuée par l'essai suivant.

L'extrémité du tuyau destinée à être connectée à la **tête de nettoyage à moteur** est attachée au bras pivotant de l'équipement d'essai représenté à la Figure 103. La distance entre l'axe du pivot du bras et le point où le tuyau pénètre la partie rigide est de $300 \text{ mm} \pm 5 \text{ mm}$. Le bras peut être élevé de la position horizontale selon un angle de $40 \pm 1^\circ$. Une masse de 5 kg est suspendue par l'autre extrémité du tuyau ou par un point commode le long du tuyau de telle manière que, lorsque le bras est dans la position horizontale, la masse soit supportée et que le tuyau ne subisse aucune tension.

NOTE Il peut être nécessaire de remettre en place la masse pendant l'essai.

La masse glisse le long d'un plan incliné de telle sorte que le tuyau ne fasse pas avec la verticale un angle supérieur à 3° .

Le bras est élevé et abaissé au moyen d'un mécanisme à bielle qui tourne à la vitesse de $10 \text{ r/min} \pm 1 \text{ r/min}$.

L'essai est effectué pendant 2 500 tours du mécanisme à bielle, puis l'extrémité fixe du tuyau est tournée de 90° et l'essai est poursuivi pendant 2 500 tours supplémentaires. L'essai est répété dans chacune des deux autres positions à 90° .

Après 10 000 tours, le tuyau doit satisfaire à l'essai de rigidité diélectrique de 16.3.

Si le tuyau se rompt avant les 10 000 tours, l'essai de flexion est terminé. Le tuyau doit toujours satisfaire à l'essai de rigidité diélectrique de 16.3.

21.105 Les tuyaux parcourus par le courant doivent être résistants à la torsion.

La vérification est effectuée par l'essai suivant.

Une extrémité du tuyau est maintenue dans une position horizontale avec la partie restante du tuyau en suspension libre. L'extrémité libre subit une rotation en cycles, chaque cycle comprenant cinq tours dans un sens et cinq tours dans le sens opposé, à une vitesse de 10 tours par minute.

L'essai est effectué pendant 2 000 cycles.

Après l'essai, le tuyau doit satisfaire à l'essai de rigidité diélectrique de 16.3 et ne doit pas être endommagé à un point tel que la conformité à la présente norme en soit affectée.

21.106 Les tuyaux conducteurs doivent être résistants au froid.

La vérification est effectuée par l'essai suivant.

Un morceau de 600 mm de tuyau est plié comme représenté à la Figure 104 et les extrémités sont liées ensemble sur une longueur de 25 mm. Le tuyau est alors placé pendant 2 h dans une enceinte dont la température est de $-15\text{ °C} \pm 2\text{ °C}$. Immédiatement après, le tuyau est retiré de l'enceinte et est plié trois fois (voir la Figure 105) à la cadence d'une flexion par seconde.

L'essai est effectué trois fois.

Le tuyau ne doit présenter aucune fissure ni rupture et doit satisfaire à l'essai de rigidité diélectrique de 16.3. Une modification de couleur du tuyau n'est pas considérée comme une défaillance.

22 Construction

L'article de la Partie 1 est applicable avec les exceptions suivantes.

22.6 Addition:

Les **machines de nettoyage à aspiration d'eau** doivent être construites de façon à ce que ni l'eau ni la mousse issues des détergents ne puissent pénétrer dans le moteur ou entrer en contact avec les **parties actives**.

22.35 Addition:

Ces parties sont soumises à l'essai au marteau de l'Article 21. Si cette isolation ne satisfait pas à l'exigence de 29.3, elles sont soumises à l'essai d'impact suivant.

Un échantillon de la partie comportant un revêtement est conditionné à une température de $70\text{ °C} \pm 2\text{ °C}$ pendant sept jours (168 h). Après conditionnement, l'échantillon est refroidi jusqu'à atteindre approximativement la température ambiante.

Un examen doit montrer que le revêtement n'a pas rétréci à un point tel que l'isolation exigée n'est plus assurée ou que le revêtement ne s'est pas détaché de sorte qu'il puisse se déplacer longitudinalement.

Après cet essai, l'échantillon est maintenu pendant 4 h à une température de $-10\text{ °C} \pm 2\text{ °C}$.

Toujours à cette température, l'échantillon est ensuite soumis à des chocs à l'aide de l'équipement présenté à la Figure 101. Le poids "A", présentant une masse de 0,3 kg, tombe d'une hauteur de 350 mm sur le burin "B" en acier trempé, dont le bord est placé sur l'échantillon.

*Un choc est appliqué à chaque endroit où l'isolation est présumée faible ou susceptible d'être endommagée en **fonctionnement normal**, la distance entre les points d'impact étant d'au moins 10 mm.*

Après ces essais, il doit être démontré que l'isolation ne s'est pas détachée et un essai de rigidité diélectrique tel que celui spécifié en 16.3 est effectué entre les parties métalliques et une feuille métallique entourée autour de l'isolation dans la zone exigée.

Pour les **aspirateurs à unité centrale d'aspiration**, ce paragraphe de la Partie 1 est applicable.

22.54 Ce paragraphe n'est pas applicable.

22.101 Les machines doivent être construites de façon à empêcher la pénétration d'objets à partir du sol pouvant compromettre la sécurité de la machine.

Les **parties actives** des machines destinées à une utilisation à sec doivent se situer à au moins 30 mm de distance de la surface du sol, mesurée dans le sens vertical à travers des trous existants. Cette exigence ne s'applique pas aux **têtes de nettoyage à moteur**.

La vérification est effectuée par examen et par des mesures.

22.102 Les appareils de classe I ou les appareils de classe II doivent être équipés d'un interrupteur d'isolement du réseau garantissant la **coupure omnipolaire** conformément aux conditions de surtension de catégorie III.

Pour les chargeurs de batterie intégrés, cette **coupure omnipolaire** peut être réalisée en tirant sur la prise.

D'autres interrupteurs peuvent être de construction unipolaire.

Le dispositif de déconnexion d'alimentation peut ne pas déconnecter les circuits suivants:

- prise et socles de prise de courant;
- circuits de protection contre les sous-tensions uniquement fournis pour un déclenchement automatique en cas de défaillance de l'alimentation;
- indicateurs de rotation de phases;
- circuits de commande de verrouillage.

Il est cependant recommandé de fournir ces circuits avec leur propre dispositif de déconnexion.

La vérification est effectuée par examen.

22.103 Pour les machines pour lesquelles l'**opérateur** doit utiliser un équipement de protection individuelle (EPI), les commandes doivent être conçues de façon à pouvoir fonctionner en toute sécurité.

La vérification est effectuée par examen et par un essai fonctionnel.

22.104 Si des machines sont équipées de dispositifs d'arrêt, ces derniers doivent empêcher que le niveau de liquide ne dépasse le niveau maximal autorisé.

La vérification est effectuée par examen

22.105 Bretelle de sécurité des aspirateurs dorsaux

Toutes les mesures sont effectuées avec l'ensemble des filtres en place, les compartiments à poussière vides et sans le poids du **câble d'alimentation**.

Les **aspirateurs dorsaux** d'une masse supérieure à 6 kg doivent être équipés d'au moins une bretelle de sécurité simple. Une bretelle de sécurité double doit être fournie pour les **aspirateurs dorsaux** d'une masse supérieure à 7,5 kg.

Les bretelles de sécurité simples doivent être conçues de façon à ce que la machine puisse être libérée rapidement par l'**opérateur** en cas d'urgence. Une méthode pour atteindre cet objectif consiste à installer un mécanisme de décrochage rapide sur la bretelle.

Les bretelles de sécurité doubles doivent toujours être munies d'un mécanisme de décrochage rapide. Ce mécanisme doit uniquement permettre une séparation grâce à une action délibérée.

Toutes les bretelles doivent être réglables à la taille de l'**opérateur**. La bretelle doit répartir la charge uniformément sur le dos, les épaules, la taille et/ou la hanche de l'**opérateur**.

Les **aspirateurs dorsaux** d'une masse supérieure à 7,5 kg doivent être fournis avec un patin placé aux points de contact entre la machine et le corps de l'opérateur.

La vérification est effectuée par examen et par un essai fonctionnel.

22.106 Poignée des aspirateurs dorsaux

Les **aspirateurs dorsaux** doivent être équipés d'une poignée munie d'une surface ou d'une structure spécialement conçue pour que la main de l'**opérateur** lui permette de saisir l'**aspirateur dorsal** afin de le placer sur son dos ou de le retirer.

La vérification est effectuée par examen et par un essai fonctionnel.

22.107 Interrupteur de verrouillage

Les interrupteurs de verrouillage permettant d'éviter l'accès aux parties actives doivent être situés de façon à éviter tout fonctionnement non intentionnel.

La vérification est effectuée par examen et en utilisant le calibre d'essai B défini dans l'IEC 61032.

23 Câblage interne

L'article de la Partie 1 est applicable.

24 Composants

L'article de la Partie 1 est applicable avec les exceptions suivantes:

24.1.3 Addition:

L'interrupteur principal des aspirateurs doit être soumis à 50 000 cycles de manœuvres.

Cette spécification d'essai ne s'applique pas aux **aspirateurs à unité centrale d'aspiration**.

Les interrupteurs de verrouillage sont utilisés 10 000 fois.

Si l'interrupteur de verrouillage utilise un relais ou un contacteur ou s'il est mis en fonctionnement par un système d'actionnement mécanique, l'ensemble du système d'interrupteur est soumis à l'essai.

24.2 Addition:

Pour les **aspirateurs dorsaux** équipés d'un dispositif de commutation situé à l'extrémité d'un câble d'interconnexion, le dispositif de commutation doit être conçu de façon à ne pas pouvoir entrer en contact avec le sol en utilisation normale.

Les serre-câbles des deux côtés du câble d'interconnexion doivent satisfaire à 25.15.

24.101 Les machines équipées de moteurs possédant des **coupe-circuit thermiques à réarmement automatique** doivent fonctionner de manière fiable dans des conditions de surtension.

La vérification est effectuée par l'essai suivant.

*La machine est alimentée à une tension égale à 1,1 fois la **tension assignée**, sous une charge avec le rotor coincé faisant fonctionner le **coupe-circuit thermique** en quelques minutes, jusqu'à ce que ce dernier ait effectué 200 cycles de fonctionnement.*

Après l'essai, la machine doit satisfaire aux essais de l'Article 16.

24.102 Les interrupteurs de verrouillage empêchant l'accès aux **parties actives** doivent

- déconnecter tous les pôles, sauf si le circuit secondaire est alimenté par un transformateur d'isolement;
- si une seule action de commutation est obtenue à l'aide d'un dispositif de commutation, ce dernier doit assurer une déconnexion complète et les distances dans l'air pour une déconnexion complète spécifiées en 20.1.5.3 de l'IEC 61058-1:2000 doivent être obtenues à partir du Tableau 22 de l'IEC 61058-1:2000 à l'aide d'une tension de tenue aux chocs assignée de 4 000 V.

La vérification est effectuée par examen.

25 Raccordement au réseau et câbles souples extérieurs

L'article de la Partie 1 est applicable avec les exceptions suivantes.

25.1 Addition:

Les machines classées IPX7 ne doivent pas être munies d'un socle de connecteur.

Les machines classées IPX4, IPX5 ou IPX6 ne doivent pas comporter de socle de connecteur, à moins que le socle et que le connecteur ne soient tous deux de la même classe que la machine, qu'ils soient séparés ou raccordés, ou que le socle et le connecteur ne puissent être séparés qu'à l'aide d'un **outil** et aient la même classe que la machine lorsqu'ils sont raccordés.

Les machines munies d'un socle de connecteur doivent également être équipées d'un cordon-connecteur approprié.

25.7 Remplacement:

Les **câbles d'alimentation** doivent appartenir à l'un des types suivants:

- Avec gaine en caoutchouc

Leurs propriétés doivent être au moins celles de câbles souples sous gaine ordinaire de caoutchouc (désignation 60245 IEC 53);

NOTE 101 Ces câbles ne sont pas adaptés aux machines destinées à être utilisées en extérieur, ou s'ils sont susceptibles d'être exposés à des quantités importantes de rayons ultraviolets.

– Avec gaine de polychloroprène

Leurs propriétés doivent être au moins celles de câbles sous gaine ordinaire de polychloroprène (désignation 60245 IEC 57);

NOTE 102 Ces câbles sont adaptés aux machines destinées à être utilisées pour des applications à faible température.

– Avec gaine en chlorure de polyvinyle

Ces câbles ne doivent pas être utilisés s'ils sont susceptibles de toucher des parties métalliques présentant un échauffement supérieur à 75 K lors de l'essai de l'Article 11. Leurs propriétés doivent être au moins celles de câbles sous gaine ordinaire de chlorure de polyvinyle (désignation 60227 IEC 53).

– Avec gaine en chlorure de polyvinyle résistant à la chaleur

Ces câbles ne doivent pas être utilisés pour des **fixations du type X** autres que des câbles spécialement préparés. Leurs propriétés doivent être au moins celles de câbles sous gaine ordinaire de chlorure de polyvinyle résistant à la chaleur (désignation 60227 IEC 57).

La vérification est effectuée par examen.

25.14 Addition:

Pour des machines incorporant des **fixations du type X** ou du **type Y**, le nombre de flexions est de 20 000.

25.15 Modification:

Remplacer le Tableau 12 par le tableau suivant:

Tableau 12 – Force de traction et couple

Masse de la machine	Force de traction	Couple
kg	N	Nm
≤ 1	30	0,1
> 1 et ≤ 4	60	0,25
> 4	125	0,40

Addition:

L'essai est également appliqué au cordon dans le cordon-connecteur des machines classées IPX4 ou au-delà qui sont munies d'un socle de connecteur. Le cordon-connecteur est fixé au socle de connecteur avant le commencement de l'essai.

26 Bornes pour conducteurs externes

L'article de la Partie 1 est applicable.

27 Dispositions en vue de la mise à la terre

L'article de la Partie 1 est applicable.

28 Vis et connexions

L'article de la Partie 1 est applicable.

29 Distances d'isolement, lignes de fuite et isolation solide

L'article de la Partie 1 est applicable avec l'exception suivante.

29.2 Addition:

Le microenvironnement est caractérisé par le degré de pollution 3, à moins que l'isolation ne soit enfermée ou située de sorte qu'elle ne soit pas susceptible d'être exposée à la pollution produite par la machine en utilisation normale.

30 Résistance à la chaleur et au feu

L'article de la Partie 1 est applicable avec l'exception suivante.

30.2 Addition:

Pour les **aspirateurs à unité centrale d'aspiration**, 30.2.3 s'applique.

31 Protection contre la rouille

L'article de la Partie 1 est applicable.

32 Rayonnement, toxicité et dangers analogues

L'article de la Partie 1 est applicable avec l'exception suivante.

Addition:

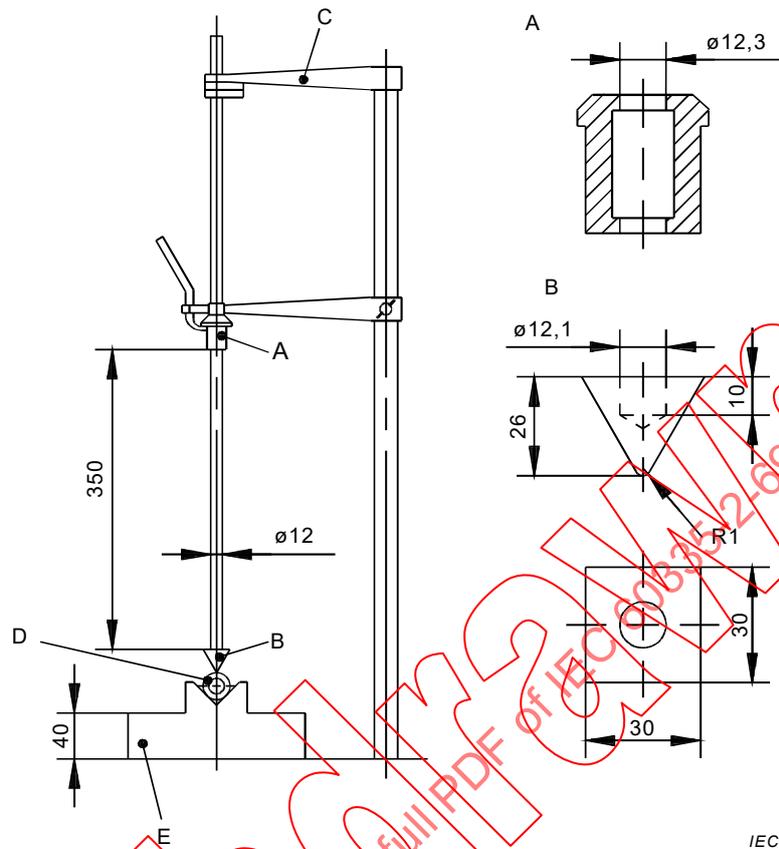
Pour les machines destinées à aspirer de la **poussière dangereuse**, des exigences supplémentaires sont spécifiées à l'Annexe AA.

NOTE 101 Des informations sur les risques d'explosion de certaines poussières sont données à l'Annexe BB.

Pour les machines destinées à aspirer de la **poussière combustible** dans une **atmosphère explosive**, les exigences supplémentaires sont spécifiées à l'Annexe CC.

Pour les machines destinées à aspirer de la poussière dans des **zones protégées contre les DES**, les exigences supplémentaires sont spécifiées à l'Annexe DD.

Dimensions en millimètres



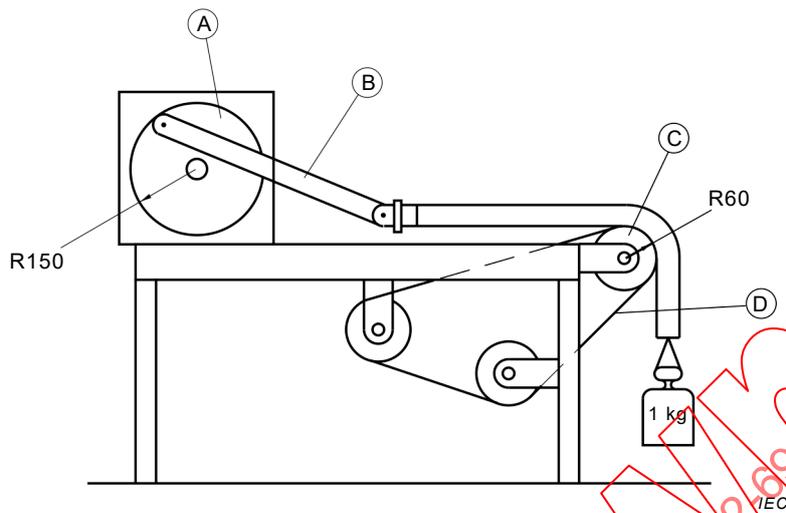
IEC

Légende

- A poids
- B burin
- C bras de fixation
- D échantillon
- E socle ayant une masse de 10 kg

Figure 101 – Équipement pour les essais d'impacts

Dimensions en millimètres

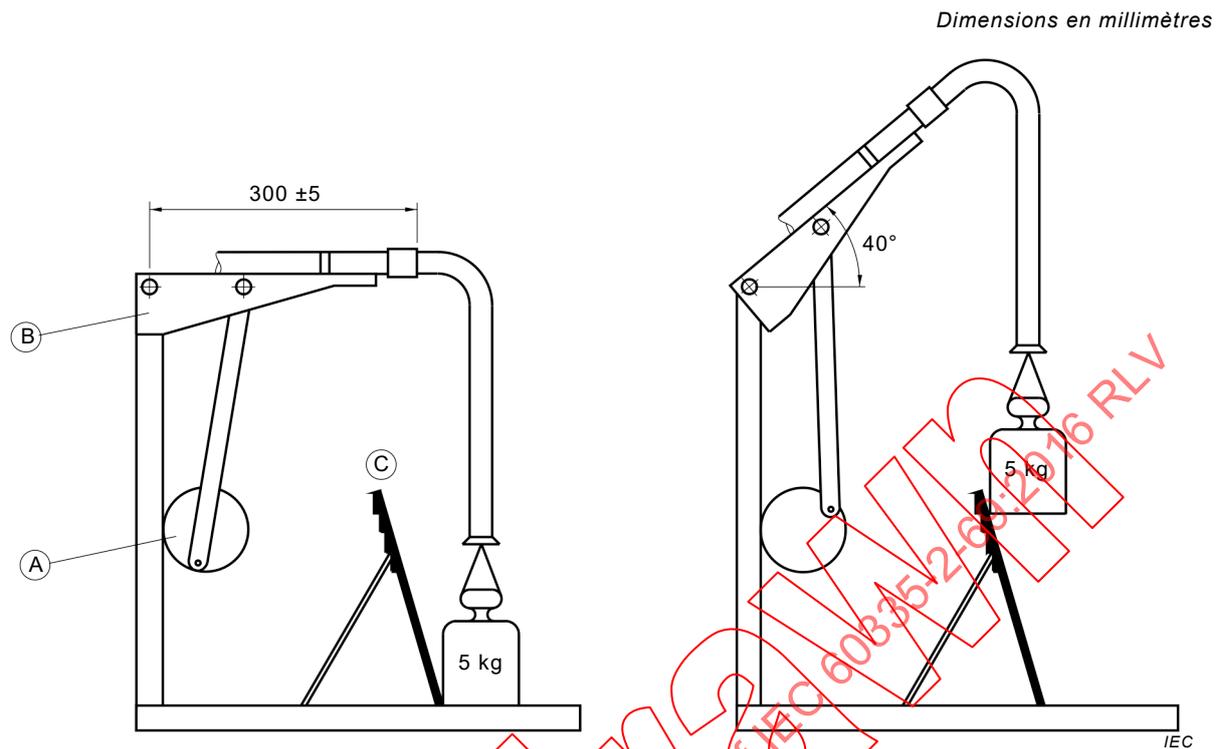


Légende

- A mécanisme à bielle
- B tige de raccordement
- C rouleau, diamètre 120 mm
- D courroie en tissu abrasif

Figure 102 – Équipement pour les essais de résistance à l'abrasion des tuyaux parcourus par le courant

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**Légende**

- A mécanisme à bielle
- B bras
- C plan incliné

Figure 103 – Équipement pour les essais de résistance à la flexion des tuyaux parcourus par le courant

Dimensions en millimètres

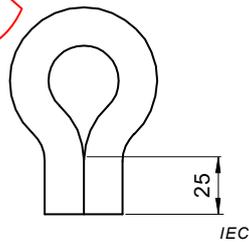


Figure 104 – Configuration du tuyau pour le traitement à basse température

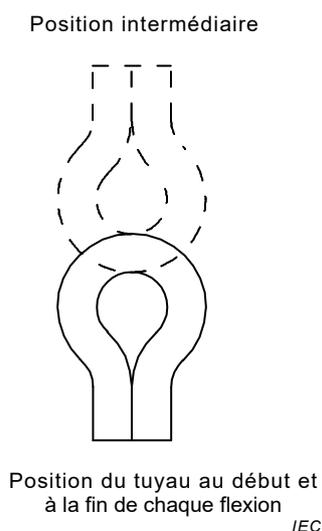
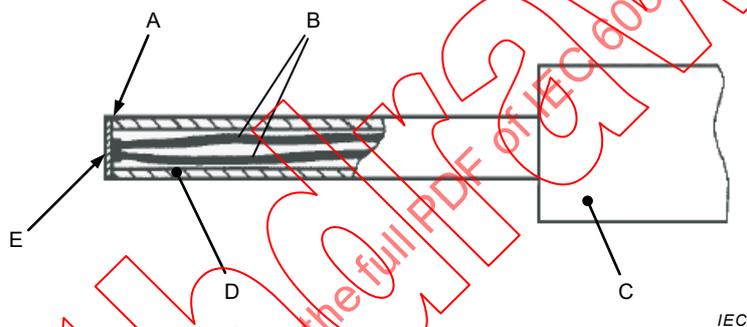


Figure 105 – Positions de flexion pour le tuyau après retrait de l'armoire de congélation



Légende

- A adhésif
- B fils de thermocouple 0,3 mm de diamètre conformément à l'IEC 60584-1 Type K (chrome alumel)
- C disposition de la poignée permettant une force de contact de $4\text{ N} \pm 1\text{ N}$
- D tube en polycarbonate: diamètre intérieur 3 mm, diamètre extérieur 5 mm
- E disque en cuivre étamé: 5 mm de diamètre, 0,5 mm d'épaisseur

La face de contact du disque doit être plate.

Figure 106 – Calibre permettant de mesurer les températures de surface