UL 60335-2-69

STANDARD FOR SAFETY

Household and Similar Electrical Appliances – Safety – Part 2-69: Particular Requirements for Wet and Dry Vacuum Cleaners, including Power Brush, for Commercial Use

UL Standard for Safety for Household and Similar Electrical Appliances – Safety – Part 2-69: Particular Requirements for Wet and Dry Vacuum Cleaners, including Power Brush, for Commercial Use, UL 60335-2-69

First Edition, Dated March 25, 2022

Summary of Topics

This first edition of ANSI/UL 60335-2-69 is an adoption of IEC 60335-2-69, Household and similar electrical appliances – Safety – Part 2-69: Particular requirements for wet and dry vacuum cleaners, including power brush, for commercial use (Edition 5, issued by the IEC June 2016). Please note that the national difference document incorporates all of the U.S. national differences for UL 60335-2-69.

The new requirements are substantially in accordance with Proposal(s) on this subject dated July 2, 2021 and October 15, 2021.

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CSA Group
CSA C22.2 No. 60335-2-69:22
Third Edition
(IEC 60335-2-69:2016, MOD)

Underwriters Laboratories Inc.
UL 60335-2-69
First Edition

Household and Similar Electrical Appliances – Safety – Part 2-69: Particular Requirements for Wet and Dry Vacuum Cleaners, including Power Brush, for Commercial Use

March 25, 2022

This national standard is based on publication IEC 60335-2-69, Fifth Edition (2016).

ANSI/UL 60335-2-69-2022

Commitment for Amendments

This standard is issued jointly by the Canadian Standards Association (operating as “CSA Group”) and Underwriters Laboratories Inc. (UL). Comments or proposals for revisions on any part of the standard may be submitted to CSA Group or UL at anytime. Revisions to this standard will be made only after processing according to the standards development procedures of CSA Group and UL. CSA Group and UL will issue revisions to this standard by means of a new edition or revised or additional pages bearing their date of issue.

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This Standard is subject to review within five years from the date of publication, and suggestions for its improvement will be referred to the appropriate committee. The technical content of IEC and ISO publications is kept under constant review by IEC and ISO. To submit a proposal for change, please send the following information to inquiries@csagroup.org and include "Proposal for change" in the subject line: Standard designation (number); relevant clause, table, and/or figure number; wording of the proposed change; and rationale for the change.

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This ANSI/UL Standard for Safety consists of the First Edition. The most recent designation of ANSI/UL 60335-2-69 as an American National Standard (ANSI) occurred on March 25, 2022. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface. The National Difference Page and IEC Foreword are also excluded from the ANSI approval of IEC-based standards.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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PREFACE

This is the harmonized CSA Group and UL standard for Household and similar electrical appliances – Safety – Part 2-69: Particular requirements for wet and dry vacuum cleaners, including power brush, for commercial use. It is the third edition of CSA C22.2 No. 60335-2-69, and the first edition of UL 60335-2-69. This edition of CSA C22.2 No. 60335-2-69 supersedes the previous edition published in 2001 as CAN/CSA-E60335-2-69 (adopted IEC 60335-2-69:1997, including Amendment 1:2000).

This harmonized standard is based on IEC Publication 60335-2-69, Fifth edition, Household and similar electrical appliances – Safety – Part 2-69: Particular requirements for wet and dry vacuum cleaners, including power brush, for commercial use, issued June 2016. IEC 60335-2-69 is copyrighted by the IEC.

This harmonized standard was prepared by CSA Group and Underwriters Laboratories Inc. (UL). The efforts and support of the Technical Harmonization Committee are gratefully acknowledged.

This standard is considered suitable for use for conformity assessment within the stated scope of the standard.

This standard was reviewed by the CSA Subcommittee on Electrical Motor and Battery-Operated Cleaning Appliances for Industrial and Commercial Use, under the jurisdiction of the CSA Technical Committee on Consumer and Commercial Products and the CSA Strategic Steering Committee on Requirements for Electrical Safety, and has been formally approved by the CSA Technical Committee. This standard has been developed in compliance with Standards Council of Canada requirements for National Standards of Canada. It has been published as a National Standard of Canada by CSA Group.

Application of Standard

Where reference is made to a specific number of samples to be tested, the specified number is to be considered a minimum quantity.

Note: Although the intended primary application of this standard is stated in its scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.

CSA C22.2 No. 60335-2-69 is to be used in conjunction with the second edition of CAN/CSA-C22.2 No. 60335-1. The requirements for wet and dry vacuum cleaners, including power brush, for commercial use, are contained in this Part 2 Standard and CAN/CSA-C22.2 No. 60335-1. Requirements of this Part 2 Standard, where stated, amend the requirements of CAN/CSA-C22.2 No. 60335-1. Where a particular subclause of CAN/CSA-C22.2 No. 60335-1 is not mentioned in CSA C22.2 No. 60335-2-69, the CAN/CSA-C22.2 No. 60335-1 subclause applies.

UL 60335-2-69 is to be used in conjunction with the sixth edition of UL 60335-1. The requirements for wet and dry vacuum cleaners, including power brush, for commercial use are contained in this Part 2 Standard and UL 60335-1. Requirements of this Part 2 Standard, where stated, amend the requirements of UL 60335-1. Where a particular subclause of UL 60335-1 is not mentioned in UL 60335-2-69, the UL 60335-1 subclause applies.

Level of Harmonization

This standard adopts the IEC text with national differences.

This standard is published as an equivalent standard for CSA Group and UL.

An equivalent standard is a standard that is substantially the same in technical content, except as follows: Technical national differences are allowed for codes and governmental regulations as well as those

recognized as being in accordance with NAFTA Article 905, for example, because of fundamental climatic, geographical, technological, or infrastructural factors, scientific justification, or the level of protection that the country considers appropriate. Presentation is word for word except for editorial changes.

All national differences from the IEC text are included in the CSA Group and UL versions of the standard. While the technical content is the same in each organization's version, the format and presentation may differ.

Reasons for differences from IEC

Differences from the IEC are being added in order to address regulatory and safety situations present in the US and Canada.

Interpretations

The interpretation by the standards development organization of an identical or equivalent standard is based on the literal text to determine compliance with the standard in accordance with the procedural rules of the standards development organization. If more than one interpretation of the literal text has been identified, a revision is to be proposed as soon as possible to each of the standards development organizations to more accurately reflect the intent.

IEC Copyright

For CSA Group, the text, figures, and tables of International Electrotechnical Commission Publication 60335-2-69 Household and similar electrical appliances – Safety – Part 2-69: Particular requirements for wet and dry vacuum cleaners, including power brush, for commercial use, copyright 2016, are used in this standard with the consent of the International Electrotechnical Commission. The IEC Foreword and Introduction are not a part of the requirements of this standard but are included for information purposes only.

NATIONAL DIFFERENCES

National Differences from the text of International Electrotechnical Commission (IEC) Publication 60335-2-69, Household and similar electrical appliances – Safety – Part 2-69: Particular requirements for wet and dry vacuum cleaners, including power brush, for commercial use, copyright 2016, are indicated by notations (differences) and are presented in bold text. The national difference type is included in the body.

There are five types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences.

DR – These are National Differences based on the **national regulatory requirements**.

D1 – These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for consumers and users of products.

D2 – These are National Differences from IEC requirements based on existing **safety practices**. These requirements reflect national safety practices, where empirical substantiation (for the IEC or national requirement) is not available or the text has not been included in the IEC standard.

DC – These are National Differences based on the **component standards** and will not be deleted until a particular component standard is harmonized with the IEC component standard.

DE – These are National Differences based on **editorial comments or corrections**.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base IEC text:

Addition / Add - An addition entails adding a complete new numbered clause, subclause, table, figure, or annex. Addition is not meant to include adding select words to the base IEC text.

Modification / Modify - A modification is an altering of the existing base IEC text such as the addition, replacement or deletion of certain words or the replacement of an entire clause, subclause, table, figure, or annex of the base IEC text.

Deletion / Delete - A deletion entails complete deletion of an entire numbered clause, subclause, table, figure, or annex without any replacement text.

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FOREWORD

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

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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6) All users should ensure that they have the latest edition of this publication.

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8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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.

101DV DE *Modify Note 1 and the paragraph following it in the Part 2 Foreword by replacing it with the following:*

Note 1 When "Part 1" is mentioned in this Standard, it refers to CAN/CSA-C22.2 No. 60335-1 (2nd Ed.) / UL 60335-1 (6th Ed.)

This part 2 supplements or modifies the corresponding clauses in CAN/CSA-C22.2 No. 60335-1 Ed 2: 2016-10-31 / UL 60335-1 Ed. 6: 2016-10-31 (based on IEC 60335-1 Ed. 5.1:2013) (Ed. 5:2010 including corrigendum 1:2010, corrigendum 2:2011, and amendment 1:2013), so as to convert that publication into the CSA/UL standard: *Safety requirements for wet and dry vacuum cleaners, including power brush, for COMMERCIAL USE*.

102DV DE *Modify the fifth paragraph following Note 4 in the Part 2 Foreword by replacing it with the following:*

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

103DV DE ***Add the following text at the end of the Part 2 Foreword:***

The numbering system in this Standard uses a space instead of a comma to indicate thousands and uses a comma instead of a period to indicate a decimal point. For example, 1 000 means 1,000 and 1,01 means 1.01.

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.

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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

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.

1DV.1 DR *Modification to add the following:*

Clause 1DV.1 of the Part 1 applies.

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.

1DV.2 DE *Modification to replace the paragraph and dashed list following note 102 with following:*

They are not equipped with a traction drive. Machines equipped with traction drive are under the scope of CSA C22.2 No. 60335-2-72 / UL 60335-2-72. 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.

1DV.3 DE *Modification to replace the dashed items following "This standard does not apply to" with the following:*

– vacuum cleaners and water-suction cleaning appliances for household use (CAN/CSA-E60335-2-2, CSA C22.2 No. 243 / UL 1017)

– floor treatment machines for COMMERCIAL USE, (CSA C22.2 No. 60335-2-67 / UL 60335-2-67, CSA C22.2 No. 60335-2-72 / UL 60335-2-72);

– spray extraction machines for COMMERCIAL USE (CSA C22.2 No. 60335-2-68 / UL 60335-2-68);

– hand-held mains-operated electrical garden blowers, vacuums and blower vacuums (CSA C22.2 No. 243 / UL 1017);

– hand-held and transportable motor-operated electric tools (CSA C22.2 No. 60745 series, UL 60745 series, CAN/CSA-E1029 series, UL 987, CSA C22.2 No. 71.2, CSA C22.2 No. 62841 series, UL 62841 series);

– appliances for medical purposes (CAN/CSA-C22.2 No. 60601-1, UL 60601-1, AAMI ES60601-1);

– machines designed for use in corrosive environments;

– machines designed for picking up flammable liquids;

– machines designed for use in explosive environments (dust, vapour or gas);

NOTE Machines designed for use in hazardous locations are evaluated according to requirements of the CE Code and the NEC.

– machines with steam cleaning function (These machines are evaluated to this standard and the applicable requirements for steam cleaning from CSA C22.2 No. 243, UL 1017).

1DV.4 DE *Modify Clause 1 by deleting Note 106:*

This Note does not apply.

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*

2DV DE ***Modify Clause 2 of the Part 2 by adding the following normative references:***

AAMI ES60601-1, ***Medical electrical equipment – Part 1: General requirements for basic safety and essential performance***

ASTM F655, ***Standard Specification for Test Carpets and Pads for Vacuum Cleaner Testing***

IEC TS 62885-1:2018, ***Surface cleaning appliances – Part 1: General requirements on test material and test equipment***

ISO 13849-1, ***Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design***

CSA C22.1:18, ***Canadian Electrical Code (CE Code), Part I***

CSA C22.2 No. 0:20, ***General requirements – Canadian Electrical Code, Part II***

CSA C22.2 No. 0.23:15 (R2020), ***General requirements for battery-powered appliances***

CSA C22.2 No. 71.2-10 (R2020), ***Electric bench tools***

CSA C22.2 No. 243-17, ***Vacuum Cleaners, Blower Machines, and Household Floor Finishing Machines***

CAN/CSA-C22.2 No. 60335-1:16, ***Household and similar electrical appliances – Safety – Part 1: General requirements***

CSA C22.2 No. 60335-2-67:21, ***Household and similar electrical appliances – Safety – Part 2-67: Particular requirements for floor treatment machines, for commercial use***

CSA C22.2 No. 60335-2-68:20, ***Household and similar electrical appliances – Safety – Part 2-68: Particular requirements for spray extraction machines, for commercial use***

CSA C22.2 No. 60335-2-72:21, ***Household and similar electrical appliances – Safety – Part 2-72: Particular requirements for floor treatment machines with or without traction drive, for commercial use***

CSA C22.2 No. 60601-1:14 (R2018), ***Medical electrical equipment – Part 1: General requirements for basic safety and essential performance***

CSA C22.2 No. 60745 series, ***Hand-held motor-operated electric tools***

CSA C22.2 No. 62841 series, ***Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery***

CAN/CSA-E1029 series, ***Safety of Transportable Motor-Operated Electric Tools***

CAN/CSA-E60335-2-2:06 (R2015), ***Household and similar electrical appliances – Safety – Part 2-2: Particular requirements for vacuum cleaners and water-suction cleaning appliances***

CAN/CSA-E60335-2-41:13 (R2018), ***Household and similar electrical appliances – Safety – Part 2-41: Particular requirements for pumps***

NFPA 30 2018, ***Flammable and Combustible Liquids Code***

NFPA 484 2019, ***Standard for Combustible Metals***

NFPA 652 2019, ***Standard on the Fundamentals of Combustible Dust***

NFPA 664, 2020, ***Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities***

UL 778, ***Motor-Operated Water Pumps***

UL 987, ***Stationary and Fixed Electric Tools***

UL 1017, ***Vacuum Cleaners, Blower Machines, and Household Floor Finishing Machines***

UL 2595, ***General requirements for battery-powered appliances***

UL 60335-1, ***Household and similar electrical appliances – Safety – Part 1: General requirements***

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

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

UL 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***

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

UL 60745 series, ***Hand-held motor-operated electric tools***

UL 62841 series, ***Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery***

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_r 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_r 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.

3.1.9DV.1 D2 ***Modify the first dashed item in 3.1.9 of the Part 2 by replacing it with the following:***

– the agitating device operates on a carpet as specified in IEC 60312-1, IEC TS 62885-1, or ASTM F655;

3.1.9DV.2 D2 ***Modification: Add the following at the end of 3.1.9 of the Part 2:***

With the air inlet unobstructed, any device that ensures a flow of air to cool the motor in the event of a blockage of the main air inlet shall be allowed to operate. With the air inlet blocked, any device that is adjustable without the aid of a tool, and which ensures a flow of air to cool the motor in the event of a blockage of a main air inlet, shall be rendered inoperative.

A VACUUM RELIEF VALVE or similar device that complies with the VACUUM RELIEF VALVE endurance test shall be allowed to operate during the Temperature test.

3.4.2DV D1 ***Modification: Replace 3.4.2DV of the Part 1 with the following:***

SAFETY EXTRA-LOW VOLTAGE
voltage not exceeding 42,4 V peak a.c. or d.c. between conductors and between conductors and earth

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]

3.105DV DE *Modify 3.105 by adding the following note:*

Note 3DV to entry: See Annex AA.

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]

3.106DV DE *Delete Note 2.*

This Note does not apply.

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.

3.118DV D2 *Add the following definition to Clause 3 of the Part 2:*

VACUUM RELIEF VALVE
mechanical device that ensures a flow of air to cool the motor in the event of a blockage of the main air inlet

3.119DV D2 *Add the following definition to Clause 3 of the Part 2:*

SAFETY-CRITICAL FUNCTION
function(s) required by this standard, the loss of which would cause the appliance to function in a manner that exposes the user to a risk that exceeds the risk permitted by this end product standard under abnormal conditions

3.120DV D2 *Add the following definition to Clause 3 of the Part 2:*

LOW-VOLTAGE LIMITED-ENERGY (LVLE) CIRCUIT
a circuit involving an a.c. voltage of not more than 30 V r.m.s. or 42,4 V peak, or a d.c. voltage of 60 V and supplied by any of the following:

– a combination of a BATTERY source or an isolated transformer secondary winding and one or more resistors, or a regulating network complying with Items (a) – (c):

a) The maximum load current drawn under any condition of loading, including short circuit, using a resistor is measured 60 s after the application of the load. The resistor is continuously readjusted during this 1 min. period to maintain maximum load current. The measured load current is not exceeding the value listed in Table 3.120DV.

b) With reference to the specified voltage limit, measurement is made with the unit connected to the intended supply voltage and with all loading circuits disconnected.

c) The performance is not affected by malfunction of a single component, excluding resistors. The network complies with the value in Table 3.120DV; or

– a BATTERY with output current limited by overcurrent protection in accordance with Table 3.120DV.

NOTE: A LOW-VOLTAGE LIMITED-ENERGY CIRCUIT is also known as a LVLE CIRCUIT.

Table 3.120DV
Rating for secondary fuse or circuit protector

Circuit voltage (V r.m.s.)	Current (A)
20 or less	5
More than 20 but not greater than 60	100/V[a]
[a] V is the maximum output voltage, regardless of the load, with the primary energized.	

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'.

4DV.1 DE *Modification to the third paragraph of the Part 2 by replacing "cause no danger to persons or surroundings" with "reduce the risk of fire, electric shock, and/or injury to persons".*

4DV.2 DE *Modification by adding the following to the Part 2:*

In Canada, general requirements applicable to these products are provided in CSA C22.2 No. 0.

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.*

5.102DV D2 *Addition of the following clause to Clause 5 of the Part 2:*

Machines provided with general-use socket outlets shall be tested with the socket outlets unloaded unless otherwise specified.

5.14DV D2 *Modification to add the following note to 5.14 of the Part 1:*

NOTE 101DV Attention is drawn to the second paragraph of 5.14, as this requires the evaluation of Class II constructions within Class I machines.

5.17DV D2 *Modification to replace 5.17 of the Part 1 with the following:*

Battery operated appliances are tested in accordance with Annex B.

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.

6.1DV D2 *Modification to add the following paragraph after the third dashed item of Subclause 6.1 of the Part 2:*

Machines provided with general-use socket-outlets shall be CLASS I.

6.2 *Addition:*

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

6.2DV D2 *Modification to replace 6.2 of the Part 2 with the following:*

Products intended for outdoor use and outdoor 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).

7.1DV D2 *Modify 7.1 by adding a 5th dashed item to the Part 2 “Replacement” as follows:*

– if a manufacturer produces or assembles machines at more than one factory, each finished product shall have a distinctive marking, which can be in code, by means of which it can be identified as the product of a particular factory.

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.

7.1.101DV.1 D2 *Modification of 7.1.101 of the Part 2 by replacing the second dashed item with the following:*

– RATED POWER INPUT in watts, or RATED CURRENT in amperes;

7.1.101DV.2 D2 ***Modification of 7.1.101 of the Part 2 by adding the following:***

An appliance having provision for an electrical attachment, such as a motorized nozzle, that is not provided with the appliance shall be marked

a) to separately identify the input with and without the attachment; and

b) on a surface adjacent to the relevant socket-outlet to specify the attachment intended to be used.

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.

7.1.102DV D2 ***Modification to replace 7.1.102 of the Part 2 with the following:***

Socket-outlets for accessories shall be marked with the maximum load in watts or amperes on the socket-outlet or nearby.

Compliance is checked by inspection.

7.1.103DV D2 ***Addition of 7.1.103DV to the Part 2:***

If an appliance is provided with a SUPPLY CORD 46 cm long or less with a plug, a statement shall be marked on the appliance or included in the instructions packaged with the appliance advising of the following:

a) The availability of an extension cord;

b) An extension cord description including conductor size and, in accordance with 25.7DV, construction type; and

c) The importance of using such a cord.

7.1.104DV D2 ***Addition of 7.1.104DV to the Part 2 as follows:***

7.1.104DV.1 An appliance or an accessory of a type mentioned in Table 7.1.104DV.1 shall be provided with a permanent marking containing the applicable warning. The wording of the marking shall be as stated in Table 7.1.104DV.1 or shall be in equally definitive terminology containing all three required parts of the marking specified. These three required parts are the signal word, the risk statement, and the risk reduction statement. The marking shall be readily visible while the appliance or accessory is in use or being readied for use.

A CENTRALLY-SITED VACUUM CLEANER not intended for wet pick-up shall be marked in accordance with Table 7.1.104DV.1.

Table 7.1.104DV.1
Additional warning markings for appliances or accessories

Type of appliance or accessory	Marking required
For a product not marked at least IPX4.	WARNING – To Reduce The Risk Of Electric Shock – Do not expose to rain. Store indoors.
For a product intended for dry suction only.	WARNING – To Reduce The Risk Of Electric Shock – Do not use for wet pick-up.
Motorized cleaning head intended for dry suction only, may be connected to a vacuum cleaner intended for wet suction.	WARNING – To Reduce The Risk Of Electric Shock – Do not use motorized cleaning head for wet pick-up.
Class II motorized cleaning head may be connected to a Class I vacuum cleaner.	WARNING – Only motorized cleaning head is of CLASS II CONSTRUCTION. To reduce risk of electric shock – Connect vacuum cleaner to a properly grounded outlet.
Current-carrying hoses.	WARNING – This hose contains electric wires. To reduce the risk of electric shock, do not use or repair a damaged hose.

7.1.104DV.2 During the evaluation of an appliance to 20.2, a part need not be opened or removed if it is marked to indicate that such servicing is to be done with the appliance disconnected from the supply circuit as follows or the equivalent:

CAUTION – To Reduce The Risk Of Injury From Moving Parts – Unplug Before Servicing.

7.1.104DV.3 Unless the ELECTRONIC CIRCUIT has been evaluated as a SAFETY CRITICAL FUNCTION, an electronically controlled motor-driven brush that is necessarily exposed to perform its work function shall be marked to indicate that the brush can start unexpectedly and cleaning and servicing is to be done with the appliance disconnected from the supply circuit. The marking shall be as follows or equivalent:

CAUTION – Risk Of Injury. Brush May Start Unexpectedly. Unplug Before Cleaning or Servicing.

7.1.104DV.4 If the construction of an appliance is such that cleaning or similar servicing to be done by the user (such as replacement of lamps, fuses, drive belts, and the like) involves the exposure of normally enclosed or protected uninsulated live parts to unintentional contact, the appliance shall be marked with the following or equivalent wording:

WARNING – TO REDUCE THE RISK OF ELECTRIC SHOCK– UNPLUG BEFORE CLEANING OR SERVICING.

7.1.104DV.5 A wet pick-up current-carrying hose shall be marked with the following or equivalent wording:

"WARNING – This hose contains electric wires. To reduce risk of electric shock do not use or repair a damaged hose."

7.1.104DV.6 A machine provided with one or more general-use socket-outlets shall be marked with the word "CAUTION" and the following or equivalent in Items (a) – (b) below. A single marking may apply to several socket-outlets provided that the marking is near all of them.

a) On or near switched socket-outlets: Risk of injury. This socket-outlet is energized when this product is turned ON.

b) On or near automatically controlled socket-outlets: Risk of injury. When appliances connected to this socket-outlet are turned on, this product turns on automatically.

Compliance is checked by inspection.

7.1.105DV D2 ***Add 7.1.105DV to the Part 2 as follows:***

A permanently connected appliance as permitted by Clause 22.109DV.2 shall be marked with the following or equivalent:

"Connect to a __A branch circuit," where the overcurrent protection of the branch circuit is determined from Table 7.1.105DV.

Table 7.1.105DV
Rating or Setting of Overcurrent Protective Devices

Type of motor and marking	Maximum ampere rating of protective device as a percentage of motor full-load-current rating	
	A	B
Motor with marked service factor of 1.15 or greater, or with marked temperature rise of 40 °C or less[a]	125	140
Other motors	115	130

[a] Motor manufacturer's applied marking.

A Maximum protective device rating or setting.

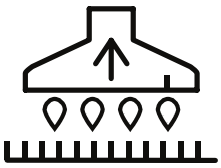
B Maximum protective device rating or setting permitted if the value of column A does not correspond to a standard device rating or setting range or is not sufficient to start the motor of carry the load.

Compliance is checked by inspection.

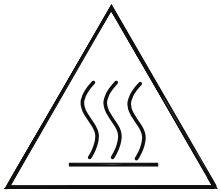
7.2DV D2 ***Replace 7.2 of the Part 1 with the following:***

An appliance having provision for two or more separate connections to a branch circuit or other power-supply source shall be permanently marked with the word "CAUTION" and the following or the equivalent, "This appliance has more than one connection to the source of supply. To reduce the risk of electric shock, disconnect all such connections before servicing." The marking shall be located at each point of connection and shall be readily visible after installation of the appliance.

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

7.6DV D2 *Modification to add the following symbols to 7.6 of the Part 2:*

I [symbol IEC 60417-5007 (2002-10)] "ON" (power) symbol

O [symbol IEC 60417-5008 (2002-10)] "OFF" (power) symbol

⏼ [symbol IEC 60417-5010 (2002-10)] "ON"/"OFF" (push-push) symbol

7.8DV DR *Modification to add the following text to 7.8 of the Part 1:*

A terminal intended for the connection of a grounded (neutral) power supply conductor shall be of, or plated with, metal that is substantially silver in color such that it is readily distinguishable from the other terminals, or identified in some other manner, such as on an attached wiring diagram. A lead intended for connection to a grounded (neutral) power supply conductor shall be finished to show a white or gray color and shall be readily distinguishable from the other leads.

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.

7.12DV.1 D2 *Modification to delete the 5th paragraph from 7.12 of the Part 1:*

This paragraph does not apply.

7.12DV.2 D2 *Modification to replace the sentence, "This wording may be replaced by symbols ISO 7000-0434A (2004-01) and ISO 7000-0790 (2004-01)." with the following:*

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

Alternatively, these symbols may be replaced by symbols ISO 7000-0434 (2004-01) and either ISO 7000-1641 (2004-01) or ISO 7000-0790 (2004-01).

If the symbols are used in place of the wording, their meaning shall be explained in the instructions.

7.12DV.3 D2 *Modification to add the following five dashed items to 7.12 of the Part 2:*

– If complete guarding of a moving part that could cause an injury to persons would defeat the utility of an appliance, a statement to warn the user of the potential risk.

– A statement that to provide additional protection from electric shock, the product shall only be connected to a socket-outlet that is protected by a ground fault circuit interrupter (GFCI).

– The instructions provided with a carpet cleaning appliance having a wet pick-up current-carrying hose shall include the following statement:

This hose is to be examined periodically for visible deterioration, such as abrasion, cracks, and splits.

– A vacuum cleaner having a removable filter/float cage shall be provided with instructions for reinstalling the cage.

– Instructions on the use of socket-outlets provided on the machine.

7.12.1DV D2 *Modification to add the following to 7.12.1 of the Part 1:*

Instructions for a permanently connected vacuum cleaner intended for outdoor use and any vacuum cleaner intended for use in areas where gasoline or other volatile flammable

liquids are transferred to fuel tanks of vehicles shall also include the information that machines designed for use in hazardous locations shall be installed according to requirements of the *CE Code* and the *NEC*.

The installation instructions provided with a CENTRALLY-SITED VACUUM CLEANER employing a SUPPLY CORD less than 1,8 m in length shall indicate the length of the SUPPLY CORD provided on the product, and shall advise the user that the product should be mounted such that the product's SUPPLY CORD can be directly plugged into an electrical outlet. It shall also indicate that an extension cord should not be used.

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.

7.12.105DV D2 *Addition of 7.12.105DV to the Part 2 as follows:*

For a vacuum cleaner provided with a float (filter) cage that serves as an enclosure or guard of hazardous moving parts, if the cage can be removed from the enclosure without tools, the instructions shall contain the following statement or equivalent:

CAUTION – MOVING PARTS – DO NOT OPERATE WITHOUT CAGE AND FLOAT IN PLACE

7.12.106DV D2 *Addition of 7.12.106DV to the Part 2 as follows:*

The instructions pertaining to a risk of fire, electric shock, or injury to persons shall be:

a) In the first part of the manual;

b) Before the operating instructions;

c) Separate in format from other instructions related to assembly, operation, maintenance, and storage; and

d) A permanent part of the manual.

7.12.107DV D2 *Addition of 7.12.107DV to the Part 2 as follows:*

The instructions shall include all applicable markings specified in Table 7.1.104DV.1; however, the signal word "WARNING" and the statement of risk may be omitted.

7.12.108DV D2 *Addition of 7.12.108DV to the Part 2 as follows:*

The following instructions shall be included:

– "Do not pick up anything that is burning or smoking, such as cigarettes, matches, or hot ashes."

– "Do not use without dust bag and/or filters in place."

– "Do not use to pick up flammable liquids, such as gasoline, or use in areas where flammable vapors may be present."

7.12.109DV D2 ***Addition of 7.12.109DV to the Part 2 as follows:***

A CLASS II machine provided with a two-blade, polarized plug shall be provided with the following instructions or the equivalent:

> **To reduce the risk of electric shock, this appliance has a polarized plug (one blade is wider than the other). This plug will fit in a polarized outlet only one way. If the plug does not fit fully in the outlet, reverse the plug. If it still does not fit, contact a qualified electrician to install the proper outlet. Do not change the product in any way.**

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.

7.14DV D2 ***Modification to add the following at the end of 7.14 of the Part 1:***

7.14DV.1 A cautionary marking shall be prefixed by a signal word "DANGER," "WARNING," or "CAUTION." These signal words shall not be replaced by symbols.

The signal words “DANGER”, “WARNING”, or “CAUTION” if in the Latin alphabet shall be in uppercase having a height not less than

a) 3,5 mm for appliances normally used on the floor;

b) 2,0 mm for PORTABLE APPLIANCES with a printable surface of less than 10 cm^2; and

c) 3,0 mm for other appliances.

NOTE A height of 3,5 mm is similar to 14-pt Arial, 3,0 mm is similar to 12-pt Arial and 2,0 mm is similar to 8-pt Arial. Other typefaces might differ in the pt value.

7.14DV.2 Uppercase letters of the text explaining the signal word shall be no smaller than 1,6 mm, with other letters according to the font size of the uppercase letter.

7.14DV.3 Unless contrasting colours are used, moulded in, engraved, or stamped, markings shall be either raised above or have a depth below the surface of at least 0,25 mm.

7.15DV D2 ***Modification to add the following to 7.15 of the Part 1:***

If the hose of a CENTRALLY-SITED VACUUM CLEANER not intended for wet pick-up is provided by the manufacturer, it shall be marked in the area of the handle in accordance with Item 6 of

Table 7.1.104DV.1 and in such a manner and location that it will be visible to the user during NORMAL OPERATION.

7.18DV DR *Modification to add the following to 7.18DV of the Part 1:*

Such appliances shall additionally be marked adjacent to the terminals with the following or equivalent for an output greater than 15 V: “Class 2 Not Wet."

8 Protection against access to live parts

This clause of Part 1 is applicable except as follows.

8.1 *Addition:*

Water and water-borne cleaning agents are considered conductive.

8.1.4DV D2 *Modification of 8.1.4DV in the Part 1 by adding the following as the first dashed item:*

– the part is supplied from a SAFETY ISOLATING TRANSFORMER, provided that the voltage does not exceed 60 V DC.

9 Starting of motor-operated appliances

This clause of Part 1 is not applicable.

9DV D2 *Modification to replace the first sentence of the Part 2 with the following:*

This clause of Part 1 is 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 N ± 1 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.

11.3DV D2 *Modification to replace the paragraph following NOTE 3 of the Part 1 with the following:*

Temperature measurements of windings by either thermocouple or resistance method are acceptable.

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.

11.5DV D2 *Modification to add the following to 11.5 of the Part 2:*

Appliances are operated under NORMAL OPERATION and supplied with RATED VOLTAGE the test being repeated at both 0,94 times and 1,06 times the RATED VOLTAGE.

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.

Table 3DV.1 D2 *Modification of Table 3 of the Part 1 by adding NOTE 104DV:*

NOTE 104DV A temperature is considered constant when three successive readings, taken at intervals of 10% of the previously elapsed duration of the test, but not less than 5-min intervals, indicate no increase.

11.8DV.1 D2 *Modification to add the following to 11.8 of the Part 2:*

For motor windings, the temperature rise limits of Table 3 for 0,94 and 1,06 times RATED VOLTAGE are increased by 20K. Evaluation of an insulation system to Annex C is acceptable as an alternative to compliance with the standards of Annex DVA.

11.8DV.2 DC *Modification to add 11.8DV.2.1 to 11.8DV.2.3 to 11.8 of the Part 2:*

11.8DV.2.1 A material used for the enclosure shall be resistant to thermal degradation at the maximum temperature to which it is exposed during normal use of the appliance. The polymeric material shall be considered appropriate from a thermal-aging standpoint if the maximum temperature to which it is exposed during normal use of the appliance does not:

a) Exceed 65 °C for portable appliance; and

b) Exceed 50 °C for other appliances.

11.8DV.2.2 With the exception of winding insulations, temperature limits for polymeric materials are evaluated only at RATED VOLTAGE, as follows:

a) For enclosures of portable appliances, the greater of 65 °C or relative thermal index of the material;

b) For all other cases, the relative thermal index of the material.

11.8DV.2.3 A VACUUM RELIEF VALVE that complies with the VACUUM RELIEF VALVE endurance test of 24.1.4ADV.1 shall be allowed to operate. In that case, the valve is disabled while the air inlet is restricted to establish the mean load P_m and then the test is conducted with this air inlet restriction while allowing the valve to operate.

11.101DV D2 *Addition of 11.101DV to Clause 11 of the Part 1:*

For machines provided with general-use socket-outlet(s) in which the vacuum and the socket-outlet cannot be energized at the same time, the socket-outlets shall be additionally operated while connected to a resistive load equal to the applicable total socket-outlet load value given in Table 22.52.101DV.1.

For a machine where the vacuum motor and socket-outlets can be energized at the same time, the machine shall be operated with the socket-outlet(s) loaded with the intended load.

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.

13.2DV D2 *Delete the "Addition" to 13.2 in the Part 2:*

This addition does not apply.

Table 4DV D1 *Modification to add footnote cDV to Table 4 of the Part 1:*

[cDV] For a CLASS I APPLIANCE that is intended for wet pick-up and is supported by the body of a person but not solely hand held, BASIC INSULATION is tested at 2500 V.

13.3DV.2 D2 *Modification by adding the following text to 13.3 of the Part 1:*

Additionally, printed wiring assemblies, and other electronic circuit components that would be damaged by application of the test potential, or that short-circuit the test potential, shall be removed, disconnected, or otherwise rendered inoperative before the dielectric voltage-withstand tests are made. A representative subassembly may be tested instead of an entire unit. The semiconductor devices in the unit may be individually shunted before the test is made to avoid destroying them in the case of a malfunction elsewhere in the secondary circuits.

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.

15.1.2DV D2 *Delete the "Addition" to 15.1.2 in the Part 2:*

This addition does not apply.

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.

15.2DV.1 D2 *Modification to add the following to the paragraph after the untitled table of the Part 2:*

The test is repeated, except with the machine operating and drawing only air and tipped over for 5 s in the most unfavorable position. A separate sample may be used for each test.

15.2DV.2 D2 *Modification to add the following after the final paragraph of 15.2 of the Part 2:*

After each of these tests, the leakage current shall not exceed 5,0 mA when the appliance is tested as specified in the leakage current tests of 13.2.

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.

16.1DV D2 *Modification to add the following to the Part 1:*

Additionally, printed wiring assemblies and other electronic circuit components that would be damaged by application of the test potential, or that short-circuit the test potential, shall be removed, disconnected, or otherwise rendered inoperative before the electric strength test of 16.3 is made. A representative subassembly may be tested instead of an entire unit. The semiconductor devices in the unit may be individually shunted before the test is made to avoid destroying them in the case of a malfunction elsewhere in the secondary circuits.

16.2DV.2 D2 *Delete 16.2DV.2 of the Part 1:*

This Clause does not apply.

16.3 *Addition:*

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

17 Overload protection of transformers and associated circuits

This clause of Part 1 is applicable.

18 Endurance

This clause of Part 1 is 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.

19.1DV.1 DC *Modification of 19.1 of the Part 1 to add the following to the fourth paragraph:*

Machines with speed settings shall be tested at lowest and highest speeds.

Machines with polymeric enclosure parts are also subjected to the test of 19.107DV.

19.1DV.2 D2 *Modification of 19.1 of the Part 2 to add NOTE 102DV:*

NOTE 102DV If an ELECTRONIC CIRCUIT has been evaluated in accordance with the standards for automatic controls given by Annex DVA, the requirements for fault conditions in 19.11.2 and electromagnetic immunity in 19.11.4 can be satisfied by component evaluation.

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.

19.11DV D2 *Modification to add the following to 19.11 of the Part 1:*

If a fault condition specified in 19.11.2 results in loss of a SAFETY-CRITICAL FUNCTION, the ELECTRONIC CIRCUIT shall comply with 19.11ADV.

19.11ADV D2 *Addition of 19.11ADV after 19.11 of the Part 1 as follows:*

19.11ADV ELECTRONIC CIRCUIT for SAFETY-CRITICAL FUNCTIONS

19.11ADV.1 Fault conditions b) to g) specified in 19.11.2 are not applied to circuits or parts of circuits performing a SAFETY-CRITICAL FUNCTION when functional reliability is demonstrated as specified in 19.11ADV.2. Common SAFETY-CRITICAL FUNCTIONS are listed in Table 19.11ADV.

Table 19.11ADV
SAFETY-CRITICAL FUNCTIONS: Required performance levels

Type and purpose of function[1]	SCF or PEC? Minimum Performance Level (PL)	Method for Immunity Tests of 19.11.4	Acceptance Criteria[2] for Immunity tests and fault conditions
Prevent loss of ON/OFF control for a power switch or control with no ACCESSIBLE MOVING PARTS capable of causing injury	No	–	–
Power switches or other controls that prevent unintended operation of motors controlling ACCESSIBLE MOVING PARTS capable of causing injury and not provided with the	Yes – SCF b	The product is to be switched off during the immunity tests. Observe the appliance input or the ACCESSIBLE MOVING PARTS during and after the application of the stimuli.	During and after the tests, the ACCESSIBLE MOVING PARTS capable of causing injury shall not operate with the switch in the "off" position.[3]

Table 19.11ADV Continued on Next Page

Table 19.11ADV Continued

Type and purpose of function[1]	SCF or PEC? Minimum Performance Level (PL)	Method for Immunity Tests of 19.11.4	Acceptance Criteria[2] for Immunity tests and fault conditions
Warning marking of Clause 7.1.104DV.3			
Power switches or other controls that prevent unintended operation of motors controlling appliances with motor-operated brushes provided with the Warning marking of Clause 7.1.104DV.3.	No	–	–
Interlocks as required to protect against electric shock or injury to persons (Clauses 20.2 and 22.107)	Yes – SCF b	The interlocked part is to be removed or opened to activate the interlock. The appliance is to be switched on. Observe the appliance input or the ACCESSIBLE MOVING PARTS during and after the application of the stimuli.	During and after the tests, moving parts capable of causing injury, which are ACCESSIBLE MOVING PARTS after removal of the interlocked part, shall not operate.[3] After the tests, parts that are ACCESSIBLE after removal of the interlocked part, shall not become LIVE PARTS.
PROTECTIVE ELECTRONIC CIRCUITS	Yes – PEC a – Portable b – Stationary	As specified in 19.11.4 with the abnormal condition removed	For immunity tests of 19.11.4, by compliance with 19.13 For the fault conditions, by compliance with 19.11.3
Prevent self-resetting after operation of a PROTECTIVE ELECTRONIC CIRCUIT that turns off the appliance where there is a risk of injury due to ACCESSIBLE MOVING PARTS, not provided with the Warning marking of Clause 7.1.104DV.3	Yes - SCF b	Before application of the stimuli, the relevant abnormal test is conducted. The abnormal condition is then removed but without disconnecting the supply voltage. Observe the appliance input or the ACCESSIBLE MOVING PARTS during and after the application of the stimuli.	During and after the tests, the ACCESSIBLE MOVING PARTS capable of causing injury shall not operate.[3]
Motor speed control.	No	–	–
Water level sensing control operating during the test of 15.2 and defeated during the test of 19.101	No	–	–
Water level sensing control operating during the test of 15.2 but not defeated during the test of Clause 19.101	Yes - SCF b – if there is a risk of fire; c – if there is a risk of shock (where required to meet the leakage current test)	After application of the stimuli, the product is evaluated to the requirements of the standard	After the tests, the test of 15.2 is repeated and the acceptance criteria of 15.2 shall be fulfilled

Table 19.11ADV Continued on Next Page

Table 19.11ADV Continued

Type and purpose of function[1]	SCF or PEC? Minimum Performance Level (PL)	Method for Immunity Tests of 19.11.4	Acceptance Criteria[2] for Immunity tests and fault conditions
Pump shut down due to overpressure condition.	No	–	–
Clogged filter sensing or self-cleaning control.	No	–	–
Operation of VACUUM RELIEF VALVE or motor shut down in response to obstructed working air flow, if the failure of this control would result in non-compliance with Clauses 19.102 – 19.105	Yes – PEC a – If attended b – If unattended	As specified in 19.11.4 with the abnormal condition removed	For immunity tests of 19.11.4, by compliance with 19.13 For the fault conditions, by compliance with 19.9
NOTE 1: Performance levels not specified here may be assessed by comparison to similar functions listed or through a consideration of increased residual risk created by a failure of the ELECTRONIC CIRCUIT by application ISO 13849-1 using the guidance of Annex 101.DVD. NOTE 2: For Immunity tests (19.11.4), the condition of the machine and controls is as described in this table. For faults conditions (19.11.3), the fault is applied with the machine in the un-energized state and the product subsequently energized for evaluation. NOTE 3: Less than 0,5 s energized or less than 10 s of uninterrupted motion of the ACCESSIBLE MOVING PART is considered unlikely to cause injury.			

19.11ADV.2 The test parameters and conditions used in the investigation of the circuit covered by Clause 19.11ADV.1 shall be as follows:

a) The reliability of portions of the electronic circuit that are responsible for the safety-critical function shall be evaluated by the MTTFd (Mean Time To Dangerous Failure) calculations required to meet the necessary Performance Level (PL) associated with the safety-critical function as described in ISO 13849-1; see Annex H. In cases of single channel designs, the required MTTFd for each performance level shall be as follows:

PL = a: MTTFd = 5 years;

PL = b: MTTFd = 20 years;

PL = c: MTTFd = 50 years.

b) If software is relied upon to perform a SAFETY-CRITICAL FUNCTION, it shall be evaluated in accordance with Clause 22.46.

19.11.3DV D2 ***Modification to replace the first paragraph of 19.11.3 of the Part 1 with the following:***

If the appliance incorporates a PROTECTIVE ELECTRONIC CIRCUIT which operates to ensure compliance with Clause 19, the relevant test is repeated with a single fault simulated, as indicated in a) to g) of 19.11.2, or the circuit is evaluated to the Minimum Performance Level in accordance with 19.11ADV.

19.11.4DV.1 D2 ***Modification to replace the second paragraph of 19.11.4 of the Part 1 with the following:***

Appliances incorporating a PROTECTIVE ELECTRONIC CIRCUIT or an ELECTRONIC CIRCUIT performing a SAFETY-CRITICAL FUNCTION as specified in 19.11ADV shall be subjected to the tests of 19.11.4.1 to 19.11.4.7. The tests shall be carried out after the PROTECTIVE ELECTRONIC CIRCUIT has operated during the relevant tests of Clause 19 except 19.2, 19.6, and 19.11.3 or with the ELECTRONIC CIRCUIT for SAFETY-CRITICAL FUNCTION in the condition as specified in Table 19.11ADV. However, appliances that are operated for 30 s or 5 min during the test of 19.7 are exempt from the tests for electromagnetic phenomena.

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.

19.101DV D2 ***Modification to add the following to 19.101 of the Part 2:***

This test is not applicable when the shut-off device is evaluated as a SAFETY-CRITICAL FUNCTION of an electronic control as specified in 19.11ADV.

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.*

19.106DV D2 *Addition of Clause 19.106DV to Clause 19 of the Part 2:*

The protection provided with a motor described in Clause 22.109DV shall be such that no burning insulation or molten material falls to the surface that supports the appliance when the motor is energized under each of the following fault conditions:

i) Open main winding;

ii) Open starting winding;

iii) Starting switch short-circuited; and

iv) Capacitor of permanent-split capacitor motor short-circuited – the short-circuit shall be applied before the motor is energized, and the rotor shall be locked.

Compliance is verified by test.

19.107DV DC *Addition of 19.107DV to Clause 19 of the Part 2:*

For appliances with polymeric enclosure parts, the appliance shall be operated under the conditions of abnormal operation that are appropriate for the product, such as stalled-rotor operation. During the test, the appliance shall rest on white tissue paper on a softwood surface. A single layer of cheesecloth shall be draped over the entire appliance and the appliance shall be operated continuously until the ultimate results have been determined. Continuous operation for 7 h may be necessary to obtain the ultimate results. There shall be no ignition of the enclosure material or exposure of live parts. There shall be no ignition of the combustible material that the appliance is placed on or draped with as a result of emission of flame through other than existing openings.

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.

20.2DV.1 D1 *Modification to add the following to the second paragraph of the Part 1:*

Protective enclosures, guards, and similar parts need not be opened or removed if they are marked in accordance with 7.1.104DV.2.

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 J ± 0,04 J.

21.1DV.1 DE *Modification of 21.1 of the Part 2 by adding the following:*

Clause 21.1DV of the Part 1 is not applicable.

21.1DV.2 D2 *Modification of 21.1 of the Part 2 by adding the following:*

For an appliance intended for outdoor storage, three samples shall be cooled to a temperature of minus 35,0 ± 2,0 °C and maintained at this temperature for 3 h. While the unit is still cold, the samples shall be subjected to the applicable impact described in 21.1.

For an appliance marked with an IP rating less than IPX4, the conditioning temperature shall be 0 ± 2 °C.

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.

21.101ADV D2 *Add Clause 21.101ADV to the Part 2:*

21.101ADV.1 General

For hand-held appliances and BACK-PACK VACUUM CLEANERS, the impact test of 21.101 is replaced by the drop impact test in 21.101ADV.2.

21.101ADV.2 Drop impact

21.101ADV.2.1 Appliances completely supported in the hand or by the body during use shall withstand being dropped three times on a concrete floor from a height of 0,91 m. The sample shall be positioned so that the sample strikes the surface in a position different from those in the other two drops.

21.101ADV.2.2 A wet pick-up appliance that is completely supported in the hand or by the body during use shall be additionally subjected to the test when filled to maximum capacity with water prior to each drop. For an appliance with separate tanks for clean solution and recovery, only one tank shall be filled. In determining compliance, the water shall not be investigated as a condition that would increase the risk of electric shock.

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 mm/min ± 5 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 mm ± 5 mm. The arm can be raised from the horizontal position by an angle of 40 ° ± 1 °. 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 °C ± 2 °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.

21.107DV D2 *Addition of 21.107DV to the Part 2:*

21.107DV.1 A handle used to carry an appliance, including a back-pack machine, shall withstand a force of four times the empty weight of the appliance without damage to the handle, its securing means, or that portion of the enclosure to which the handle is attached. Compliance is checked by the test of 21.107DV.2 to 21.107DV.4.

NOTE The straps of a BACK-PACK VACUUM CLEANER are considered to be handles.

21.107DV.2 *The weight of the appliance plus a force of three times its weight shall be used. The load shall be uniformly applied over at least a 76 mm width at the center of the handle without clamping. The load shall be started at zero and gradually increased so that the test value is reached in 5 to 10 s and shall be maintained for 1 min.*

21.107DV.3 *When more than one handle is furnished on an appliance, and the appliance is unable to be carried by one handle, the force shall be distributed between the handles. The distribution of force shall be determined by measuring the percentage of the appliance weight sustained by each handle with the appliance in the normal carrying position. When an appliance is furnished with more than one handle and can be carried by only one handle, each handle shall sustain the total force.*

21.107DV.4 *A wet pick-up type appliance that is completely supported in the hand or by the body during use shall be filled to maximum normal capacity with water when determining the weight of the appliance and during the test. For an appliance with separate tanks for clean solution and recovery, only the largest tank shall be filled to maximum normal capacity with water during the test.*

21.108DV D2 *Addition of 21.108DV to the Part 2:*

21.108DV.1 Crushing resistance

21.108DV.1.1 Stationary and fixed appliances shall withstand a 1-min application of the crushing force described in 21.108DV.1.2. After the test, the appliance shall show no damage that could impair compliance with this standard and compliance with 8.1, 15.1 and Clause 29 shall not be impaired. In case of doubt, SUPPLEMENTARY INSULATION and REINFORCED INSULATION are subjected to the electric strength test of 16.3. Damage to the finish, small dents that do not reduce CLEARANCES or CREEPAGE DISTANCES below the values specified in Clause 29, and small chips that do not adversely affect protection against access to LIVE PARTS or moisture, are ignored.

21.108DV.1.2 Three samples of an appliance shall be backed on the mounting side by a fixed rigid supporting surface. The crushing force shall be applied to the side opposite the mounting surface, and by flat surfaces each 102 by 254 mm. Each force applicator shall exert 45,4 kg on the sample. As many applicators shall be applied as the sample can accommodate on the surface opposite the mounting surface, based on an arrangement of applicators as indicated in Figure 107DV.

22 Construction

This clause of Part 1 is applicable except as follows.

22.2DV D2 *Modification to add the following to 22.2DV of the Part 1:*

Over-current protection employed for motor-running overload protection and not internal to a motor shall be located in each ungrounded conductor.

NOTE 101DV A neutral conductor is a grounded conductor.

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.

22.6DV D2 *Modification to add the following to the Part 2:*

22.6DV.1 Leakage from a polymeric liquid reservoir is not considered likely to occur, if the reservoir is subjected to Clauses 22.6DV.2 and 22.6DV.3 without any cracking, breaking, shrinking, warping, or distortion that allows liquid to leak from the reservoir.

22.6DV.2 The reservoir shall be subjected to the test of Clauses 8.2 and 8.4 of IEC 60695-10-3, except that the oven shall be maintained for a duration of 7 h at a temperature of 10 K higher than the maximum operating temperature of the reservoir measured at the hottest spot on the inside of the reservoir under normal operating conditions, but not less than 70 °C. The product shall not be operated during the test. After conditioning, the reservoir shall be allowed to cool to room temperature and shall show no signs of shrinking, warping, or distortion that allows liquid to leak from the reservoir.

22.6DV.3 If deterioration or breakage of a liquid reservoir provided as part of a machine would result in a risk of fire, electric shock, or injury to persons, the container shall be subjected to the impact test for polymeric reservoirs described in Clause 21.101 without distortion of the reservoir, including attached tubing, that results in one or both of the following conditions:

a) interference with the operation or user servicing of the product; or

b) openings that allow liquid to leak from the tank.

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 °C ± 2 °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 °C ± 2 °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.

22.40DV D2 *Modification to add the following to the Part 1:*

22.40DV.1 For motors without a hp rating, 1/3 hp is considered a motor input of 480 VA.

An extra-low voltage current-carrying hose contact that is made by any manual operation (such as connection of a hose) and energizes a relay or solid-state device which turns on the motor of a centrally-sited vacuum complies with this requirement.

22.46DV D2 *Modification to replace the first paragraph of 22.46 of the Part 1 with the following:*

If PROTECTIVE ELECTRONIC CIRCUITS or programmable electronic circuits performing SAFETY-CRITICAL FUNCTIONS are used to ensure compliance with this standard, the software shall contain measures to control the fault/error conditions specified in Table R.1.

22.52.101DV D1 *Modification to add 22.52.101DV.1 to 22.52.101DV.15 to 22.52DV of the Part 1:*

22.52.101DV.1 Machines provided with general-use socket-outlet or general-use socket-outlets shall comply with 22.52.101DV.2 to 22.52.101DV.15.

22.52.101DV.2 The socket-outlets shall be of the grounding type. The machine shall be provided with the instruction specified in Clause 7.12DV.3.

22.52.101DV.3 A cord-connected, portable, vacuum cleaner provided with a general-use socket-outlet or socket-outlets shall have a current rating as required in Table 22.52.101DV.1 and be provided with an plug rated not less than the current rating of the appliance.

Table 22.52.101DV.1
Requirements for general-use socket-outlets provided on portable, cord-connected vacuums

Number of socket-outlets	Minimum supply cord size mm² (AWG)	Appliance current rating, minimum A	Supplementary OCP required?	Supplementary OCP rating, if provided A	Minimum internal wiring size[a] mm² (AWG)	Total socket-outletb load[b] A
6	3,3 (12)	20	Yes	20	3,3 (12)	20
5	3,3 (12)	20	No	20	3,3 (12)	20

Table 22.52.101DV.1 Continued on Next Page

Table 22.52.101DV.1 Continued

Number of socket-outlets	Minimum supply cord size mm² (AWG)	Appliance current rating, minimum A	Supplementary OCP required?	Supplementary OCP rating, if provided A	Minimum internal wiring size[a] mm² (AWG)	Total socket-outletb load[b] A
4	2,1 (14)	15	Yes	15	2,1 (14)	15
1 – 3	2,1 (14)	15	No	15	2,1 (14)	15

[a] Size of conductors through which socket-outlet current is drawn.

[b] Additional resistive load applied equally between socket-outlets shall be used as the normal load in Clause 11.101DV.

22.52.101DV.4 The minimum conductor size of the SUPPLY CORD for a portable, vacuum cleaner shall be as indicated in Table 22.52.101DV.1.

22.52.101DV.5 An overcurrent protection device (OCP) as required by Table 22.52.101DV.1 or Clause 22.52.101DV.15 shall be suitably rated and comply with the following:

a) The requirements in CSA C22.2 No. 235 and UL 1077; or

b) A fuse that complies with the requirements in CSA C22.2 No. 248.14 and UL 248-14; or

c) A circuit breaker that complies with the requirements in CSA C22.2 No. 5 and UL 489.

22.52.101DV.6 The general-use socket-outlet(s) shall have a current rating of 15 or 20 A and a voltage rating of 125 or 250 V. The socket-outlets shall have a voltage and current rating equal to that of the plug on the SUPPLY CORD.

A 15-A general-use socket-outlet is not prohibited from being used with an appliance rated 20 A with a 20-A plug.

22.52.101DV.7 When multiple general-use socket-outlets are provided, they shall all have the same current rating. These socket-outlets may be of the same or different slot configurations (locking and non-locking) or employ a spring-actuated latching mechanism for locking a mated plug in place after the blades have been inserted into the female contacts.

22.52.101DV.8 The socket-outlets of an appliance shall comply with the applicable requirements in Annex DVA. Each general-use socket-outlet provided in an appliance that is either equipped with temporary mounting means or intended for use in a fixed application, and having the configuration specified in Figure C1.5 of UL 1681, shall comply with the requirements of the Grounding Contact Test in CSA C22.2 No. 42 and UL 498.

22.52.101DV.9 The face of a general-use socket-outlet shall:

a) Be flush with or project beyond a nonconductive surrounding surface; or

b) Project at least 0,38 mm (0,015 in) beyond a conductive surrounding surface.

22.52.101DV.10 Ground-fault circuit protection (Class A) shall be provided for general-use socket-outlets that are part of a fixed or stationary appliance intended to be used outdoors. The ground-fault circuit protection (Class A) shall comply with Annex DVA.

22.52.101DV.11 An general-use socket-outlet of an appliance intended for wet pick-up shall be located so that it is unlikely to be wetted.

22.52.101DV.12 Polymeric material that encloses unswitched socket-outlets and associated circuitry that is always energized when the appliance is plugged in shall comply with Clause 30.2.2 at a test severity of 650 °C.

22.52.101DV.13 The general-use socket-outlet(s) of an appliance shall function using one of the following methods:

a) Always On (Unswitched) – a socket-outlet on the appliance is energized when the appliance is plugged into a socket-outlet;

b) Switched – socket-outlets switched via one or more suitably rated switches, provided the socket-outlet is marked as required in Clause 7.1.104DV.6 a); or

c) Auto – one or more socket-outlets are designed to turn on the vacuum cleaner when a socket-outlet load is sensed. The socket-outlet(s) are to be Always On (Unswitched).

The switches provided for socket-outlets may have other positions, provided that they are suitably marked and their function described in the instruction manual. The switch shall be marked to clearly indicate which socket-outlet(s) it controls and the socket-outlet(s) shall be marked as required in Clause 7.1.104DV.6 b).

22.52.101DV.14 A general-use socket-outlet for use on a nominal 120 V circuit shall have the grounded (neutral) supply conductor connected to the terminal that is substantially silver in color or otherwise marked to indicate that it is intended for connection to the grounded (neutral) supply conductor.

22.52.101DV.15 If a permanently connected appliance includes one or more general-use socket-outlets intended for general use, and if the overcurrent protection of the branch circuit to which the appliance will properly be connected exceeds that acceptable for the socket-outlet or socket-outlets, the appliance shall include suitable overcurrent protection for the socket-outlet circuits.

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.

22.102DV D2 *Delete Clause 22.102 of the Part 2:*

This Clause does not apply.

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.

22.106DV D2 *Modification to add the following to 22.106 of the Part 2:*

Back-pack straps or harness can be considered as handles. The test of 21.108DV applies.

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.

22.108DV D2 *Add 22.108DV to the Part 2:*

An opening in an appliance provided for hanging the appliance shall be located or guarded so that a nail, hook, or the like does not displace a part that would create a risk of fire or electric shock and does not contact any of the following:

a) An uninsulated live part;

b) Magnet wire;

c) Internal wiring;

d) Moving parts; or

e) Any other part likely to create a risk of fire or electric shock.

22.109DV DC *Add 22.109DV to the Part 2:*

22.109DV.1 A motor shall be provided with overload protection when it is:

a) Permanently connected and manually started;

b) In an unattended appliance;

c) In a cord-connected, portable, vacuum cleaner provided with a socket-outlet; or

d) In a coin-operated appliance.

22.109DV.2 Motor overload protection may be provided by any of the following methods:

a) Thermal, impedance or electronic motor protection according to Annex DVA;

b) Overcurrent protective devices complying with the running overload and locked rotor motor protection requirements for thermal motor protection standards as specified in Annex DVA;

c) For appliances intended for connection to fixed wiring, supply branch circuit overcurrent protection sized according to Table 7.1.105DV and marked according to 7.1.105DV.

22.110DV D2 ***Add Clauses 22.110DV.1 and 22.110DV.2 to the Part 2:***

22.110DV.1 The screwshell of a plug type fuse holder and the cap end of an extractor post type fuse holder shall be connected toward the load.

22.110DV.2 Unless instructed to store indoors according to 7.12.101, polymeric material used for the enclosure of electrical equipment that will be exposed to an UV weathering source shall be acceptably resistant to degradation. Acceptable resistance is demonstrated by compliance with Ultraviolet Light Exposure requirements of UL 746C.

23 Internal wiring

This clause of Part 1 is applicable.

24 Components

This clause of Part 1 is applicable except as follows.

24.1DV.101 DC ***Modification to add the following text to Clause 24 of the Part 2:***

A tab used in an electrical quick-connect terminal shall comply with the standard specified in Annex DVA or the requirements of Annex 101.DVC.

24.1DV.3 DC ***Modification to add the following to 24.1DV.3 of the Part 1:***

Alternatively, motors may comply with UL 1004-1/CSA C22.2 No. 100 and be used within the insulation system ratings.

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.

24.1.3DV D2 ***Modification to 24.1.3 of the Part 1 by replacing "10 000" with "6 000" in the first and third paragraphs.***

24.1.3ADV D2 ***Add 24.1.3ADV.1 and 24.1.3ADV.2 to 24.1 of the Part 1:***

24.1.3ADV.1 General

A switch or relay that has not been evaluated for controlling an inductive (motor) load or for controlling a d.c. load shall comply with the overload test of Clause 24.1.3ADV.2.

Compliance is checked by inspection and test.

24.1.3ADV.2 Overload test

24.1.3ADV.2.1 A switch or other device that controls a motor of a product shall perform acceptably when subjected to an overload test consisting of 50 cycles of operation as described in Clauses 24.1.3ADV.2.2 – 24.1.3ADV.2.5 as applicable. Results shall be acceptable if there is no electrical or mechanical malfunction or breakdown of the device or undue burning or pitting of the contacts, and the fuse in the grounding connection does not open.

A device interlocked so that it will never break the locked-rotor motor current need not be tested for overload.

24.1.3ADV.2.2 Exposed dead metal parts of the product shall be connected to ground through a 3-ampere plug fuse, and the product shall be connected to the supply mains.

24.1.3ADV.2.3 During the test, the device shall be operated at a rate of not more than 10 cycles per minute.

A faster rate of operation may be used if agreeable to those concerned.

24.1.3ADV.2.4 The rotor of the motor shall be locked in position. For a mains-operated machine, the product shall be connected to the supply mains.

24.1.3ADV.2.5 The connection shall be such that any single-pole, current-interrupting device will be located in the ungrounded conductor of the supply circuit.

24.1.3BDV D2 ***Add 24.1.3BDV.1 and 24.1.3BDV.2 to 24.1 of the Part 1:***

24.1.3BDV.1 General

A switch or relay located in other than an LVLE CIRCUIT that has not been evaluated for controlling an inductive (motor) load or for controlling a d.c. load shall comply with the overload test of Clause 24.1.3BDV.2.

24.1.3BDV.2 Overload test

24.1.3BDV.2.1 A switch or other device that controls a motor of a product shall perform acceptably when subjected to an overload test consisting of 50 cycles of operation as described in Clauses 24.1.3BDV.2.2 – 24.1.3BDV.2.4 as applicable. Results shall be

acceptable if there is no electrical or mechanical malfunction or breakdown of the device or undue burning or pitting of the contacts, and the fuse in the grounding connection does not open.

A device interlocked so that it will never break the locked-rotor motor current need not be tested for overload.

24.1.3BDV.2.2 Exposed dead metal parts of the product shall be connected to ground through a 3 A plug fuse, and the product shall be connected to a grounded (neutral) supply circuit of rated frequency for main connected machines.

24.1.3BDV.2.3 During the test the device shall be operated at a rate of not more than 10 cycles per minute.

A faster rate of operation may be used if agreeable to those concerned.

24.1.3BDV.2.4 The rotor of the motor shall be locked in position. For a mains-operated machine, the product shall be connected to the supply mains.

24.1.3BDV.2.5 The connection shall be such that any single-pole, current-interrupting device will be located in the ungrounded conductor of the supply circuit.

Compliance is checked by inspection and test.

24.1.4DV.2 DC *Modification to add the following to 24.1.4 of the Part 1:*

If there is no increased risk of fire, electric shock, or personal injury hazard during normal and abnormal testing with an electronic control circuit rendered ineffective, compliance with the control standard requirements is not required. Instead, the electronic control shall comply with the applicable requirements of this standard.

24.1.4DV.3 DC *Modification to add the following to 24.1.4DV of the Part 1:*

The number of cycles of operation declared for 6.10 and 6.11 of IEC 60730-1 shall not be less than 1 000 for voltage-maintained NON-SELF RESETTING THERMAL CUT-OUTS and 30 cycles for other NON-SELF RESETTING THERMAL CUT-OUTS.

24.1.4ADV DC *Add 24.1.4ADV.1 to 24.1.4 of the Part 1:*

24.1.4ADV.1 Mechanical valve endurance test

24.1.4ADV.1.1 A VACUUM RELIEF VALVE shall be subjected to 6 000 cycles of operation by blocking and unblocking the vacuum air inlet so as to fully actuate the mechanical valve. The cycle rate shall be a minimum of 6 l/min.

24.1.4ADV.1.2 As an alternative to testing the valve in the vacuum cleaner, a VACUUM RELIEF VALVE may be bench tested using prescribed or declared end-use air-flow parameters to determine compliance.

24.1.4ADV.1.3 If polymeric materials are used in the construction of a valve, a second sample of the valve shall be placed in a full-draft circulating air oven maintained at a uniform temperature at least 10 °C higher than the maximum temperature of the material measured under normal operating conditions but not less than 70 °C. The sample shall remain in the oven for 7 h. After its careful removal from the oven and return to room temperature, the valve shall be tested in accordance with 24.1.4ADV.1.1 and comply with 24.1.4ADV.1.4.

24.1.4ADV.1.4 Upon completion of the testing, the valve shall still be functional and operate as intended.

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.

24.103DV DC *Add 24.103DV.1 to 24.103DV.3 to Clause 24 of the Part 2:*

24.103DV.1 For appliances other than centrally-sited vacuums, accessory plugs and socket-outlets for them shall not be interchangeable with general use plugs and socket-outlets or with connectors and appliance inlets complying with the standard sheets of CSA C22.2 No. 60320-1 / UL 60320-1.

NOTE 1 General use refers to plug and socket-outlet configurations permitted under national wiring rules.

NOTE 2 Reference to IEC 60320-1 is for connector and appliance inlet configuration comparison purposes only.

A motorized nozzle intended to be connected to an appliance that is intended for wet pick-up shall be provided with:

a) An attached flexible SUPPLY CORD of such length as to plug directly into the appliance without the use of an intermediate connection such as a detachable cord set; or

b) A cord-and-hose assembly that has been investigated and found to be acceptable for the application without creating a risk of fire, electric shock, or injury to persons when exposed to moisture.

24.103DV.2 An appliance provided with pin terminals shall have a pin guard to reduce the likelihood of mechanical damage to the pins.

Compliance is checked by the following test.

A straight-edge is placed in any position across and in contact with edges of the plug opening. The pin guard shall prevent the straight-edge from contacting any current-carrying pin.

24.103DV.3 If a device required to be connected to a specific supply conductor is employed in an externally interconnected part such as a motorized nozzle, the connections shall employ terminal fittings that can only mate such that the required connection to the proper supply conductor is maintained.

24.104DV DC *Add 24.104DV to Clause 24 of the Part 2:*

24.104DV Mechanical valve endurance test

24.104DV.1 A mechanical air-flow valve shall be subjected to 6 000 cycles of operation by blocking and unblocking the vacuum air inlet so as to fully actuate the mechanical valve. The cycle rate shall be a minimum of 6 cycles per minute.

24.104DV.2 As an alternative to testing the valve in the vacuum cleaner, a mechanical air-flow valve may be bench tested using prescribed or declared end-use air-flow parameters to determine compliance.

24.104DV.3 If polymeric materials are used in the construction of a valve, a second sample of the valve shall be placed in a full-draft circulating air oven maintained at a uniform temperature at least 10 °C higher than the maximum temperature of the material measured under normal operating conditions but not less than 70 °C. The sample shall remain in the oven for 7 h. After its careful removal from the oven and return to room temperature, the valve shall be tested in accordance with 24.104DV.1 and comply with 24.104DV.4.

24.104DV.4 Upon completion of the testing, the valve shall still be functional and operate as intended.

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.

25.1.101DV DR *Modification to add 25.1.101DV to 25.1 of the Part 1:*

An appliance that is required to employ a polarized plug and that is provided with a detachable cord set shall also employ a polarized appliance connector.

25.1.102DV D2 *Modification to add 25.1.102DV to 25.1 of the Part 1:*

The SUPPLY CORD of a portable appliance shall exit from the body of the plug in a direction parallel to the major dimension of the blades and at a point opposite a point on the face of the plug geometrically centered between the blades, unless the appliance is a portable utility vacuum, in which case an angled plug can be provided if the plug pins are integral with a GFCI or ALCI.

NOTE A utility vacuum is considered to be a floor-supported vacuum cleaner intended for picking up debris in garages and shops and has a nozzle separated from the cleaner by a hose.

25.1.103DV D2 *Modification to add 25.1.103DV.1 to 25.1.103DV.5 to 25.1 of the Part 1:*

25.1.103DV.1 Appliance cord lengths (detachable and attached) shall comply with Table 25.1.103DV.1, except as noted in 25.1.103DV.2.

Table 25.1.103DV.1
Minimum cord lengths

Type of appliance	Minimum SUPPLY CORD lengths
Vacuum cleaner or blower cleaner, except as noted below and as allowed in 25.1.103DV.2	182 cm
CENTRALLY-SITED VACUUM CLEANER	90 cm
Wet pick-up appliance supported by the body of a person but not solely handheld	6 m

25.1.103DV.2 A portable commercial appliance, portable outdoor use appliance, portable hand-supported blower cleaner or portable wet pick-up appliance may be provided with an attached SUPPLY CORD not longer than 50 cm or with a connector base (motor-attachment plug) if:

a) The appliance is marked in accordance with 7.1.103DV; or the manufacturer furnishes a detachable cord set with the appliance. The minimum length of the provided cord set shall be as specified in Table 25.1.103DV.1; and

b) For outdoor use appliances and wet pick-up appliances, the connection between the attached SUPPLY CORD and the detachable cord set cannot be placed within 75 mm of the floor.

25.1.103DV.3 A wet pick-up appliance intended for use with a detachable cord set shall incorporate a locking type appliance coupler.

25.1.103DV.4 The free length of a conductor inside an outlet box or wiring compartment shall not be less than 15 cm if the lead is intended for field connection to an external supply.

25.1.103DV.5 A cord-connected, portable, vacuum cleaner provided with a general-use socket-outlet or socket-outlets shall not employ a cord set (detachable SUPPLY CORD).

25.2DV.1 D2 *Modification to add the following to 25.2 of the Part 1:*

If an appliance is of CLASS I construction and is provided with means for separate connection to more than one power supply, each such connection shall be provided with a means for grounding.

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.

25.7DV DC *Delete 25.7 of the Part 2:*

This Clause does not apply.

25.7DV.1 DC *Modification to add the following to Clause 27.5DV.1 of the Part 1:*

SUPPLY CORDS shall be at least as serviceable as one of the types given by Table 25.7DV.

Table 25.7DV
Cord types

Appliance use	Type of cord[c]
Automotive and garage	S, ST[a, b]
Other Appliances rated up to 300 V	SJ, SJT
Other Appliances	S, ST

[a] An oil-resistant cord is required when the equipment is likely to be subjected to grease or oil.

[b] Type SJ, or SJT cord is usable when the appliance is intended to be installed or used in a separate room provided for the purpose.

[c] A cord marked with suffix "W" (such a SJTW) is required when the appliance is intended for outdoor use.

25.8.101DV D2 *Modification to add 25.8.101DV.1 to 25.8DV of the Part 1:*

25.8.101DV.1 Minimum SUPPLY CORD sizes for machines provided with general-use socket-outlets shall be as specified in 22.52.101DV.4.

25.13DV DC *Modification to add the following to 25.13 of the Part 1:*

If an accessible metal strain-relief clamp is employed, it shall be provided with supplementary insulation located between the clamp and the flexible cord.

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.

28DV DE *Modification to replace the first paragraph in the Part 2 with the following:*

This clause of Part 1 is applicable except as follows.

28.3DV D2 *Modification to add the following to 28.3 of the Part 1:*

Terminal plates through which wire binding screws are threaded shall have a thickness at least equal to twice the pitch of the thread of the screw but not less than 0,78 mm, and shall have at least two complete clean-cut full threads.

Screws engaging threaded holes in plates shall have not fewer than two full threads engaging under any reasonably foreseeable condition of service.

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.

30.2.2DV D2 *Modify 30.2.2DV of the Part 1 by adding the following:*

Polymeric parts employed to enclose uninsulated live parts or insulated live parts whose insulation is less than 0,7 mm, or equivalent, shall have a flammability rating as noted below in accordance with IEC 60695-11-10:

a) 5VA for a stationary appliance or an appliance that is permanently installed. Alternatively, the polymeric part may be subjected to the 127 mm end-product flame test in accordance with UL 746C.

b) V2 minimum for an appliance other than as mentioned in Item (a). Alternatively, the polymeric part may be subjected to the Needle Flame Test of Annex E, or the 12-mm or 20-mm end-product flame test in accordance with UL 746C.

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.

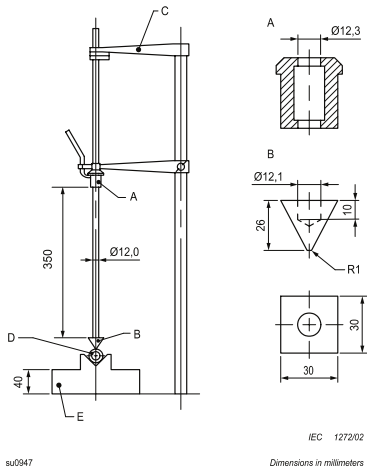
NOTE 101 Information on the explosion risk of certain dusts is given in Annex BB.

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.

32DV DE *Modification to replace the second paragraph of the Part 2 "Addition" with the following:*

For machines intended to pick up COMBUSTIBLE DUST in an ordinary location, additional requirements are specified in Annex AA.



Key

A weight

B chisel

C fixing arm

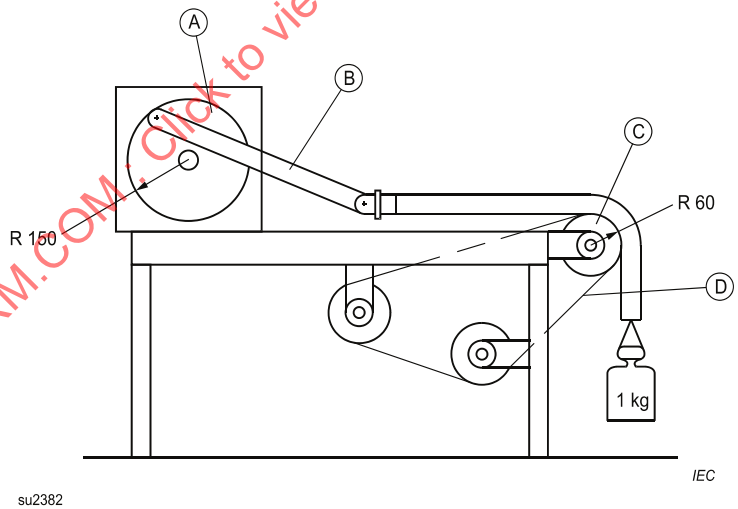
D sample

E base having mass of 10 kg

Figure 101

Impact test apparatus

Dimensions in millimetres



Key

A crank mechanism

B connecting rod

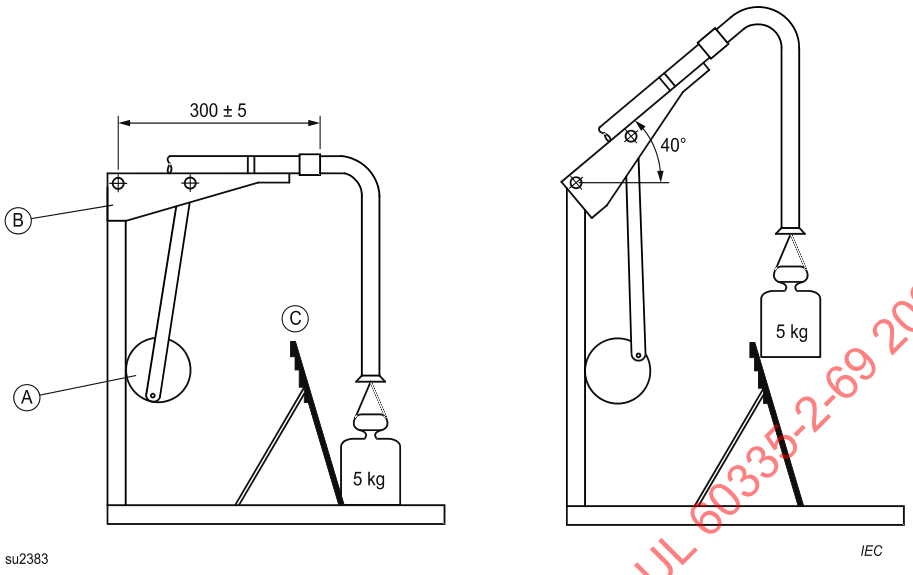
C roller, diameter 120 mm

D abrasive cloth belt

Figure 102

Apparatus for testing the abrasion resistance of current-carrying hoses

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

Dimesions in millimetres

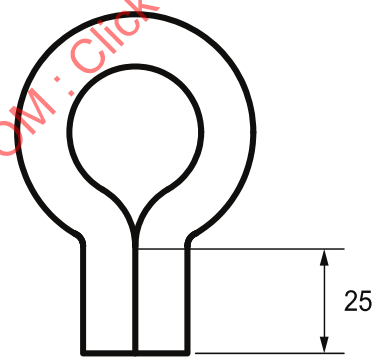


Figure 104

Configuration of the hose for the freezing treatment

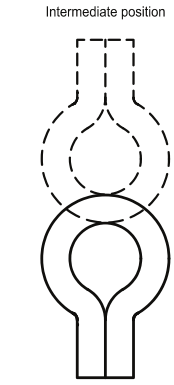
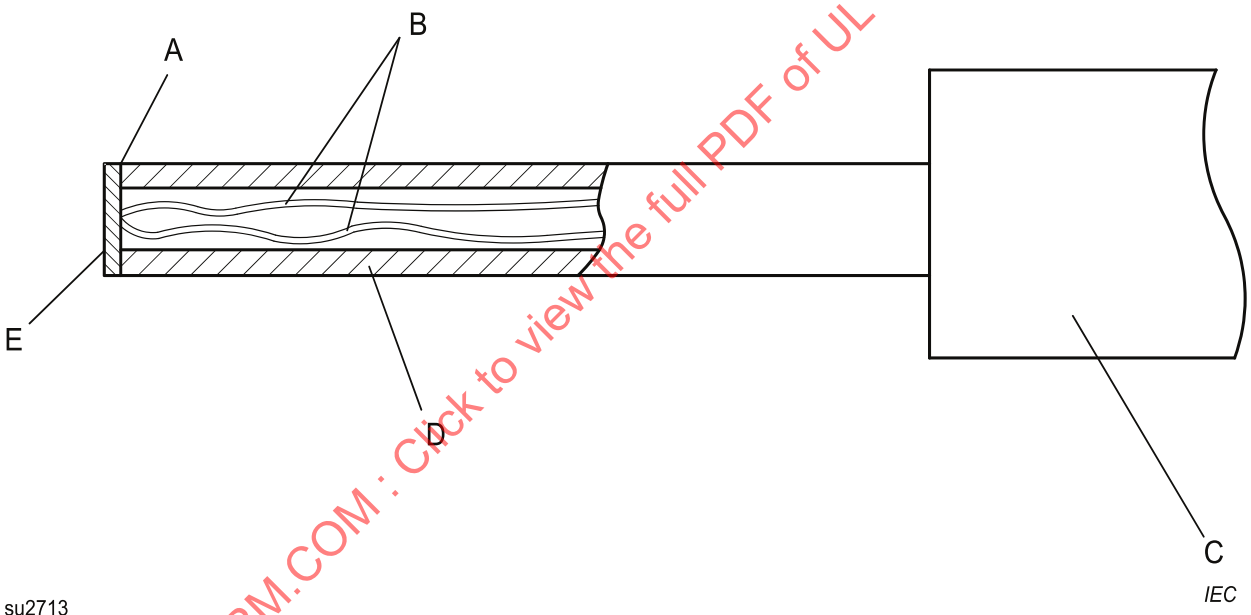


Figure 105

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 N ± 1 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

Figure 107DV DR ***Add the following figure to the Part 2:***

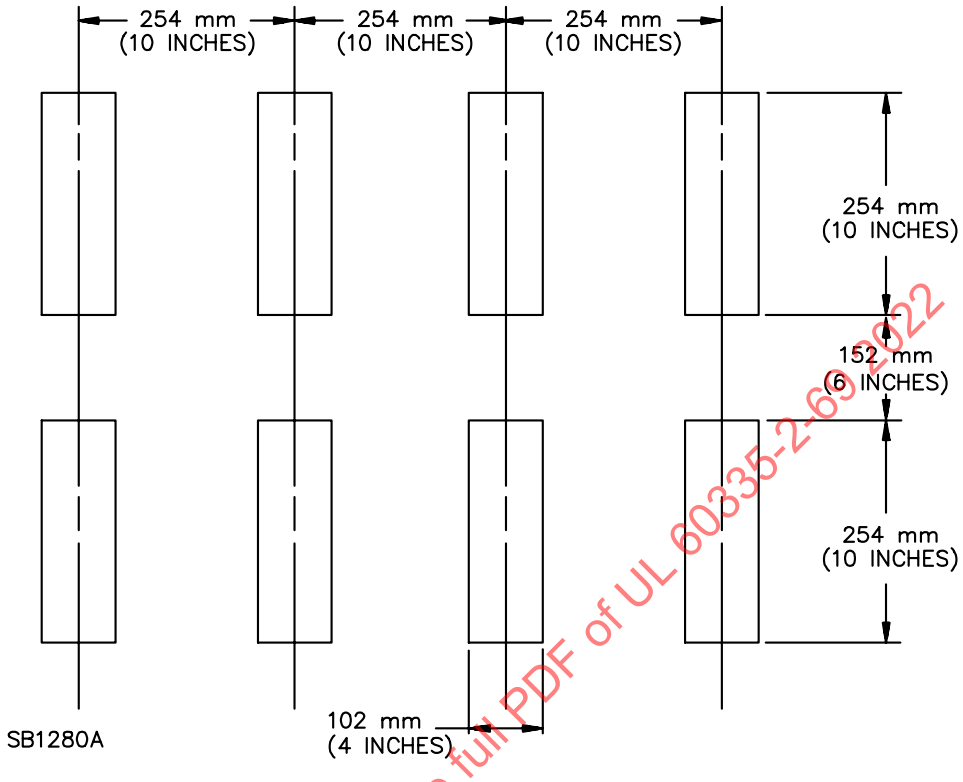


Figure 107DV

Location of applicators for crush resistance test

Annexes

The annexes of Part 1 are applicable except as follows.

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.

ADV D2 ***Modification to replace "normative" with "informative" and replace the first sentence of Annex A in the Part 2 with the following:***

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

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.

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.*

BDV D2 *Modification to replace Annex B of the Part 1 and Part 2 with the following:*

BDV.1 General

Products covered by this standard that are powered by rechargeable batteries either solely, as an alternative, or in conjunction with other sources shall meet the requirements of UL 2595/CSA 22.2 No. 0.23, with the conditions and specifications as required by Annex D of that standard as indicated in the following clauses of this Annex that refer to the various indents of UL 2595/CSA 22.2 No. 0.23.

BDV.2 Indent A

In reference to Indent A of Annex D of UL 2595/CSA 22.2 No. 0.23, except as indicated elsewhere in UL 2595/CSA 22.2 No. 0.23, the following requirements in this end product standard do not apply or are amended as indicated below:

a) Clauses 8, 9, 10, 11, 13, 14, 16, 17, 23, 25, 26, 27, 29 and 30 are not applicable.

b) With respect to Clause 5: 5.2, 5.3, 5.4, 5.8, 5.11, 5.14 and 5.15 are not applicable.

c) With respect to Clause 6: 6.1 is not applicable.

d) With respect to Clause 7, 7.1: 7.2, 7.3, 7.4, 7.5, 7.7 and 7.8 are not applicable. Sub-clause 7.12 is applicable except for references to attachment types and mains connections.

e) For markings including the statement "Unplug before servicing or cleaning" or similar, the machines shall be provided with a detachable or separable battery pack or an integral battery with a means to be readily disconnected with or without the use of tools, and the statement shall be replaced by "Disconnect battery before servicing or cleaning" or equivalent. With respect to 7.1.104DV.2, a machine without means to disconnect the battery but with a reliable power switch and a mechanical device to prevent actuation of the power switch actuator, such as a switch lockout device, the statement shall be replaced by "Engage switch lockout before servicing" or the equivalent. However, if the switch lockout is self-restoring, no marking is required.

f) With respect to Clause 15, the electric strength test is not applicable and 15.3 is not applicable.

g) With respect to Clause 24: 24.1.3, 24.3, 24.5 and 24.8 are not applicable.

h) The clauses referenced in Items (a) – (e) above would apply to those products also powered from mains or other non-isolated sources to the extent that requirement would apply to the risk of electric shock in the area of the product containing such a source.

i) The testing of Clause 21 applies to the appliance with integral battery or detachable battery pack attached, but the compliance criteria of the mechanical strength test of UL 2595/CSA 22.2 No. 0.23 shall be applied.

BDV.3 Indent B

With respect to Indent B of Annex D of UL 2595/CSA 22.2 No. 0.233, users are not considered to be wet during the use of these products except for wet pick-up appliances.

BDV.4 Indent C

With respect to Indent C of Annex D of UL 2595/CSA 22.2 No. 0.23, LT specification is required for batteries for products intended to be used outdoors but stored indoors. For other products intended for use outdoors, the ELT: –35 °C specification is applicable.

BDV.5 Indent D

With respect to Indent D of Annex D of UL 2595/CSA 22.2 No. 0.23, during the heating test, portable vacuum cleaners shall be operated without detachable hoses and attachments and with no additional restriction on the intake of air.

BDV.6 Indent E

With respect to Indent E of Annex D of UL 2595/CSA 22.2 No. 0.23, the temperature limits listed in Table 9.1 of UL 2595/CSA 22.2 No. 0.23 are considered suitable.

BDV.7 Indent F

With respect to Indent F of Annex D of UL 2595/CSA 22.2 No. 0.23, during the abnormal tests of Annex D of UL 2595/CSA 22.2 No. 0.23, the appliance shall be operated with the intake ports uncovered and with no additional mechanical load for those tests where applicable.

BDV.8 Indent G

With respect to Indent G of Annex D of UL 2595/CSA 22.2 No. 0.23, the safety-critical functions (SCFs) identified in 19.11ADV of this standard replace those of Table 11.1 of UL 2595/CSA 22.2 No. 0.23.

BDV.9 Indent H

With respect to Indent H of Annex D of UL 2595/CSA 22.2 No. 0.23, the impact test may be conducted on a hardwood or concrete surface.

BDV.10 Indent I

With respect to Indent I of Annex D of UL 2595/CSA 22.2 No. 0.23, products covered by this end-product standard are not required to have this special switching arrangement.

BDV.11 Indent J

With respect to Indent J of Annex D of UL 2595/CSA 22.2 No. 0.23, battery-operated appliances that can also be operated or charged by mains or a non-isolated source as described in UL 2595/CSA 22.2 No. 0.23, shall also meet the requirements of this standard that apply to the risk of electric shock. For these types of appliances, the requirements specified in BDV.2 are applicable.

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.

SDV D2 ***Modification to replace Annex S of the Part 2 with the following:***

Annex S of Part 1 is replaced by Annex BDV.

Annex AA
(normative)

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

Annex AADV DE *Modify Annex AA by replacing it with Annex AADV.*

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

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

$\dot{m}_{\text{in}}$ 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 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 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 mg × m^{-3}	Degree of penetration *D* %	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)	≥ 0,1	< ,01	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 ± 20) mg/m^3, where 90 % of the particle diameters at the measuring point P are between 0,2 µm and 2 µm, based on Stokes diameter.

The degree of PENETRATION is calculated by means of the following formula:

[AA.1]

$$D = \frac{C_H - C_o}{C_v - C_o} \times 100 \ \%$$

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 µm.

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/m^2;

– 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/m^2. 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.

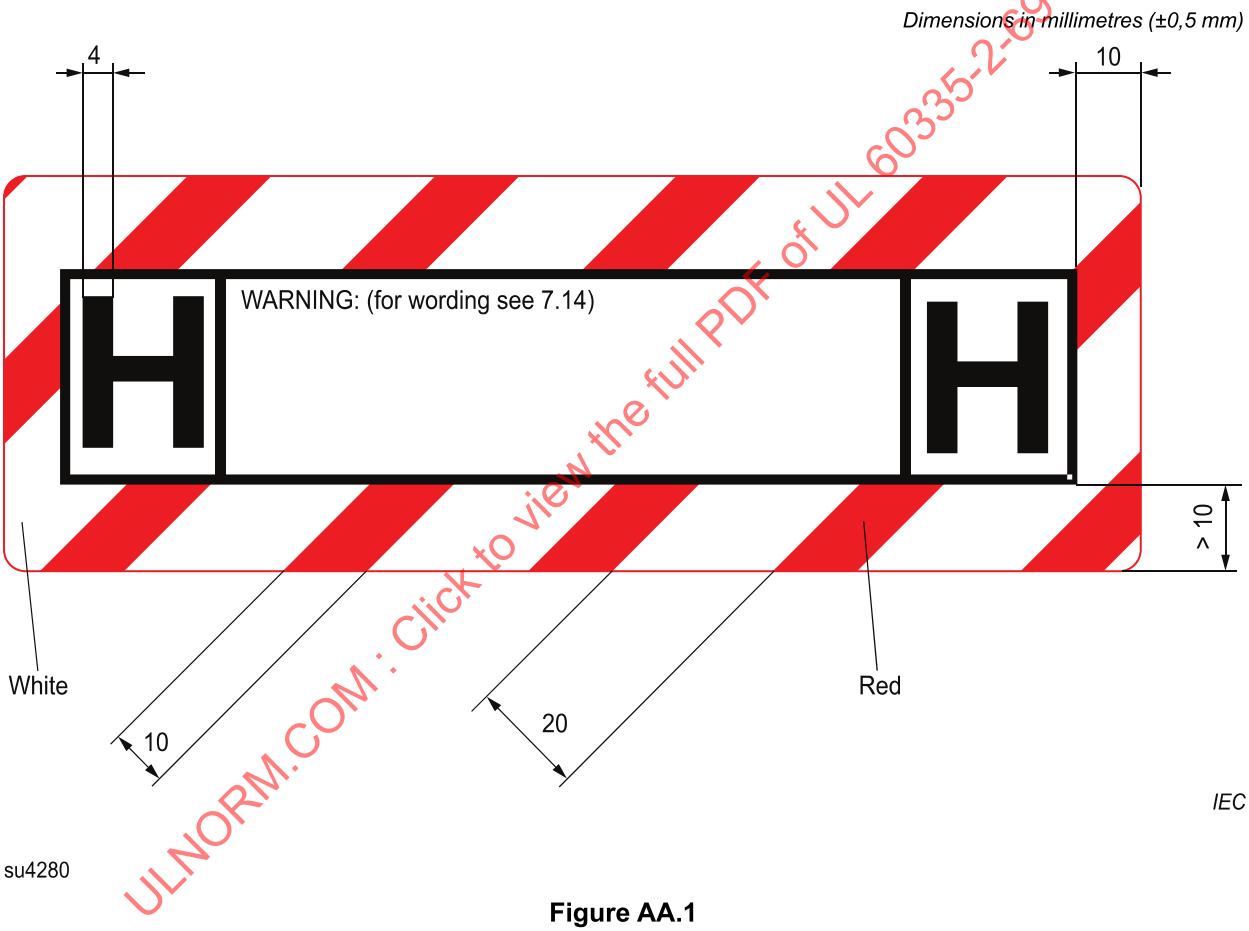


Figure AA.1

Warning label for dust class H machines

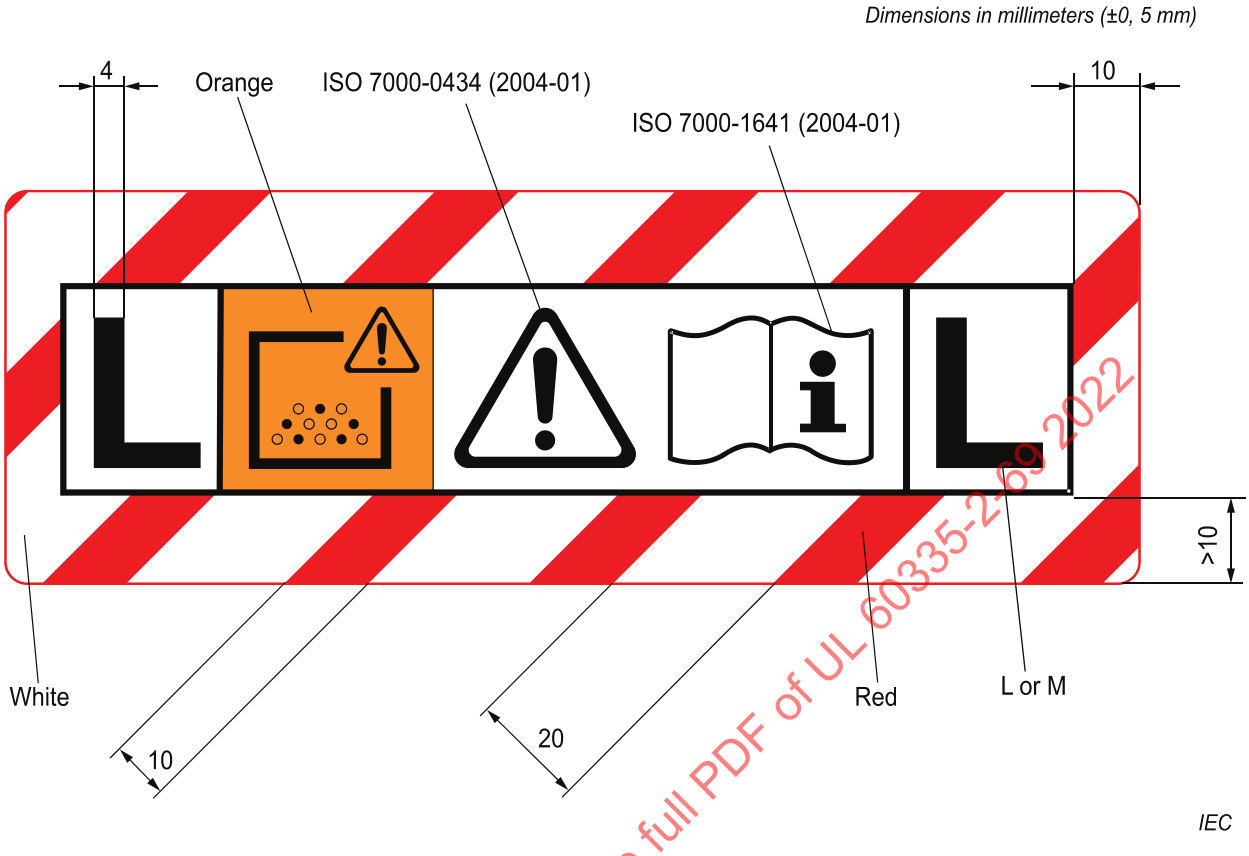


Figure AA.2

Warning label for dust class L and dust M machines

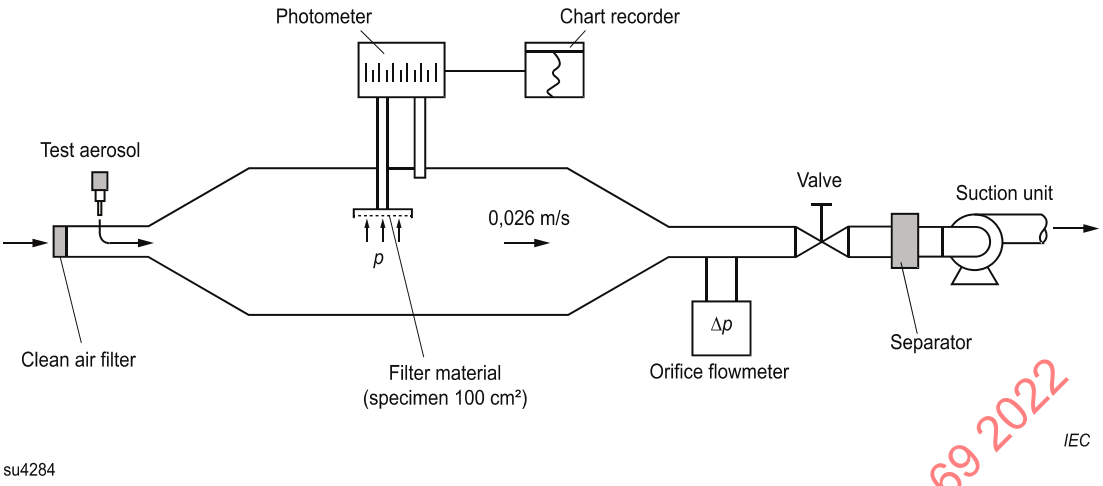


Figure AA.3

Test method for essential filter material

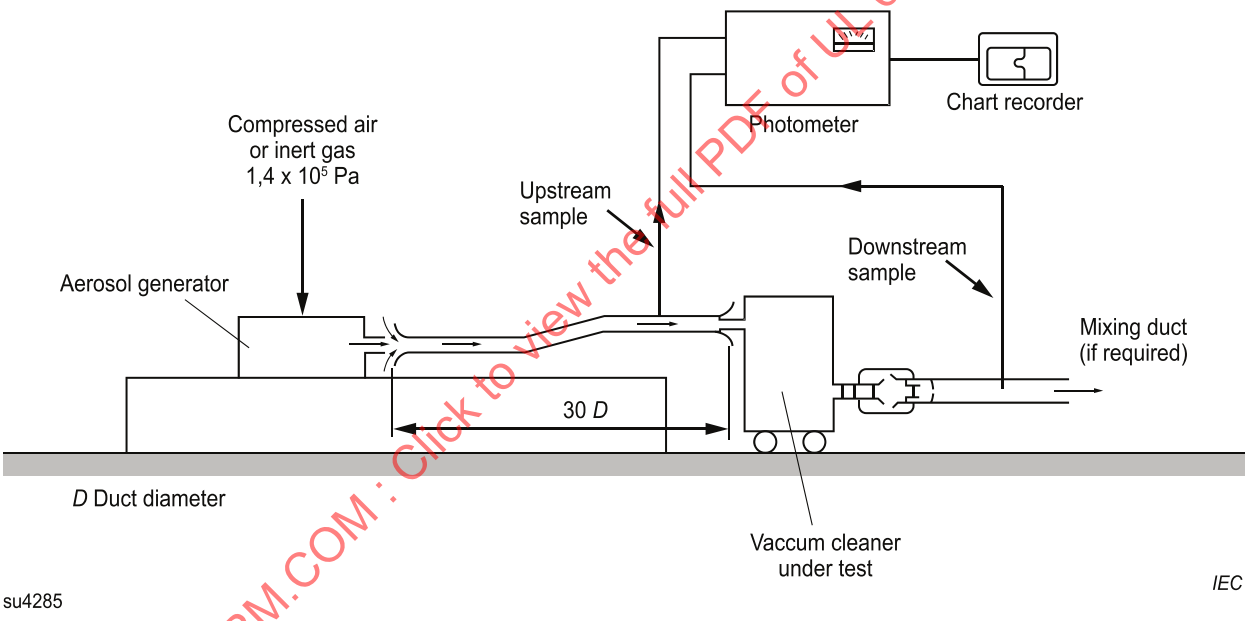
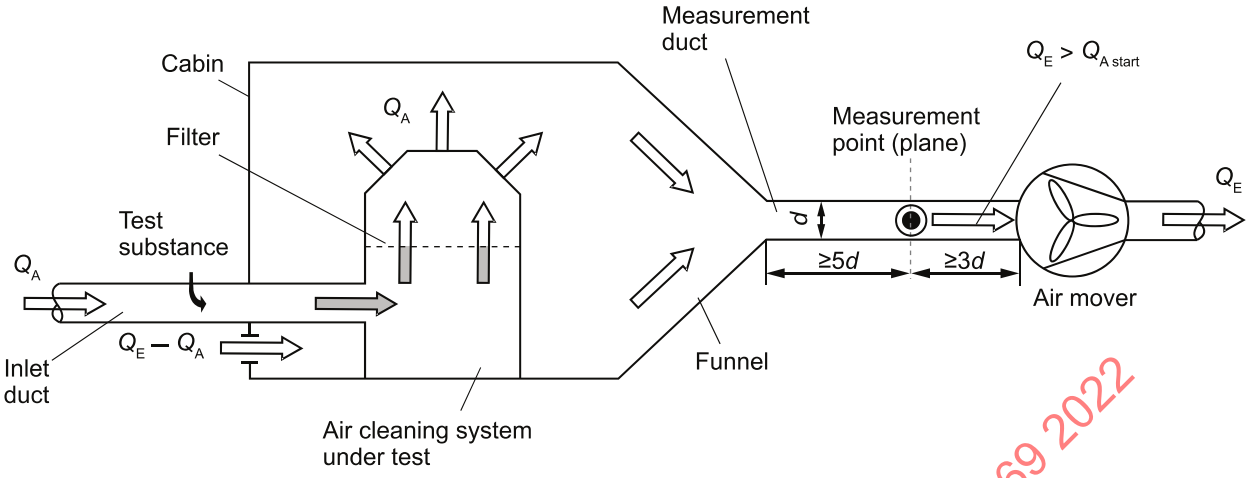


Figure AA.4

In situ essential filter element test



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

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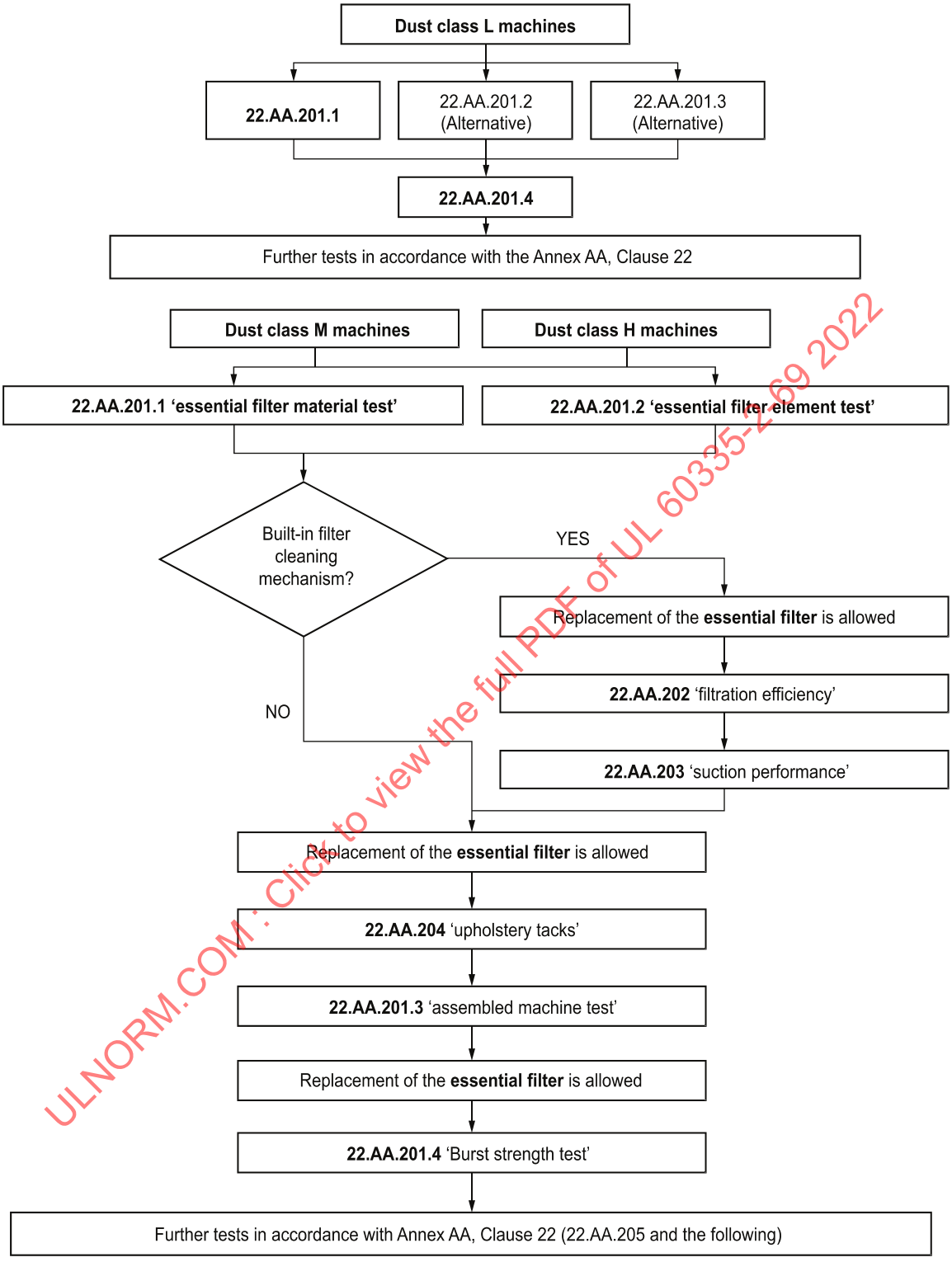
The air entering at Q_E should be filtered. The filter used shall be of dust class M.

Figure AA.5

Assembled machine test



su4287 IEC

Figure AA.6

Sequence and selection of tests according to Clause 22

Annex AADV DE *Modify Annex AA by replacing it with the following:*

Annex AADV
(normative)

Particular requirements for vacuum cleaners and DUST EXTRACTORS for the collection of HAZARDOUS DUSTS and COMBUSTIBLE DUSTS

NOTE 1 This Annex has been adapted from Annex AA in IEC 60335-2-69:2021.

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 HAZARDOUS DUSTS and COMBUSTIBLE DUSTS in other than an EXPLOSIVE DUST ATMOSPHERE.

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

NOTE 3 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.

NOTE 4 Vacuum cleaners and DUST EXTRACTORS used for the collection of explosive dust are not part of the scope.

NOTE 5 In some countries, national regulations exist concerning disposal of HAZARDOUS DUSTS.

ACD covered by this standard are suitable for picking up COMBUSTIBLE DUST, except for magnesium powder or magnesium dust, and are presumed to be limited in use to those locations referred to as "unclassified locations" as the term is used in NFPA 70 (also known as "ordinary locations") and does not address those additional risks associated with the use of these machines in explosive environments.

NOTE 6 Potentially explosive environments are those described as "classified" as described in NFPA 70 as well as those regulated by standards for occupational safety such as the US CFR, NFPA 664 and others. These obligations are assumed to be borne by the user or employer.

NOTE 7 Additional requirements are required for the collection of magnesium powder or dust.

NOTE 8 Machines with dirty side volume greater than 226 L (8 ft^3) have additional requirements per NFPA 484 and NFPA 652.

2 Normative references

Add prior to the first addition the following:

IEC 60079-32-2:2015, *Explosive atmospheres – Part 32-2: Electrostatics hazards – Tests*

3 Terms and definitions

AADV.3.201
PENETRATION
D
degree of PENETRATION of a filter material, a filter or a machine, determined as follows:

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

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.

AADV.3.202
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).

AADV.3.203
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

AADV.3.204
DUST CLASS X MACHINE
machine designed to comply with requirements specified for dust class L, M or H in accordance with AADV.6.201

AADV.3.205
ESSENTIAL FILTER
principal filter in a system which may use multiple filters and is a filter which ensures that the PENETRATION limits of Table AADV.1 are met

AADV.3.206
DUST COLLECTION MEANS
container having means of safe dust disposal to be undertaken when handled in accordance with the manufacturer's instructions

AADV.3.207
NEGATIVE PRESSURE UNIT
extraction unit used to ensure that the pressure within a working enclosure is below atmospheric

AADV.3.208
ACD (APPLIANCES FOR PICK-UP OF COMBUSTIBLE DUST)
appliances intended to pick up COMBUSTIBLE DUST

AADV.3.209
EPL DA (EQUIPMENT PROTECTION LEVEL DA)
equipment for EXPLOSIVE DUST ATMOSPHERES, having a "very high" Level of Protection, which is not a source of ignition in NORMAL OPERATION, during expected malfunctions, or during rare malfunctions

AADV.3.210
ELECTROSTATIC EARTHING
connection to earth with a maximum resistance of 1 MΩ

AADV.3.211
FLOW-THROUGH MOTOR
turbine where the suction air is also used to cool the electric motor

AADV.3.212
CONDUCTIVE PART
part made of materials with a specific resistance of not more than 10 kΩ

[SOURCE: IEC 62784:2017 including IEC 62784:2017/AMD1:2019]

AADV.3.213
ANTISTATIC FILTER MATERIAL
filter material with a surface resistance of not more than 10^8 Ω

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.

5 General conditions for the tests

5.5 *Add after the first sentence:*

For ACD incorporating a liquid reservoir, the reservoir shall be filled to the minimum fill line for all tests unless otherwise specified.

6 Classification

6.1 *Addition:*

ACD shall be of CLASS I.

6.2 *Addition:*

ACD shall be at least IPX4 according to IEC 60529:1989+AMD1:1999+AMD2:2013.

ACD for picking up CONDUCTIVE DUST shall be at least IP54.

NOTE: For ACD intended for universal use with infrequent pickup of small amounts of CONDUCTIVE DUST, only IPX4 is required.

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

Data lead connectors are not required to be IPX4 if they are SELV and their current is limited to 20 mA.

AADV.6.201 The machines are classified according to dust classes:

– L (light hazard) suitable for separating dust with a degree of penetration D < 1 %;

– M (medium hazard) for separating dust with a degree of penetration D < 0,1 %;

– H (high hazard) for separating dusts with a degree of penetration D < 0,005 %.

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 DUST CLASS H MACHINES often find utility in separating dusts that may be contaminated with carcinogens or pathogens.

All ACD shall be classified as dust class L, M, or H.

7 Marking and instructions

7.1 *Addition:*

The model or type reference marked on the machine shall include the dust class letter and the acronym ACD if applicable. 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.

For ACD incorporating a liquid reservoir, a transparent surface and a marking shall be included to the container to ensure visual inspection of the minimum liquid level in the reservoir. The hydrogen vent, if any, shall be identified on the liquid reservoir. The maximum operating level shall also be identified to notify the user when to empty the sludge.

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 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 AADV.22.201.2. Either the test is conducted, or the ESSENTIAL FILTER is replaced by a new one.

– 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 H, M and CLASS L MACHINES, the meaning of the relevant warning label according to Figure AADV.1;

– 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 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. For all ACD, the substance of the following instructions shall be provided, as applicable:

– Collection of combustible dust presents a risk of fire and explosion. Qualified users only.

– This appliance is suitable for collection of combustible dusts, except for magnesium dust or powder, in non-classified (ordinary) locations.

– This appliance is not suitable for use in classified (hazardous) locations, to pick up dusts or liquids of high explosion risk, nor mixtures of combustible dust with liquids.

– The dust container has to be emptied when full, 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. This is to be checked before every use.

– Use for collection only of the combustible dusts specified by the manufacturer. Combinations of different metals or dusts can lead to fire or explosion.

– Periodic earthing continuity tests shall be performed as required by federal, state, provincial and local laws and regulations.

– Use care in hose routing during operation to prevent kinking.

– Conduct regular cleaning and inspection for dust accumulation in the hose, dust collection container and liquid reservoir.

– The possible accumulation of dust on the appliance could present a potential source of ignition. Clean regularly the appliance surface.

– Use appropriate personal protective equipment while operating, emptying and cleaning the appliance.

– Use only accessories recommended by the manufacturer. The use of other accessories can cause explosion hazard.

– Picking up hot particles or glowing materials is not permitted, as they can trigger a fire and explosion in the hose or the container.

– The user shall be aware of all relevant characteristics of the combustible dusts which the machine is sucking up 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.

– WARNING – Attention is drawn to the issues associated with handling metallic dusts and the possibility of exothermic reaction (e.g. fire, explosion).

The instructions for ACD vacuum cleaners shall also include the substance of the following:

– This appliance is not suitable for connection to a dust-generating machine.

The instructions for ACD DUST EXTRACTORS shall also include the substance of the following:

– The dust extractor is suitable to be connected to dust-generating appliances, however, it is not suitable for appliances where ignition sources are produced;

– 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 APPLIANCES or tools, shall be ELECTROSTATICALLY EARTHED. Otherwise, additional safety measures are needed.

NOTE A liquid reservoir / immersion separator can be considered as an additional measure.

– ELECTROSTATIC EARTHING can be accomplished through the DUST EXTRACTOR or through a separate ELECTROSTATIC EARTHING means.

The instructions for ACD incorporating a liquid reservoir shall also include the substance of the following:

– Use proper sludge removal, handling and storage precautions, such as mixing with inert materials, in accordance with local regulations;

– Fill the liquid reservoir only with the liquid recommended by the manufacturer;

– Class IIIB liquids shall be handled in accordance with local regulations and NFPA 30. The instructions for ACD intended for collection of metal dust and incorporating a liquid reservoir intended to be filled with water shall also include the substance of the following:

– Ensure applying correct liquid in the liquid reservoir for picking up metal dust to avoid hazardous reaction;

– Hydrogen gas is flammable and can be generated by picking up certain material like aluminum, magnesium, etc.;

– Hydrogen vent prevents accumulation of hydrogen gas within the liquid reservoir;

– Clean and inspect vent on a regular basis and examine it for signs of damage;

– Ensure proper ventilation of the storage area to reduce hydrogen gas concentrations;

– Empty the sludge after each use and when full to reduce hydrogen gas generation.

7.14 *Addition:*

CLASS H, M and L MACHINES shall be fitted with the relevant label according to Figure AADV.1, the minimum dimension of x being 5 mm. The label shall be visible while the machine is placed in any normal position of use. ACD shall be clearly and permanently marked with the label according to Figure AADV.2, the minimum dimension of x being 5 mm.

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.

11 Heating

11.8 *Addition:*

The temperature of the surfaces of an ACD that are in contact with COMBUSTIBLE DUST shall not exceed 135 °C.

19 Abnormal operation

19.13 *Addition:*

The temperature of the surfaces of an ACD that are in contact with COMBUSTIBLE DUST shall not exceed 135 °C.

22 Construction

22.1 *Addition:*

IP 5X machines are operated at RATED POWER INPUT in the dust test chamber as specified in 13.4 of IEC 60529:1989+AMD1:1999+AMD2:2013 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 for 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.

AADV.22.201 Dust collecting machines

Dust collecting machines shall be designed and constructed in accordance with the dust classes given in AADV.6.201 and meet the values given in Table AADV.1:

Table AADV.1
PENETRATION limits

Dust class	Degree of PENETRATION D %	ESSENTIAL FILTER material test	ESSENTIAL FILTER element test	Assembled machine test method
L (light hazard)	< 1	AADV.22.201.1	AADV.22.201.2 may be applied alternatively to AADV.22.201.1	AADV.22.201.3 if ESSENTIAL FILTER material test is not carried out
M (medium hazard)	< 0,1	AADV.22.201.1	AADV.22.201.2 may be applied alternatively to AADV.22.201.1	AADV.22.201.3
H (high hazard)	< 0,005	Not required	AADV.22.201.2	AADV.22.201.3
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 AADV.1, and taking into account the flow chart as shown in Figure AADV.6.

AADV.22.201.1 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 AADV.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 ± 20) mg/m^3, where 90 % of the particle diameters at the measuring point P are between 0,2 µm and 2 µm, based on Stokes diameter.

The degree of PENETRATION is calculated by means of the following formula:

[AADV.1]

$$D = \frac{C_H - C_o}{C_v - C_o} \times 100 \ \%$$

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 AADV.1.

AADV.22.201.2 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 AADV.4.

On machines with a ducted outlet, Figure AADV.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 µm.

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 [AADV.1]. The effect of carbon brush dust shall be taken into consideration.

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

AADV.22.201.3 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 AADV.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 AADV.22.202.

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/m^3 airflow.

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

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

AADV.22.201.4 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).

AADV.22.202 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 AADV.22.203.

AADV.22.203 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/m^2;

– for other machines, the suction airflow is 20 % greater than the minimum airflow volume as specified in AADV.22.205.

AADV.22.204 'Upholstery tacks' test

All ACD regardless of dust class and machines for collection of HAZARDOUS DUST of dust class M and dust class H 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. For ACD, FLOW-THROUGH MOTORS are not permitted.

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 AADV.22.201 shall be carried out.

AADV.22.205 Indication regarding dust removal

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

a) All ACD regardless of dust class and machines for collection of HAZARDOUS DUST 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.

NOTE: The limit of the air velocity of 20 m/s is to ensure that the inner surface of the suction hose is kept sufficiently clean from hazardous dust. This value does not ensure sufficient dust pick up of e.g. power tools connected to the suction hose.

b) All suction-sweeping machines shall be provided with an indicator which operates before the reduction of pressure in the suction region of the brush area becomes less than 50 N/m^2. This also applies to the side brush area.

c) All ACD regardless of dust class and DUST EXTRACTORS for collection of HAZARDOUS DUST (excluding NEGATIVE PRESSURE UNITS and DUST CLASS L MACHINES), shall be provided with an indicator which operates 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 the following criteria:

• providing a minimum luminous intensity of 600 mcd;

• its main beam angle where applicable, directed towards the main direction of the user or such that the operator may detect the warning from the most likely position of use.

– 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.

AADV.22.206 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.

AADV.22.207 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.

Machines equipped with technical means to detect the presence of the ESSENTIAL FILTER, shall not be able to be operated without the essential filter element in place. It is acceptable that the suction motor operates for a maximum of 6 seconds for detection purposes.

Compliance is checked by inspection and functional test.

AADV.22.208 Air speed of the dust exhaust

The air speed of the exhaust of all ACD regardless of dust class and machines for collection of HAZARDOUS DUST 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.

AADV.22.209 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 AADV.22.201.3 shall be conducted.

Compliance is checked by the relevant test.

AADV.22.210 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.

AADV.22.211 Easy cleaning

All ACD regardless of dust class and machines for collection of HAZARDOUS DUST with dust class M and dust class H 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.

AADV.22.212

DUST CLASSES M or H MACHINES 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.

AADV.22.213 The suction fan of ACD shall be on the clean air side.

Compliance is checked by inspection.

AADV.22.214 ACD 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. Isolated metal parts coming into contact with the dust are not permitted. All metal parts are bonded and connected to the earth terminal of the connection facility.

Compliance is checked by inspection.

AADV.22.215 For ACD, parts enclosing collected dust and dust conduits shall be made of materials not containing more than 7,5 % in total of magnesium, titanium and zirconium.

Nozzles made of material containing more than 7,5 % in total of magnesium, titanium and zirconium shall 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.

AADV.22.216 For ACD, 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.

AADV.22.217 Downstream of the ESSENTIAL FILTER within ACD, the air is considered to be free of COMBUSTIBLE DUST.

ESSENTIAL FILTERS are not considered to produce an explosion risk, as long as they either

a) comply to IEC 60079-32-2:2015, clause 4.11, measured upstream side with max. charge limited to 200 nC, 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.

The criteria above applies also to other filters in contact with the explosive atmosphere within the ACD.

AADV.22.218 For ACD incorporating a liquid reservoir the following additional requirements apply:

– operation of the appliance shall be prevented when the liquid level is below the minimum fill level;

– the dust laden airflow shall go through the liquid, in order to inertize the dust itself;

– the ACD shall not operate, if relevant inner parts which ensure the dust inertization are missing. It is technically necessary to make sure that the dust-laden air flow mixes well with the liquid, for example with a sieve element.

Compliance is checked by functional test and inspection.

NOTE These requirements are not applicable for ACD incorporating a liquid reservoir not used for dust separation or inertization purposes.

AADV.22.219 For ACD intended for collection of metal dust and incorporating a liquid reservoir intended to be filled with water, the following additional requirements apply:

– The liquid reservoir shall be provided with a vent at the top of the dust collection container to prevent accumulation of hydrogen gas generated from combustible metal dust contacting a liquid which results in hydrogen production, like water. The vent shall be at least 25 mm (1 inch) in diameter and it shall open automatically when the appliance is not operating.

– All compartments above the liquid reservoir shall be provided with venting at the top of the compartment to prevent the accumulation of hydrogen gas when the unit is not in operation.

– Any electrical compartment above the liquid reservoir shall be provided with means to prevent hydrogen gas from entering the compartment.

Compliance is checked by functional test, measurement and inspection.

AADV.22.220 For ACD, end-to-end suction hose resistance of the hose assembly shall be less than 1 MΩ.

Compliance is checked by measurement.

AADV.22.221 ACD 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.

Compliance is checked as follows.

The ELECTROSTATIC EARTHING is measured with minimum 100 V DC, with an electrode surface not exceeding 20 cm^2. The electrode is applied with a force of 10 ± 2 N.

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.

24 Components

24.1 *Addition:*

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, i.e. EPL DA. Except for ACD incorporating a liquid reservoir, components shall be at least suitable for EPL DC.

Compliance is checked by inspection.

24.1.3 *Addition:*

An electromechanical liquid level control of an ACD using an incorporated liquid reservoir shall be suitable for 50,000 cycles. An electronic liquid level control shall be considered a safety critical function with a minimum Performance Level (PL) of C in accordance with ISO 13849-1. Any software relied upon for this function shall be evaluated to normative Annex R of CAN/CSA-C22.2 No. 60335-1 / UL 60335-1 using Table R.1.

AADV.24.201 Socket-outlets for general use incorporated in ACD shall be earthed type.

Compliance is checked by inspection.

AADV.24.202 If filters for cooling air are needed to comply with 6.2 of this normative Annex, they shall be removable only by using TOOLS.

Compliance is checked by inspection.

25 Supply connection and external flexible cords

25.1 *Addition:*

For ACD, 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.

Compliance is checked by inspection

25.7 *Replacement:*

SUPPLY CORDS for ACD shall not be lighter than 60245 IEC 66.

Compliance is checked by inspection

30 Resistance to heat and fire

AADV.30.2.201

Non-metallic parts of ACD enclosing collected COMBUSTIBLE DUST (i.e. covering or supporting) 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 RATED POWER INPUT not exceeding 1200 W and with the useable volume of the dust container not exceeding 50 cm^3.

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, unless the material has a glow-wire flammability index of at least 550 °C according to IEC 60695-2-11, the test sample being no thicker than the relevant part.

Non-metallic parts 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 650 °C, unless the material has a glow-wire flammability index of at least 650 °C according to IEC 60695-2-11, the test sample being no thicker than the relevant part. 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 60695-2-11, provided that the test sample was not thicker than the relevant part.

31 Resistance to rusting

Addition:

For ACD incorporating a liquid reservoir, the reservoir shall be made out of non-corrosive material.

Compliance is checked by inspection.

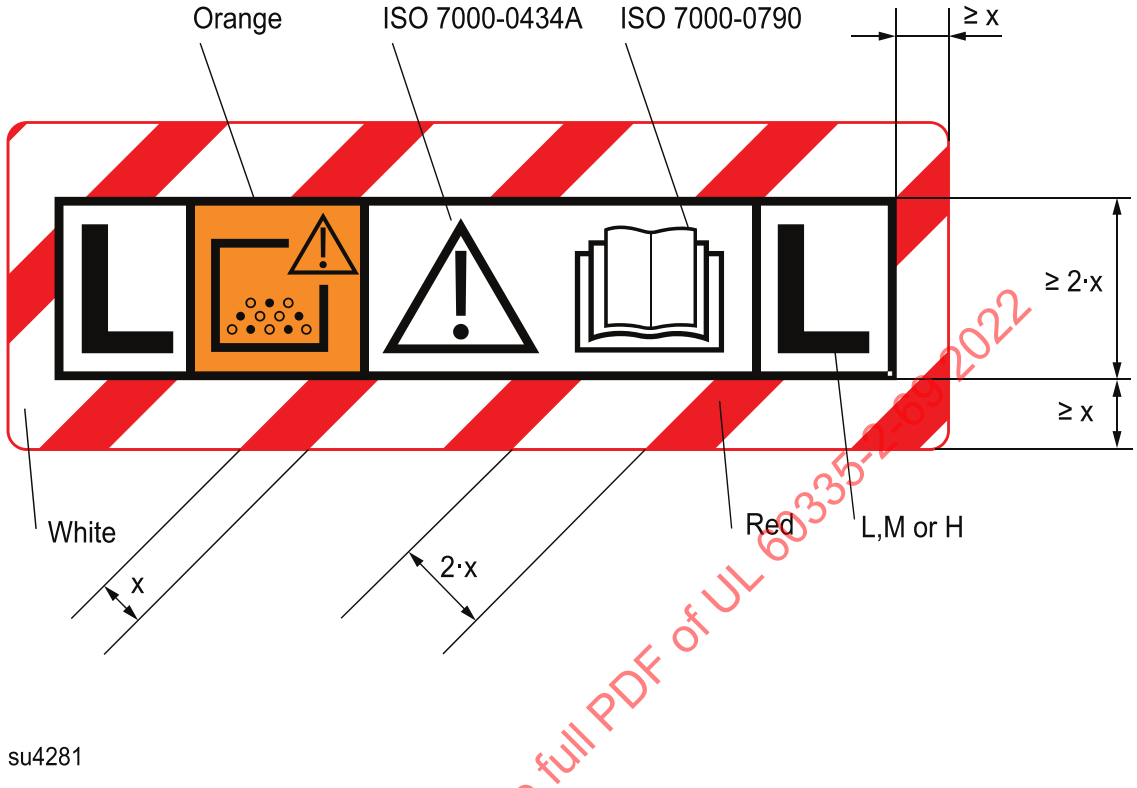


Figure AADV.1

Warning label for DUST CLASS L, M and H MACHINES

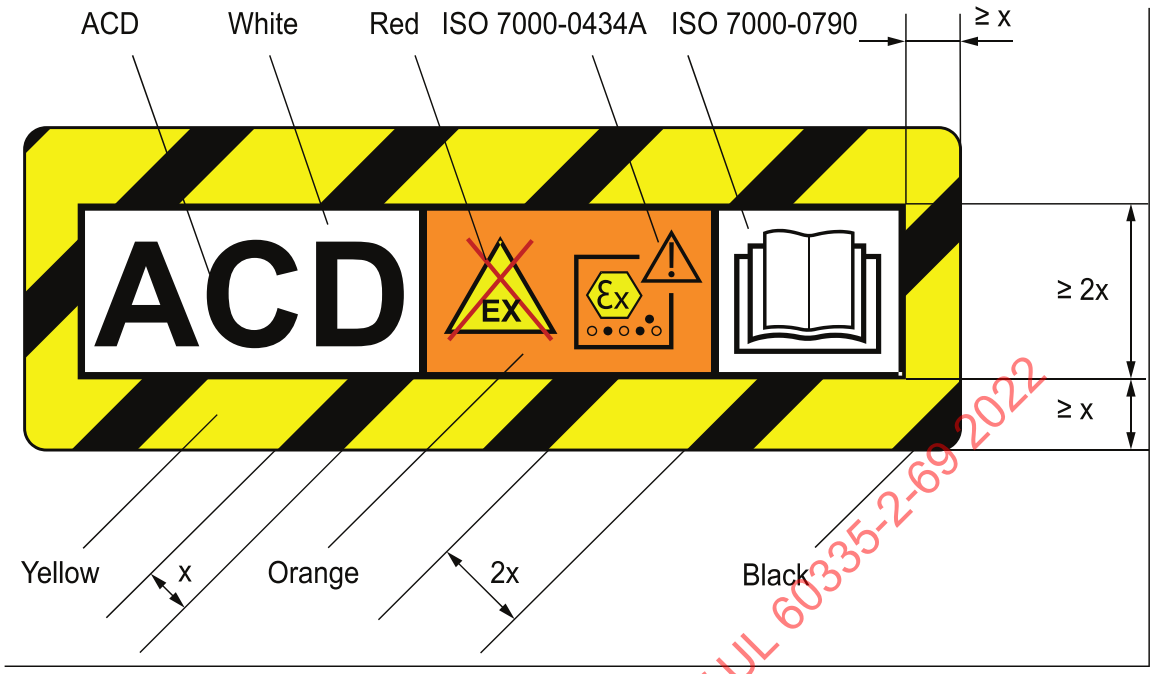


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Figure AADV.2

Warning label for ACD

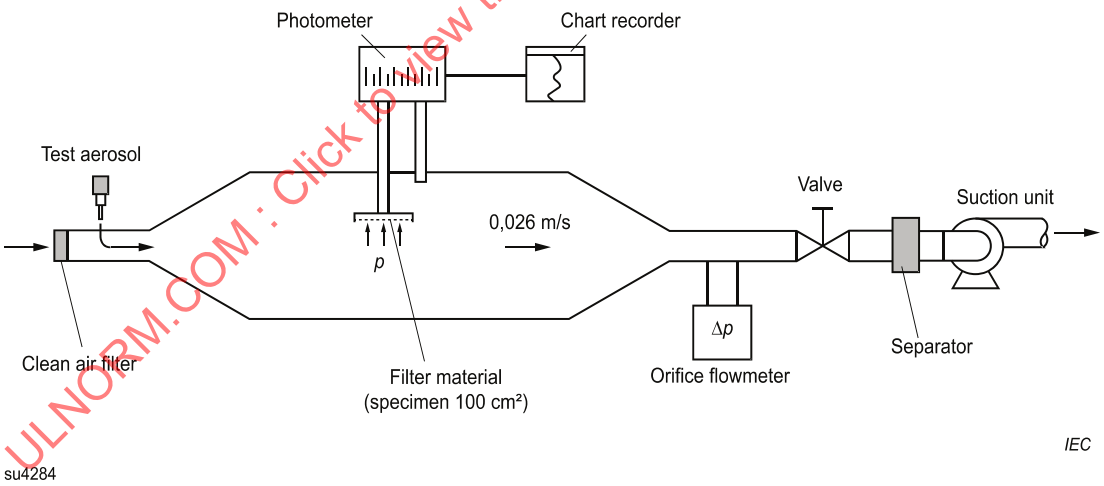

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Figure AADV.3

Test method for ESSENTIAL FILTER material

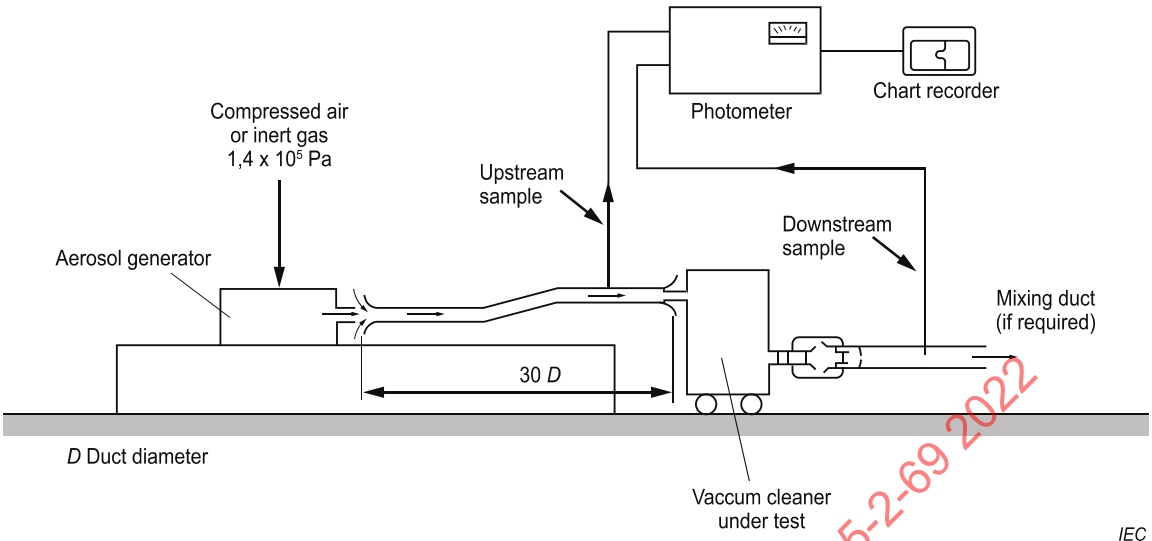
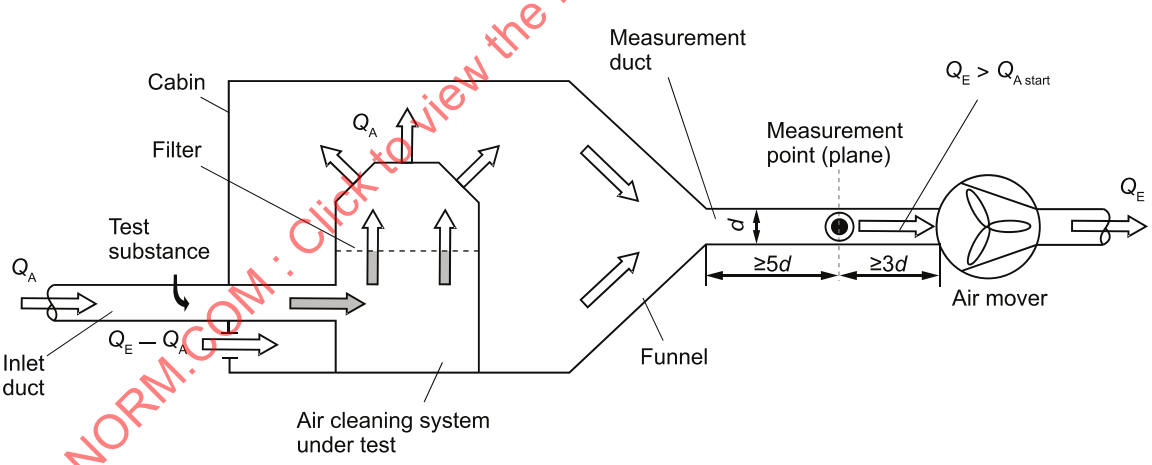


Figure AADV.4

In situ ESSENTIAL FILTER element test



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

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Figure AADV.5

Assembled machine test

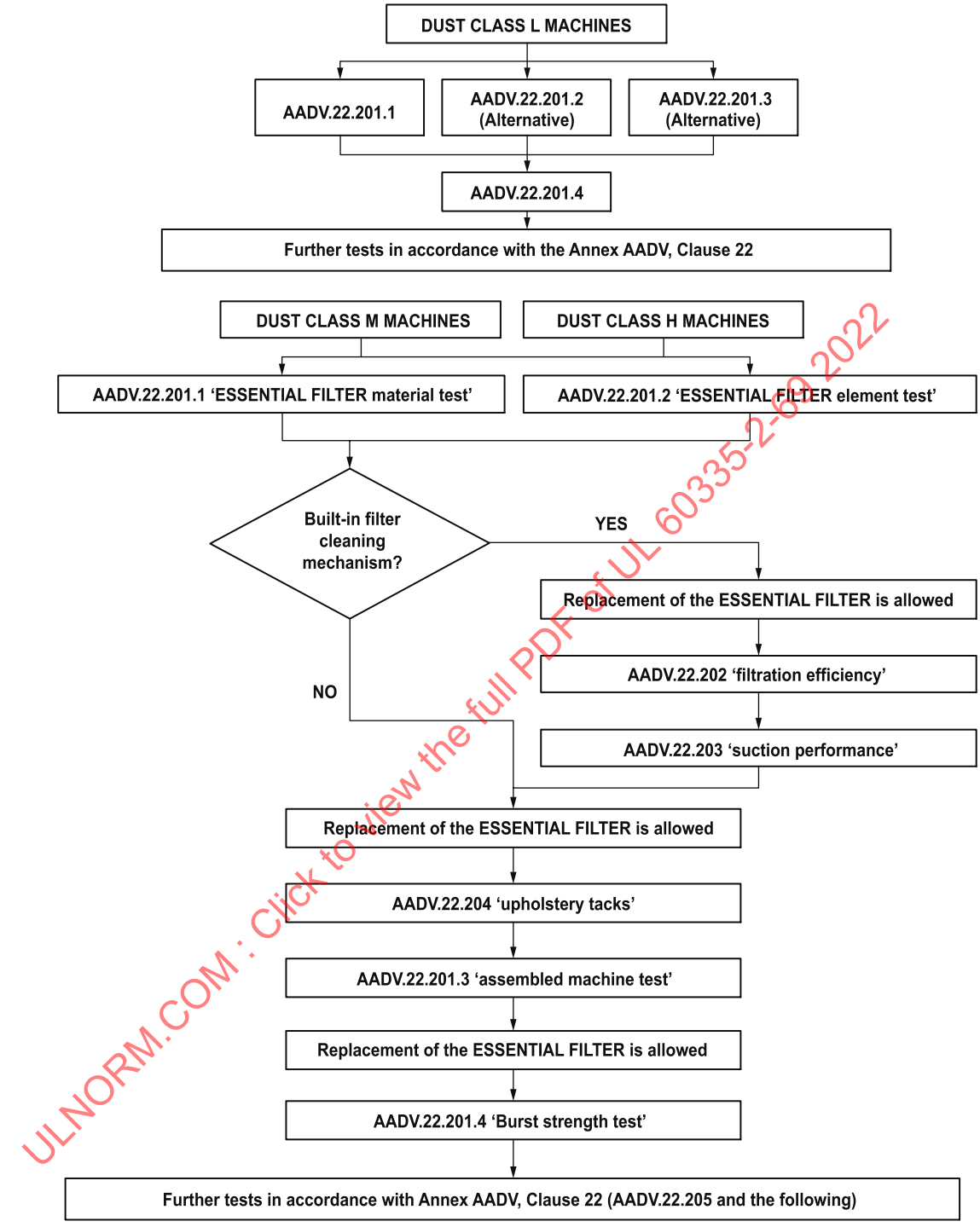

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Figure AADV.6

Sequence and selection of tests for DUST CLASS L, M and H MACHINES according to Clause 22

Annex BB
(informative)

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

BBDV D2 *Delete Annex BB:*

This Annex does not apply.

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	640	–	–
Aluminium, linishings	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	–	–

Table BB.1 Continued on Next Page

Table BB.1 Continued

Dust	Minimum ignition temperature °C	Minimum explosible concentration kg/m^3	Minimum ignition energy mJ
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	–	–
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	–	–

Table BB.1 Continued on Next Page

Table BB.1 Continued

Dust	Minimum ignition temperature °C	Minimum explosible concentration kg/m^3	Minimum ignition energy mJ
Coffee 55 %, chicory 45 %	370	0,1	140
Cork	400	–	–
Cornflour	390	–	–
Cornstarch	380	0,15	–
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
Diphenyol 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_2O	–	–	–
Ferrochrome	600	–	–
Fish meal	520	–	–
Flour, English 13 % H_2O	–	–	–
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	–	–

Table BB.1 Continued on Next Page

Table BB.1 Continued

Dust	Minimum ignition temperature °C	Minimum explosible concentration kg/m^3	Minimum ignition energy mJ
Lauryl peroxide	–	–	12
Lead stearate, dibasic	–	–	12
Leather, < 420 µm	520	–	–
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	–	–	–
Monochloracetic acid	620	–	–
Monosodium salt of tri-chloroethyl phosphate	540	–	–
β-Naphthol	670	–	–
Nigrosine hydrochloride	630	–	–
p-Nitro o-anisidene	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

Table BB.1 Continued on Next Page

Table BB.1 Continued

Dust	Minimum ignition temperature °C	Minimum explosible concentration kg/m^3	Minimum ignition energy mJ
Polyethylene, commercial	–	–	57
Polyethylene, ground	400	–	–
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	–	–
Propyliodine	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	620	–	–
Sodium salt of 2,2 dihydroxy naphthalene disulphonic acid	510	–	–
Sodium glucaspaldrate	600	–	–
Sodium glucoheptonate, dried	600	–	–
Sodium monochloracetate	550	–	–
Sodium propionate	470	–	–

Table BB.1 Continued on Next Page

Table BB.1 Continued

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_2O	–	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

CCDV D2 *Delete Annex CC:*

This Annex does not apply.

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 MΩ

3.CC.203
CONDUCTIVE PART
part made of materials with a specific resistance of not more than 10 000 Ωm

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 Ω

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 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

6.2 *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 s minimum cross-sectional area of 1,0 mm^2.

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 dm^3.

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 cm^2. The electrode is applied with a force of 10 N ± 2 N.

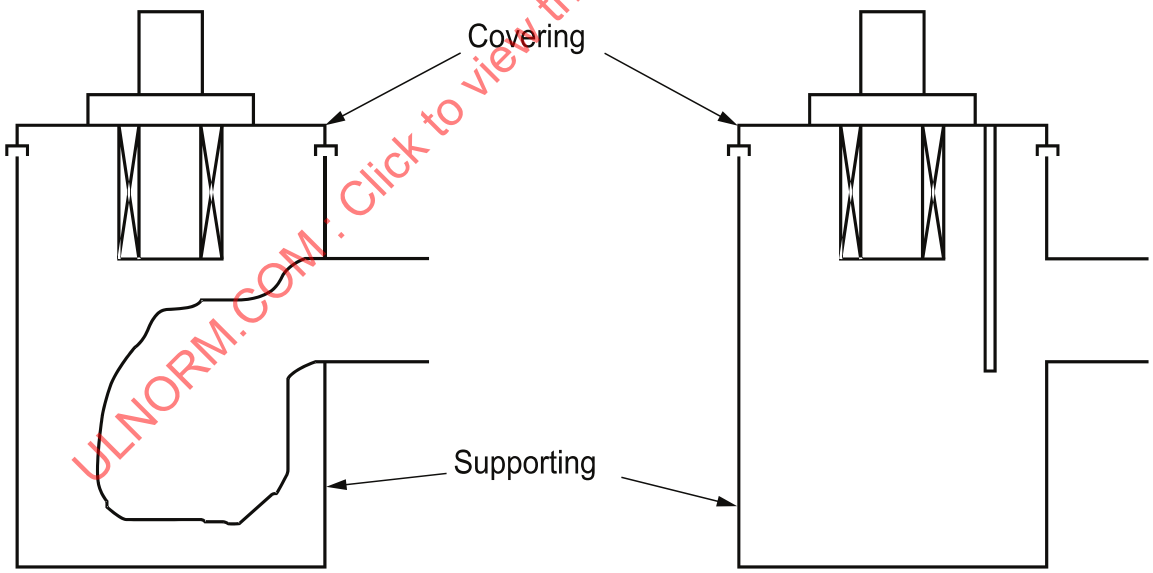


Figure CC.1

Non-metallic parts enclosing collected combustible dust

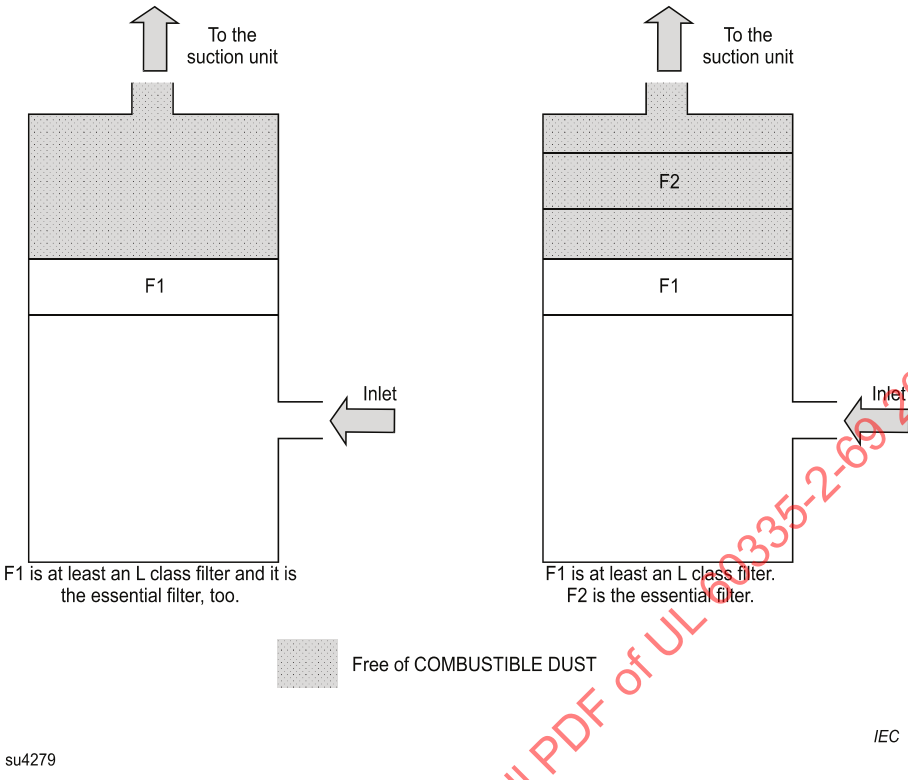


Figure CC.2

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 MΩ

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.

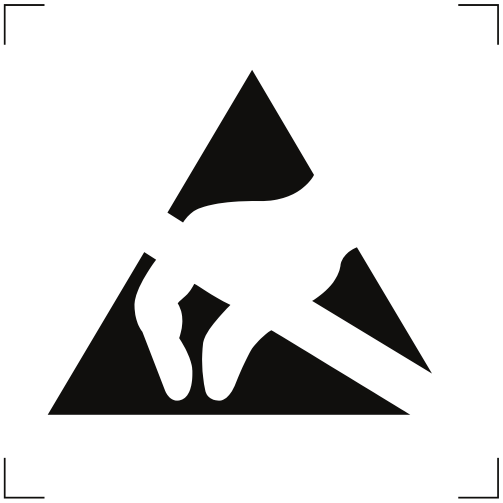
The test is carried out with air moving fans working.

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):



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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 cm^2. 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 Ω.