UL 60335-2-72

STANDARD FOR SAFETY

Household and Similar Electrical Appliances – Safety – Part 2-72: Particular Requirements for Floor Treatment Machines With or Without Traction Drive, for Commercial Use

Household and Similar Electrical Appliances – Safety – Part 2-72: Particular Requirements for Floor Treatment Machines With or Without Traction Drive, for Commercial Use, UL 60335-2-72

First Edition, Dated September 15, 2017

Summary of Topics

This revision of ANSI/UL 60335-2-72 dated November 8, 2019 includes revisions to 20.104.DV3 and 25.1DV to align with the current IEC test procedure for parking breaks

UL 60335-2-72 is an adoption of IEC 60335-2-72, Safety Standard for Household and similar electrical appliances – Safety – Part 2-72: Particular requirements for floor treatment machines with or without traction drive, for commercial use, (Edition 3.0, Issued by the IEC April, 2012). Please note that the national difference document incorporates all of the U.S. national differences for UL 60335-2-72.

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The revised requirements are substantially in accordance with Proposal(s) on this subject dated July 19, 2019.

No Text on This Page

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CAN/CSA-C22.2 No. 60335-2-72:17
First Edition
(IEC 60335-2-72:2012, MOD)

Underwriters Laboratories, Inc.
UL 60335-2-72
First Edition

Household and Similar Electrical Appliances – Safety – Part 2-72: Particular Requirements for Floor Treatment Machines With or Without Traction Drive, for Commercial Use

September 15, 2017

(Title Page Reprinted: November 8, 2019)

This national standard is based on publication IEC 60335-2-72, Third Edition (2012).

ANSI/UL 60335-2-72-2019

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 including revisions through November 8, 2019. The most recent designation of ANSI/UL 60335-2-72 as an American National Standard (ANSI) occurred on November 8, 2019. 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. Any other portions of this ANSI/UL standard that were not processed in accordance with ANSI/UL requirements are noted at the beginning of the impacted sections.

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 particular requirements for floor treatment machines with or without traction drive, for commercial use. It is the first edition of CAN/CSA-C22.2 No. 60335-2-72, and the first edition of UL 60335-2-72. This harmonized standard has been jointly revised on November 8, 2019. For this purpose, CSA Group and UL are issuing revision pages dated November 8, 2019.

This harmonized standard is based on IEC Publication 60335-2-72: Third edition Household and Similar Electrical Appliances – Safety – Part 2-72: Particular Requirements for Floor Treatment Machines With or Without Traction Drive, for Commercial Use, issued March 2012. IEC 60335-2-72 is copyrighted by the IEC.

At the time of this publication, IEC 60335-2-72:2012 is available from IEC in English only. CSA Group will publish the French version when it becomes available from the IEC.

This harmonized standard was prepared by CSA Group and Underwriters Laboratories Inc. (UL). The efforts and support of the Technical Harmonization Committee, 335K 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.

This CAN/CSA-C22.2 No. 60335-2-72, the Standard for Safety for Household and Similar Electrical Appliances – Safety – Part 2-72: Particular Requirements for Floor Treatment Machines With or Without Traction Drive, for Commercial Use, is to be used in conjunction with the first edition of CAN/CSA-C22.2 No. 60335-1:11. The requirements for floor treatment machines, with or without traction drive, for commercial use, are contained in this Part 2 Standard and CAN/CSA-C22.2 No. 60335-1:11. Requirements of this Part 2 Standard, where stated, amend the requirements of CAN/CSA-C22.2 No. 60335-1:11. Where a particular subclause of CAN/CSA-C22.2 No. 60335-1:11 is not mentioned in CAN/CSA-C22.2 No. 60335-2-72, the CAN/CSA-C22.2 No. 60335-1:11 subclause applies.

This UL Standard 60335-2-72, the Standard for Safety for Household and Similar Electrical Appliances – Safety – Part 2-72: Particular Requirements for Floor Treatment Machines With or Without Traction Drive, for Commercial Use, is to be used in conjunction with the fifth edition of 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 60335-2-72, 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 safety and regulatory 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 60335-2-72 Household and Similar Electrical Appliances – Safety – Part 2-72: Particular Requirements for Floor Treatment Machines With or Without Traction Drive, for Commercial Use, copyright 2012, 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.

These materials are subject to copyright claims of IEC and UL. No part of this publication may be reproduced in any form, including an electronic retrieval system, without the prior written permission of UL. All requests pertaining to the Household and Similar Electrical Appliances – Safety – Part 2-72: Particular Requirements for Floor Treatment Machines With or Without Traction Drive, for Commercial Use, UL 60335-2-72 Standard should be submitted to UL.

NATIONAL DIFFERENCES

GENERAL

In the CSA Group and UL publications of this standard, National Differences from the text of International Electrotechnical Commission (IEC) Publication 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, copyright 2012, 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.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY – Part 2-72: Particular Requirements for Floor Treatment Machines With or Without Traction Drive, for Commercial Use

FOREWORD

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

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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 60335-2-72 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 third edition cancels and replaces the second edition published in 2002 and its Amendment 1 (2005). It constitutes a technical revision.

The principal changes in this edition as compared with the second edition of IEC 60335-2-72 are as follows (minor changes are not listed):

The standard has be revised completely and changed significantly, in particular with regard to the following clauses:

- the title has been changed for better distinction with regard to IEC 60335-2-67;
- the scope has been revised editorially to avoid misunderstandings;
- Clause 3 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 markings and instructions (Clause 7) have been revised basically;
- a new Annex DD 'Emission of acoustical noise' was added; and
- a new Annex EE 'Emission of vibration' was added.

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

FDIS	Report on voting
61J/491/FDIS	61J/500/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 floor treatment machines with or without traction drive, 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:

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

NOTE 3 The following print types are used:

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

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

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 web site under ″http://webstore.iec.ch″ in the data related to the specific publication. At this date, the publication will be

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

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

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 paragraphs immediately before and after Note 1 in the Part 2 Foreword by replacing it with the following:***

Note 1 When "Part 1" is mentioned in this standard, it refers to CSA C22.2 No. 60335-1-11 / UL 60335-1 (5th Ed.)

This part 2 supplements or modifies the corresponding clauses in CAN/CSA C22.2 No. 60335-1 Ed. 1: 2011-10-31 / UL 60335-1 Ed. 5: 2011-10-31 (based on IEC 60335-1 Ed. 4.2:2006), so as to convert that publication into the CSA/UL standard: Particular requirements for floor treatment machines with or without traction drive, for commercial use

102DV DE ***Modify the paragraph following Note 3 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 ***Modify by adding 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.

104DV D2 ***Modify by adding the following text to DV.2 of the Part 1 Foreword:***

Relevant requirements for components are listed in Annex 101.DVB.

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 electrical household and similar 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 so far as possible so that there is compatibility with the wiring rules when the appliance is connected to the supply mains. However national wiring rules may differ.

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

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

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

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

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

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

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

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY – Part 2-72: Particular requirements for floor treatment machines with or without traction drive, for commercial use

1 Scope

This clause of Part 1 is replaced by the following.

This International Standard deals with the safety of powered ride-on and powered WALK-BEHIND MACHINES intended for commercial indoor or outdoor use for the following applications:

– sweeping,

– scrubbing,

– wet or dry pick-up,

– polishing,

– application of wax, sealing products and powder based detergents,

– shampooing

of floors with an artificial surface.

Their cleaning motion is more linear than lateral or periodic.

NOTE 101 By contrast, the cleaning motion of machines covered by IEC 60335-2-67 is more lateral or periodic than linear.

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 may be equipped with a TRACTION DRIVE system. The following power systems are covered:

– internal combustion engines,

– mains powered motors up to a RATED VOLTAGE of 250 V for single-phase appliances and 480 V for other appliances,

– battery powered motors.

Battery powered machines may be equipped with a built-in battery charger.

This standard does not apply to

– floor treatment appliances for household use according to IEC 60335-2-10;

– floor treatment machines for COMMERCIAL USE according to IEC 60335-2-67;

– spray extraction machines for COMMERCIAL USE (IEC 60335-2-68);

– wet and dry vacuum cleaners, including power brush, for COMMERCIAL USE (IEC 60335-2-69);

– road sweepers;

NOTE 103 In Europe, EN 13019 covers road sweepers.

– machines designed for use on SLOPES with a gradient exceeding 20 %;

– machines equipped with a power take-off (PTO);

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

– machines designed for picking up hazardous dusts (as defined in IEC 60335-2-69), inflammable substances, or glowing particles;

– machines designed for use in vehicles or on board of ships or aircraft.

NOTE 104 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;

– RIDE-ON MACHINES designed for transport over public roads can be subject to additional requirements (e.g. lighting, license plate etc.).

1DV.1 DE *Modify by replacing the second sentence following Note 102 and the dashed list with the following:*

They include the following energy sources or power systems, or combinations of them:

– mains up to a rated voltage of 250 V for single-phase appliances and 480 V for other appliances,

– internal combustion engines;

– batteries supplying 150 V or less;

– double layer (ultra) capacitors;

– fuel cells.

Energy sources or power systems utilizing both BATTERY and mains are excluded.

1DV.2 DE *Modify the first four dashed items by replacing with the following:*

– floor treatment appliances for household use according to CAN/CSA-E60335-2-10 / CSA C22.2 No. 243 / UL 1017;

– floor treatment machines for COMMERCIAL USE according to CAN/CSA-E60335-2-67 / CSA C22.2 No. 10 / UL 561;

– spray extraction machines for COMMERCIAL USE (CAN/CSA-E60335-2-68 / CSA C22.2 No. 10 / UL 561);

– wet and dry vacuum cleaners, including power brush, for COMMERCIAL USE (CAN/CSA-E60335-2-69 / CSA C22.2 No. 243 / UL 1017;

1.101.DV DR *Add the following clause to the Part 1:*

Except as noted, powered cleaning machines covered by this standard, other than mains supplied machines, are those identified by NFPA 505 as Types E, EE, ES, CGH, CNS, G, GS, D, DS, LP, LPS, CN, G/LP, GS/LPS, G/CN, and GS/CNS. Not covered by this standard are NFPA 505 Types EX, DY, and DX.

NOTE Additional requirements applicable to machine designations that include the letters "EE" or "S" can be found in Annexes 101.DVD and 101.DVE.

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 62061, *Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems*

ISO 3411, *Earth moving machinery – Human physical dimensions of operators and minimum operator space envelope*

ISO 5353, *Earth-moving machinery, and tractors and machinery for agriculture and forestry – Seat index point*

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

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

ISO 13857, *Safety of machinery – Safety distances to prevent hazard zones being reached by the upper and lower limbs*

ISO 25119 (all parts), *Tractors and machinery for agriculture and forestry – Safety-related parts of control systems*

Replacement:

IEC 60068-2-78:2001, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

2DV.1 DC *Modify by adding the following reference publications:*

CSA Group

C22.2 No. 10-1965 (R2013), Electric floor surfacing and cleaning machines

C22.2 No. 243-15, Vacuum cleaners, blower cleaners, and household floor finishing machines

CAN/CSA-E60335-2-10:15, Household and similar electrical appliances — Safety — Part 2-10: Particular requirements for floor treatment machines and wet scrubbing machines

CAN/CSA-E60335-2-69-01 (R2015), Safety of household and similar electrical appliances - Part 2: Particular requirements for wet and dry vacuum cleaners, including power brush, for industrial and commercial use

CAN/CSA-E730-2-2-94 (R2013), Automatic electrical controls for household and similar use - Part 2: Particular requirements for thermal motor protectors

UL

21 , Standard for LP-Gas Hose

62 , Flexible Cords and Cables

157 , Gaskets and Seals

561 , Standard for Floor-Finishing Machines

569 , Standard for Pigtails and Flexible Hose Connectors for LP-Gas

558 , Standard for Industrial Trucks, Internal Combustion Engine-Powered

583 , Standard for Electric-Battery-Powered Industrial Trucks

746C , Standard for Polymeric Materials - Use in Electrical Equipment Evaluations

969 , Standard for Marking and Labeling Systems

1004–1 , Standard for Rotating Electrical Machines - General

1004–3 , Standard for Thermally Protected Motors

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

1337 , Outline of Investigation for LP-Gas, Natural Gas, and Manufactured Gas Devices for Engine Fuel Systems

2003 , Outline of Investigation for LP-Gas Cylinder Assemblies

IEC

60216-6, Electrical insulating materials - Thermal endurance properties - Part 6: Determination of thermal endurance indices (TI and RTE) of an insulating material using the fixed time frame method

60695–10–3, Fire hazard testing - Part 10-3: Abnormal heat - Mould stress relief distortion test

60695-11-20:2015, Fire hazard testing - Part 11-20: Test flames - 500 W flame test method

62885-2, Surface cleaning appliances – Part 2: Dry vacuum cleaners for household or similar use – Methods for measuring the performance

ISO

3405, Petroleum products - Determination of distillation characteristics at atmospheric pressure

SAE

J30, Fuel and Oil Hoses

J1681, Recommended Practice for Gasoline, Alcohol, and Diesel Fuel Surrogates for Material Testing

J2044, Quick Connect Coupling Specification For Liquid Fuel and Vapor/Emissions Systems

J2045, Fuel System Tubing Assemblies

J2260, Nonmetallic Fuel System Tubing with One or More Layers

NFPA

NFPA 505, Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations

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, as intended by the manufacturer

It denotes the load corresponding to the RATED POWER INPUT or the highest obtainable load of all particular loads of the various functions that can be operated at the same time in accordance with the manufacturer's instructions. For machines provided with a seat or an OPERATOR platform, a mass of 75 kg secured in position at the appropriate height is used to simulate the OPERATOR in the most unfavourable position.

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

Operational functions include all treatment and driving functions.

The NORMAL OPERATION related to the operational functions is specified in 3.1.9.101 to 3.1.9.103:

3.1.9.101
Scrubbing and sweeping machines are operated on a surface of hydraulically pressed concrete paving slabs (see Annex AA) intermittently at least 30 min switched on, and for a period of 5 min switched off.
An alternative is a smooth concrete area of a surface consistency comparable with hydraulically pressed concrete paving slabs.

3.1.9.102
Polishing and dry buffing machines are operated as follows.
PVC- or comparable flooring surfaces are considered to be suitable for establishing normal operation. The peak of input occurring during the drying process of the chemical applied to treat the surface is not taken as NORMAL OPERATION but is averaged by extending measurements over a period of at least 10 min.

3.1.9.103
Carpet shampooers are operated on a test surface consisting of a carpet, in accordance with IEC 60312-1, the carpet being fastened to the floor.
Prior to testing, the brush of the shampooing machine is conditioned by operating it for 15 min on a clean, dry concrete surface. After running on the concrete surface, the brush is immersed in a shampoo solution for at least 30 min.
The solution tank is filled and the machine is operated over a period of 10 min.

3.1.9.103DV DE *Replace the first paragraph with the following:*

Carpet shampooers are operated on a test surface consisting of a carpet, in accordance with IEC 60312-1 or IEC 62885-2, the carpet being fastened to the floor.

3.4.2DV D1 *Modification by replacing 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
TRACTION DRIVE – system used to propel the machine, e.g. by powered wheels
Traction by the effect of rotating brushes is not included.

3.102
WALK-BEHIND MACHINE – machine with or without a TRACTION DRIVE designed to be controlled by the OPERATOR walking behind the machine
It may be equipped with a detachable SULKY.

3.103
RIDE-ON MACHINE – machine with a TRACTION DRIVE and with an OPERATOR seat or a platform on which the OPERATOR is sitting/standing during operation

3.104
SULKY (TRAILER) – removable trailing seat or stand-on platform with wheels or skids designed to carry an OPERATOR in a sitting or standing position, while controlling a WALK-BEHIND MACHINE with TRACTION DRIVE

3.105
WET CLEANING MACHINE – machine for applying and sucking up liquids

3.106
WATER-SUCTION CLEANING MACHINE – machine for sucking up liquids

3.107
MOTORIZED CLEANING HEAD – hand-held or hand-guided cleaning device connected to the machine, with an integrated electrical motor
Note 1 to entry: The main cleaning head permanently attached is not regarded as a MOTORIZED CLEANING HEAD.

3.108
HOPPER – container to store picked up debris

3.109
PARKING BRAKE – means, actuated by the OPERATOR in the normal operating position, to prevent a stationary machine from moving

3.110
SERVICE BRAKE – means for decelerating and stopping a machine, with a TRACTION DRIVE, from its ground travel speed

3.111
OPERATOR PRESENCE CONTROL (OPC) – control device that automatically interrupts the power, e.g. to a drive or an engine, when the OPERATOR's actuating force is removed
Note 1 to entry: Such devices can be, for example, continuous action controls (″hold-to-run″ controls) or seat switches.

3.112
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.

3.113
OPERATOR – person installing, operating, adjusting, cleaning, moving, or performing user maintenance on the machine

3.114
GROSS VEHICLE WEIGHT (GVW) – maximum allowable fully laden weight of the machine and its payload, as ready for use
Note 1 to entry: See 5.102 for further test conditions.

3.115
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 $C_{12}H_{25}NaSO_4$.

3.116
LEVEL SURFACE – plane with a gradient up to and including 2 %

3.117
SLOPE – inclined plane with a gradient greater than 2 % but not exceeding 20 %

3.118
MAXIMUM CLEANING GRADEABILITY – maximum gradient according to manufacturer's instruction and as indicated on the machine, on which the machine can be used safely for cleaning purposes

3.119
MAXIMUM TRANSPORT GRADEABILITY – maximum gradient according to manufacturer's instruction, on which the machine can be used safely for transport purposes

3.120
BUILT-IN CHARGER – charger mounted on or into the machine and designed to operate only on or into the machine.
Note 1 to entry: BUILT-IN CHARGERS can also be called on-board chargers.

3.121
BUILT-IN CHARGER WITH POWER SUPPLY FUNCTION – component intended to provide power for charging, operation or both

3.121DV DE *Delete Clause 3.121 of the Part 2:*

This definition does not apply.

3.122
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.

3.123DV 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 (a) – (c):

a) The maximum load current shall be drawn under any condition of loading, including short circuit, using a resistor. The current shall be measured 60 s after the application of the load. The resistor shall be continuously readjusted during this 1 min. period to maintain maximum load current. The measured load current shall not exceed the value listed in Table 3.123DV.

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

c) The performance shall not be affected by malfunction of a single component, excluding resistors. The network shall comply with the value in Table 3.123DV; or

– a BATTERY with output current limited by overcurrent protection in accordance with Table 3.123DV.

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

Table 3.123DV – 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.	

3.124DV D2 *Add the following definition to Clause 3 of the Part 2:*

BATTERY – one or more electrical cells, electrically connected so that the combination furnishes current as a unit.

There is one positive and one negative externally accessible connection, and there are no externally accessible inter-cell connections.

NOTE See IEV (IEC 60050) definition 482-01-04.

3.125DV D2 *Add the following definition to Clause 3 of the Part 2:*

BATTERY ASSEMBLY – a multi-cell BATTERY design that is ready for use, contains a common pressure vessel construction, a single vent line assembly, and shared hardware and that is furnished with a single connection cable that has an electrical connector at the end

NOTE See IEV (IEC 60050) definition 482-02-17.

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.

4DV DE *Modification of Clause 4 of the Part 2:*

Replacing “cause no danger to person or surroundings” with “reduce the risk of fire, electric shock, and/or injury to persons” in the third paragraph.

Addition:

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

5 General conditions for the tests

This clause of Part 1 is applicable except as follows.

5.14DV.1 DE *Modification of Clause 5.14 of the Part 1:*

Replace "NOTE" with "NOTE 1DV".

5.14DV.2 DE *Modification of Clause 5.14 of the Part 1 by adding the following NOTE:*

NOTE 2DV Attention is drawn to the second paragraph of 5.14, as this requires the evaluation of Class II constructions within Class I appliances.

5.101 *The TEST SOLUTION is to be stored in a cool atmosphere and used within seven days after its preparation.*

5.102 *The GVW includes, if applicable, full clean water tanks, empty dirty water tanks (half full for recycling systems), empty dust bags, HOPPER loaded at rated capacity, largest recommended batteries, all options such as cords, hoses, wands, cleaning agents, brooms and brushes.*

For RIDE-ON MACHINES, the GVW includes a standard OPERATOR, weighing 75 kg

5.103 *Liquid containers of machines for wet scrubbing and shampooing are filled to the highest level indicated by the manufacturer.*

5.104 *Machines that are designed to have a SULKY are tested with the sulky including the weight of a standard OPERATOR (75 kg) or without the SULKY, whichever is the most unfavourable condition.*

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 *Replacement:*

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

– CLASS I,

– CLASS II, or

– CLASS III.

Compliance is checked by inspection and by the relevant tests.

6.2 *Addition:*

Mains supplied and battery powered machines for indoor use intended for dry cleaning only shall be at least IPX0. Other machines shall be at least IPX3.

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;

7.1DV.1 D2 ***Modify by adding the following dashed item after the Part 2 replacement of the 4th dashed item:***

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

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.

– GVW of the machine, in kg;

– the symbol indicating the MAXIMUM CLEANING GRADEABILITY, with the value of x.

7.1DV.2 DE ***Modify by adding the following dashed item after the second dashed item below NOTE 102 of the Part 2:***

– the applicable NFPA 505 Type designation (i.e., E, EE, ES, CGH, CNS, G, GS, D, DS, LP, LPS, CN, G/LP, GS/LPS, G/CN, GS/CNS). (This requirement is not applicable to mains supplied machines.)

NOTE 103 I.e. the machine might be able to drive on a higher gradient (maximum transport gradeability). This additional information can be given also in the instructions for use.

Machines intended to be used indoors and powered by internal combustion engines shall be marked in addition with the symbol according to Figure 106. It is acceptable to show this symbol in monochrome colour.

7.1.101 MOTORIZED CLEANING HEADS shall be marked with

– RATED VOLTAGE or RATED VOLTAGE RANGE in volts;

– RATED POWER INPUT in watts;

– name, trade mark or identification mark of the manufacturer or responsible vendor;

– model or type reference;

– mass of the most usual configuration in kg.

MOTORIZED CLEANING HEADS for water-suction cleaning appliances, except those of CLASS III construction having a WORKING VOLTAGE up to 24 V shall be marked with symbol IEC 60417-5935 (2002-10).

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

Compliance is checked by inspection.

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

Compliance is checked by inspection.

7.1.103DV D2 *Add the following text to Clause 7.1 of the Part 2:*

BATTERIES and BATTERY ASSEMBLIES shall be legibly and permanently marked with the following:

a) The manufacturer's name, trade name, or trademark.

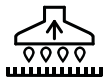
***Exception: The manufacturer's identification may be in a traceable code when the BATTERY* is identified by the brand or trademark owned by a private labeler.**

b) Catalog designation or equivalent identification.

c) BATTERY nominal voltage, rated ampere-hour capacity, and the hour rating at which this capacity is determined.

d) Additionally, BATTERY ASSEMBLIES shall be marked with identification letters – "Type E," "Type EE," or "Type EO." Individual batteries do not require type marking.

7.6 *Addition:*

x %		maximum cleaning gradeability ‘x’
	[symbol IEC 60417-5935 (2002-10)]	motorized cleaning head for water-suction cleaning

su2365

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 instructions before using the machine.

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

The instructions shall contain at least the following:

– the business name and full address of the manufacturer and, if applicable, his authorized representative;

– designation of 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 GVW of the machine in kilograms;

– the transportation weight of the machine in kilograms, which includes the batteries but excludes options (e.g. driver cabin, FOPS, second and third side broom, front mounted sweeping attachment for scrubbers), fresh water (in case of scrubbers or combined machines), and the weight of a standard operator (75 kg);

– 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 suction nozzles, spray bars, 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 GVW;

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

– the conditions in which the machine meets the requirement of stability during use, transportation,

assembly, dismantling when out of service, testing or foreseeable breakdowns;

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

– the 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.

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;

– information on the seat adjustment and related parts;

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

For machines having a TRACTION DRIVE and a GVW exceeding 100 kg, the instructions shall also include the substance of the following:

– in order to prevent unauthorized use of the machine, the power source shall be switched off or locked, for example by removing the key of the main switch or the ignition key.

For machines with a TRACTION DRIVE that are designed to be used on SLOPES, the instructions shall also include the substance of the following:

– machines left unattended shall be secured against unintentional movement.

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 Always ensure that the safety support is installed before working beneath hopper.

– WARNING This machine is for dry use only.

– WARNING Do not inhale exhaust gas fumes. Only use indoors when adequate ventilation is provided, and when a second person has been instructed to look after you.

– 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 non frame connected pole of the battery or by an equivalent method (disconnecting device);
- for internal combustion engine powered machines, by removing the ignition key and by disconnecting the battery.

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

– WARNING Do not use for cleaning purposes on surfaces having a gradient exceeding that marked on the machine.

NOTE 2 If the machine is marked for use on surfaces having a gradient up to and including 2 %, this warning can be replaced by the following:

WARNING Do not use on SLOPES.

Instructions for RIDE-ON MACHINES fitted with hazardous exposed moving side brushes shall also include the substance of the following:

– WARNING Always ensure that the warning light is switched on when the hazardous exposed side brushes are moving.

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.

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.

Instructions for RIDE-ON MACHINES shall also include the substance of the following, if applicable:

– WARNING Do not use the machine without a falling object protective structure (FOPS) in areas where it is likely that the operator is hit by falling objects.

Instructions for internal combustion engine powered machines using LPG shall also include the substance of the following:

– WARNING Machines shall be parked safely.

– The machine shall be inspected by a qualified person regularly, in particular regarding the LPG container and their connections, as required for safe operation by regional or national regulations.

7.12.102 Information on noise

NOTE The instructions can provide information on airborne noise emission as indicated in DD.2.7.

7.12.103 Information on vibration

NOTE The instructions can provide information on vibration emission as indicated in EE.2.

7.12.104.DV DR *Add Clauses 7.12.104.DV.1 and 7.12.104.DV.2 to Clause 7.12 of the Part 2:*

7.12.104.DV.1 The instructions for Class I, mains supplied machines shall include the text or the equivalent in (a) plus the information in (b) or (c), as appropriate. The instructions for Class II mains supplied machines shall include the text or the equivalent in (d):

a) For all Class I appliances:

> **This floor-finishing machine shall be grounded while in use to protect the operator from electric shock. The machine is provided with a three-contact grounding-type attachment plug to fit the proper grounding type receptacle.**

b) For a Class I machine rated less than 15 A and intended for use on a nominal 120-V supply circuit, the instructions shall include the statements in either (1) or (2):

> **1) This appliance is for use on a nominal 120-V circuit, and has a grounded plug that looks like the plug illustrated in sketch A in Figure 107.DV. A temporary adaptor that looks like the adaptor illustrated in sketches B and C may be used to connect this plug to a 2-pole receptacle as shown in sketch B if a properly grounded outlet is not available. The temporary adaptor should be used only until a properly grounded outlet (sketch A) can be installed by a qualified electrician. The green-colored rigid ear, lug, or the like extending from the adaptor must be connected to a permanent ground such as a properly grounded outlet. Whenever the adaptor is used, it must be held in place by a metal screw.**

Exception: In Canada, the use of a temporary adaptor is not permitted by the Canadian Electrical Code, CSA C22.1.

> **2) This appliance is for use on a nominal 120-V circuit and has a grounding attachment plug that looks like the plug illustrated in sketch A in Figure 107.DV. Make sure that the appliance is connected to an outlet having the same configuration as the plug. No adaptor should be used with this appliance.**

c) For Class I machines rated 150 – 250 volts:

> **No adapter is available for this plug.**

d) For all Class II appliances:

> **In a double-insulated product, two systems of insulation are provided instead of grounding. No grounding means is provided on a double-insulated machine, nor should a means for grounding be added to the machine. Servicing a double-insulated machine requires extreme care and knowledge of the system, and should be performed only by qualified service personnel. Replacement parts for a double-insulated machine must be identical to the parts they replace. Always replace a damaged cord. A double-insulated product is marked with the words "DOUBLE INSULATION" or "DOUBLE INSULATED." The symbol: ⧈ (square within a square) may also be marked on the machine.**

Exception No. 1: Machines intended for rental use may be provided with legible and permanent safety instruction markings instead of an instruction manual. The markings shall include all of the applicable safety instructions required in 7.12 and its subclauses. The marking's letter height shall be not less than 2.4 mm (3/32 inch) and any caution or warning signal word shall be more prominent than any other required marking on the unit.

Exception No. 2: Machines intended for rental use, and provided with a specialty connector or assembly for connection of the power supply cord to the machine, may be provided with the markings described in Exception No. 1 in the form of a cord tag; see 7.101DV.1 - 7.101DV.6. The statement, "Do Not Remove This Tag", or equivalent wording, shall be included on the cord tag.

7.12.104.DV.2 A Class II mains supplied machine provided with a two-blade, polarized attachment 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 plug 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 (2002-10) shall be at least 15 mm.

Compliance is checked by measurement.

7.101DV D2 *Modification of Subclause 7.14 of the Part 1: add the following:*

7.101DV Tags

7.101DV.1 A cord tag used for cautionary markings and a tag other than a cord tag that is used for cautionary or warning markings shall comply with the requirements:

a) In 7.101DV.2 – 7.101DV.5; and

b) For permanence and legibility in UL 969/ C22.2 No. 0.15.

7.101DV.2 Three as-received samples and six samples of the tag that have been subjected to the conditioning specified in 7.101DV.4, three for each condition, shall be subjected to the test described in 7.101DV.5. After testing, the samples shall comply with the following requirements:

a) The tag shall not tear for more than 1,6 mm at any point;

b) The tag shall not separate from its point of attachment;

c) The tag shall not slip or move along the length of a cord or a tubular-type mounting surface more than 15 mm.

d) There shall be no permanent shrinkage, deformation, cracking, or any other condition that will render the marking on the tag illegible; and

e) Overlamination shall remain in place and not be torn or otherwise damaged. The printing shall remain legible.

7.101DV.3 Each sample shall consist of a length of cord or tubular-type mounting surface, or if the surface is flat, a section of the surface having dimensions larger than the tag. The tag shall be affixed to the cord or surface in the intended manner. If tags are applied by an adhesive, tests shall be conducted no sooner than 24 h after application of the tag.

7.101DV.4 The conditioning required by 7.101DV.2 shall consist of the following:

a) The samples shall be conditioned for 24 h in an air-circulating oven maintained at a uniform temperature of 87,0 ±1,0°C. Following removal from the oven, the samples shall remain at a temperature of 23,0 ±2,0°C and a relative humidity of 50 ±5 percent for 30 min before testing.

b) The samples shall be conditioned for 72 h in a humidity of 85 ±5 percent at 32,0 ±2,0°C. The samples shall be tested within 1 min after the conditioning.

7.101DV.5 A cord or tubular-type mounting surface shall be held rigidly in a vertical orientation. A flat mounting surface shall be held rigidly in a vertical plane. A force of 22,3 N shall be applied to the uppermost corner of the tag farthest from the point of attachment, within 7 mm of the vertical edge of the tag. The force shall be applied vertically downward and maintained for 1 min. In determining compliance with 7.101DV.2(d), manipulation such as straightening of the tag by hand is permitted.

7.101DV.6 The cord tag shall:

a) Be permanently affixed to the power-supply cord; and

b) Be located not more than 150 mm from the attachment plug.

7.16DV D2 *Modification of Clause 7.16 of the Part 1 by deleting the NOTE:*

This NOTE does not apply.

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 *Add a dash item to 8.1.4 of the Part 1:*

– the part is supplied by a battery, and the voltage does not exceed 60 V d.c.

9 Starting of motor-operated appliances

This clause of Part 1 is replaced by the following.

It shall only be possible to start the machine by intended actuation of a control device provided for the purpose. The same requirement applies when restarting the machine after a stoppage, whatever the cause. This requirement only applies to components where the unexpected starting might cause a hazard. It does not apply to components such as suction units, pumps, etc.

Compliance is checked by inspection and test.

9DV.2 DR *Modification by replacing the text of Clause 9DV.2 in the Part 1 with the following:*

The use of time delay fuses is acceptable for stationary or portable appliances marked as indicated in Clause 7.17DV.

9DV.5 DR *Add the following text to Clause 9 of the Part 1:*

Subclauses 9DV.1 – 9DV.4 apply to all mains supplied machines.

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 disassemble the machine for fitting these thermo-couples and related 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 if the assembling has been accomplished properly.

11.3DV D2 *Modification by replacing the paragraph following NOTE 3 of the Part 1 with the following:*

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

11.5 *Addition:*

The NORMAL OPERATION may be simulated by applying appropriate braking equipment.

For battery powered machines, the test is carried out commencing with a fully charged battery.

11.7 Addition:

Machines are operated until steady conditions are established.

Table 3DV D2 *Modification of Table 3 of the Part 1 by adding NOTE 5DV:*

NOTE 5DV A temperature is considered constant when readings taken during any continuous 1 h period of the test indicate an increase of no more than 3 K, or until the batteries have been discharged, whichever comes first.

12 Void

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable except as follows.

13.1.DV.1 D2 *Delete Clause 13.1DV.1 of the Part 1.*

The requirements of 13.1DV.1 do not apply.

13.1.DV.2 D2 *Modification by adding the following Clause to 13.1 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. Testing a representative subassembly instead of an entire unit is permitted. Individually shunting the semiconductor devices in the unit before the test is made to avoid destroying them in the case of a malfunction elsewhere in the secondary circuits is permitted.

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 *Modification: Delete the first paragraph of 13.2 of the Part 2.*

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 Modification:

Replacement of the first sentence by the following:

The enclosure of the machine shall provide the degree of protection against moisture in accordance with the classification of the machine, except for batteries.

Addition:

For mains supplied machines used outdoors, the tests referred to in 15.1.1 shall be carried out with suction devices operating.

15.2 *Addition:*

For the following tests, detachable cords shall be removed.

Mains supplied machines including liquid containers, with a GVW up to 100 kg, are tilted with the full container into the most unfavourable horizontal position, and left in this position for 5 min.

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.

After these tests:

– WET CLEANING MACHINES, except shampooing machines, are operated 10 min under NORMAL OPERATION on a floor of paving slabs with a smooth surface that are fastened to the bottom of a tray. At the beginning of the test, the tray is filled with the TEST SOLUTION to a level of approximately 5 mm above the surface of the floor;

– shampooing machines are operated 20 min under NORMAL OPERATION;

– the WATER SUCTION CLEANING MACHINE including the MOTORIZED CLEANING HEAD is operated until its liquid container is completely full and afterwards for a further 5 min.

All machines with a liquid container shall be subjected with attached cord to the overflow test using the TEST SOLUTION.

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

There shall be no trace of liquid on insulation that reduces the CLEARANCES or CREEPAGE DISTANCES below the values specified in Clause 29.

15.3 *Addition:*

If it is not possible to place the whole machine in the humidity cabinet, and to comply with the requirements of 4.1 of IEC 60068-2-78, it is also sufficient to monitor the required climate conditions at the relevant locations in the machine.

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 floor treatment machine for 15 min, if applicable; and

– connected to the floor treatment machine until the machine 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 liquid 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.

16.1.DV D2 *Delete Clause 16.1DV of the Part 1:*

The requirements of 16.1DV do not apply.

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

The requirements of 16.2.DV.2 do not apply.

16.1.DV.3 D2 *Modification adding 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. Testing a representative subassembly instead of an entire unit is permitted. Individually shunting the semiconductor devices in the unit before the test is made to avoid destroying them in the case of a malfunction elsewhere in the secondary circuits is permitted.

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 except as follows:

17.101 For battery powered machines, the following requirements apply:

– each circuit shall be protected against short-circuit or overload by a PROTECTIVE DEVICE, for example by fuses, overcurrent switches, protectors with relays or contactors;

– a single PROTECTIVE DEVICE may be used for more than one circuit if the sum of the working currents of the connected circuits does not exceed 16 A;

– for TRACTION DRIVE motors denoted for switching in series or in parallel, a single PROTECTIVE DEVICE may be used;

– the PROTECTIVE DEVICE shall be located close to the point of feeding the circuit. If this is impossible, the unprotected length of the wiring shall be as short as possible.

PROTECTIVE DEVICES may be used also for switching and control purposes in NORMAL OPERATION if their construction is adequate (allowable current capacity for inrush-current, switching rate, etc.).

Compliance is checked by inspection.

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.

19.7 *Addition:*

Brush and TRACTION DRIVE *motors are tested for 30 s.*

Fan blades are not regarded as parts liable to be jammed.

Battery powered machines and/or their electrical components shall be capable of being supplied at 0,7 times RATED VOLTAGE *without impairing the safety requirements of this standard.*

Compliance is checked by operation of all functions by testing at 70 % of the RATED VOLTAGE *in cases when this may impair the safety requirements of this standard.*

The requirements are deemed to be met if an overcurrent protection, fuse or any other safety device interrupts the circuit before the allowed temperature of the windings is reached.

MOTORIZED CLEANING HEADS *are tested with the rotating brush or similar device locked for 30 s.*

19.9 Not applicable.

19.13 In the second paragraph add ", 22.105 and 22.115" after "20.2".

19.101 *Machines having 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 shall be taken to suck up an air-liquid mixture to prevent overloading of the motor of the suction unit. The input power shall 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.*

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.1 *Replacement:*

Machines and their components and fittings shall have adequate mechanical stability when in use.

The following test is not applicable to MOTORIZED CLEANING HEADS.

Compliance is checked by inspection and by the following test.

Machines provided with doors or covers that can be opened without a tool are tested with the doors or covers open or closed, whichever is the more unfavourable. Doors or covers that can be opened only with the aid of a tool remain closed.

Machines intended to be filled with liquid by the user in normal use are tested empty and tested again completely filled with water.

The machine is placed with the motor switched off, in the normal position of use on a gradient of 10 % or the maximum climbing capacity as indicated on the machine, whichever is greater, in the most unfavourable direction. During the test, the PARKING BRAKE, if any, shall be applied and the wheels or rollers shall be blocked. Cords shall be reeled and positioned on the machine at the normal storing place, if applicable.

Lift-off shall not occur at any wheel or roller.

20.2 *Replacement:*

Moving parts of machines shall, as far as compatible with the use and working of the machine and depending on the risk, be positioned and/or guarded and/or enclosed and/or equipped with PROTECTIVE DEVICES to provide adequate protection against personal injury in normal use.

NOTE 101 For some machines, complete protection is impracticable.

Protective enclosures, GUARDS and similar parts shall be NON-DETACHABLE PARTS and shall have adequate mechanical strength.

NOTE 102 Enclosures that can be opened by overriding an interlock by applying the test probe are considered to be DETACHABLE PARTS.

The unexpected reclosure of self-resetting thermal cut-outs and overcurrent PROTECTIVE DEVICES shall not cause a hazard.

In particular

– cog and chain wheels and belt pulleys shall be enclosed and the inlet openings of chains or belts shall be guarded;

– slots, KEYS, screws, etc., on rotating or moving parts shall be enclosed or guarded by smooth and rounded GUARDS;

– shaft ends and similar rotating parts shall be protected if they protrude by more than a quarter of their diameter, except rounded shaft ends shorter than 50 mm;

– places where crushing or cutting could occur shall be avoided or covered;

– protective covers or GUARDS shall be sufficiently far from moving parts or shall be so designed that an access by hand or foot is prevented.

Covers or GUARDS are not needed for the bristles of rotating brushes or brooms. The solid parts of rotating brushes that are accessible during operation shall, however, be protected. Covers or GUARDS are also not needed for rotating brushes or similar devices and to moving parts of machines if they become accessible during converting the machine to another application by changing of attachments.

The unintentional closing or slamming of side walls, lids, covers, etc., that could cause injury shall be prevented.

Wheels or rollers for the TRACTION DRIVE or the transport of machines shall be located or protected as to prevent injury to the feet of the OPERATOR.

The safety distances given in ISO 13857, except Table 5, shall be taken into account. In particular, it shall not be possible to touch moving parts from the OPERATOR's position

Compliance is checked by inspection, by measurements, by the tests of 21.1 and by applying a force not exceeding 5 N by means of a test probe that is similar to test probe B of IEC 61032 but having a circular stop face with a diameter of 50 mm, instead of the noncircular face.

For machines provided with movable devices such as those intended for varying the tension of belts, the test with the test probe is carried out with these devices adjusted to the most unfavourable position within

their range of adjustment. If necessary, belts are removed.

It shall not be possible to touch dangerous moving parts with this test probe.

20.101 Machines with TRACTION DRIVE and a GVW exceeding 100 kg shall be equipped with:

– a device to prevent unauthorised switching-on the driving and the operational functions, for example a key-operated switch, mechanical locking means or removable control handles;

– a switch-off device for the driving operation, which can be operated rapidly without danger from the OPERATOR's position, in case the controls for NORMAL OPERATION fail. This switch-off device can be an interruption of the mechanical or electrical drive.

It is allowed to combine these devices into one device, for example a key-operated switch.

Compliance is checked by inspection and functional test.

20.102 Pedals shall be arranged so that they can be operated without risk of confusion. Their surface shall be slip-resistant and easy to clean.

Compliance is checked by inspection.

20.103 WALK-BEHIND MACHINES shall not exceed a maximum speed of 6 km per hour.

Compliance is checked by measurement on a LEVEL SURFACE.

20.104 WALK-BEHIND MACHINES with TRACTION DRIVE that are designed to be used on SLOPES having a gradient exceeding 2 % shall be equipped with a PARKING BRAKE function. This function may be realized by a separate PARKING BRAKE or the switched-off TRACTION DRIVE.

The PARKING BRAKE function shall be capable of holding the machine on a SLOPE with a gradient of 10 %, or the maximum cleaning or transport gradeability, whichever is greater.

Compliance is checked by the following test:

The machine, with the PARKING BRAKE applied or the TRACTION DRIVE switched off, is placed on a SLOPE of dry paving slabs with a smooth surface with a gradient of 10 % or the maximum cleaning or transport gradeability, whichever is greater.

The PARKING BRAKE, if any, is applied with a force not exceeding 200 N.

The machine is operated while loaded to the GVW rating. If the machine is designed for a SULKY, the load shall be increased with an additional mass of 75 kg, replacing the OPERATOR on the SULKY.

The machine shall not move.

20.104.DV D2 *Modification to replace the fourth through seventh paragraphs of Clause 20.104 of the Part 2 with the following:*

20.104.DV.1 The machine, while traveling up a slope, shall be brought to a stop. The PARKING BRAKE shall be applied and/or the TRACTION DRIVE shall be switched off.

20.104.DV.2 The SLOPE shall consist of dry paving slabs in accordance with Annex AA.

20.104.DV.3 The PARKING BRAKE, if any, shall be applied with a force not exceeding

– 400 N, for hand operation, and

– 600 N, for foot operation.

20.104.DV.4 The machine shall be operated while loaded to the GVW rating. If the machine is designed for a SULKY, the load shall be increased with an additional mass of 75 kg, replacing the OPERATOR on the SULKY.

20.104.DV.5 After each of the parking brake functions has been engaged, the machine shall not travel down the slope more than 50 mm, measured from the point of application of the braking function(s), within 30 s.

20.105 Fittings for the coupling of a SULKY with a seat or a platform shall be so designed that they are easily operable and cannot become disconnected unintentionally. Towing bars shall be clear of the floor.

Compliance is checked by the following test:

The pulling force of the connection between the towing machine and the SULKY, loaded with an additional mass of 150 kg, shall be measured on a LEVEL SURFACE when accelerating the machine up to the maximum speed. This connection shall withstand five times the measured pulling force.

20.106 A SULKY shall have non-slip foot rests and shall be so designed that if the machine reverses, the OPERATOR cannot become jammed between the machine and the SULKY.

Compliance is checked by inspection and functional test.

20.107 RIDE-ON MACHINES shall not exceed a maximum speed of 25 km per hour.

They shall be constructed so that

– the TRACTION DRIVE can only be started after the OPERATOR has taken place on the provided seat or platform;

– the TRACTION DRIVE cannot be started without an intentional action.

Compliance is checked by inspection, by functional tests and by measurements on a LEVEL SURFACE.

20.108 RIDE-ON MACHINES shall have a horn controlled by the OPERATOR. If fitted with hazardous exposed moving side brushes, they shall also have a warning light.

The warning light shall be of the appropriate colour (e.g. yellow), taking into account ISO 3864-1, national requirements, and the environment where the machine is to be used.

The construction of the machine shall, as far as possible, not impair the visibility of the OPERATOR.

Compliance is checked by inspection and by functional tests.

20.109 RIDE-ON MACHINES shall be equipped with a PARKING BRAKE function. This function may be realised by a separate PARKING BRAKE or the switched-off TRACTION DRIVE. The PARKING BRAKE function shall be capable of holding the machine on a SLOPE with a gradient of 10 %, or the maximum cleaning or transport gradeability, whichever is greater.

Compliance is checked by the following test.

The machine, with the PARKING BRAKE applied or the TRACTION DRIVE switched off, is placed on a SLOPE of dry paving slabs with a smooth surface with a gradient of 10 % or the maximum cleaning or transport gradeability, whichever is greater.

The PARKING BRAKE, if any, is applied with a force not exceeding

– 400 N, for hand operation, and

– 600 N, for foot operation.

The machine is operated while loaded to the GVW rating.

The machine shall not move.

20.109.DV D2 *Modification to replace Clause 20.109 of the Part 2 with the following:*

20.109.DV.1 Ride-on machines shall be equipped with a parking brake function. This function may be realised by a separate parking brake or the switched-off traction drive.

NOTE: When stated within the manufacturer's owner's manual, the traction wheel(s) may be turned perpendicular to the slope to assist with braking.

20.109.DV.2 The parking brake function shall be capable of holding the machine on a slope with a gradient of 10 %, or the maximum cleaning or transport gradeability, whichever is greater.

Compliance is checked by the following test.

The machine, while traveling up a slope, shall be brought to a stop. The PARKING BRAKE shall be applied and/or the TRACTION DRIVE shall be switched off.

The SLOPE shall consist of dry paving slabs in accordance with Annex AA.

The PARKING BRAKE, if any, shall be applied with a force not exceeding

– 400 N, for hand operation, and

– 600 N, for foot operation.

The machine shall be operated while loaded to the GVW rating.

After each of the parking brake functions has been engaged, the machine shall not travel down the slope more than 50 mm, measured from the point of application of the braking function(s), within 30 s.

20.110 RIDE-ON MACHINES shall be equipped with a SERVICE BRAKE function. This function may be realised by a separate SERVICE BRAKE or the TRACTION DRIVE.

It shall not be possible for the OPERATOR to disconnect the TRACTION DRIVE motors when they are used as SERVICE BRAKES.

Compliance is checked by inspection and by the following test.

The machine, loaded with a mass of its maximum capacity including the OPERATOR (75 kg), is operated at maximum speed on a LEVEL SURFACE of dry paving slabs with a smooth surface. The SERVICE BRAKE function is applied.

If fitted with a SERVICE BRAKE, it is applied with a force not exceeding

– 400 N, for hand operation, and

– 600 N, for foot operation.

The machine shall stop at a distance less than (0,19 × Y) metres, where Y is the maximum speed of the machine in km/h. The result is taken as the mean of three measurements.

20.111 On RIDE-ON MACHINES with a TRACTION DRIVE and with accessible moving parts, switches shall be so located that inadvertent switching-on is unlikely to occur.

Compliance is checked by inspection.

20.112 RIDE-ON MACHINES with an OPERATOR platform shall have adequate front and side protection for the OPERATOR, either by the location and arrangements of the platform or by GUARDS, etc. The handles of the controls shall be located inside the protected area unless a special protection is provided for the hands. The platform shall be non-slip and shall have protection against slipping off.

Compliance is checked by inspection.

20.113 Ride-on-machines with an OPERATOR seat shall enable the OPERATOR to maintain a stable position on the seat, shall have strong foot rests, and, if necessary, a mounting step.

If the machine has a mounting step, the machine shall provide sufficient hold for the operator to reach the seat easily.

Compliance is checked by inspection.

20.114 Hopper

Elevating equipment shall be constructed or designed so that any unintentional lowering of the HOPPER is prevented. Unintentional lowering resulting from interruption of the power supply shall be also prevented.

This requirement is met by

– check valves or similar functions within the control valves of hydraulic or pneumatic lifting equipment;

– self-locking actuators or automatically engaging latches;

– mechanical safety mechanisms.

During NORMAL OPERATION, the HOPPER shall not drop faster than 0,6 m/s.

If persons have to enter beneath the elevated or tilted HOPPER when used as intended and under conditions foreseen by the manufacturer (e.g. maintenance, cleaning, inspection) it is necessary to provide a safety device to prevent unintentional lowering.

This requirement is considered to be met by

– pilot-operated non-return valves integrated into the lifting cylinder;

– mechanical safety mechanisms which can be operated from outside the hazard zone.

It shall be prevented that objects are ejected by the main-broom when the HOPPER is lifted. Objects ejected by side brushes are not considered to be a risk.

The emptying operation of a HOPPER that is designed to be emptied by mechanical force shall not cause a danger to the OPERATOR.

Compliance is checked by inspection and functional test. The machine shall be operated while loaded to the GVW rating.

20.115 Fuel tank

If a fuel tank is within or contiguous to the engine compartment and excessively high temperatures are likely to occur, the tank and/or filling arrangement shall be isolated from the electrical and exhaust systems by suitable protection, e.g. a separate enclosure or baffles.

The tank location and facilities for filling shall be such that spillage or leakage will not drain onto electrical or exhaust system parts.

Fuel spillage shall not be possible under NORMAL OPERATION.

Compliance is checked by inspection.

20.116 Internal combustion engine powered machines using liquefied petroleum gas

Internal combustion engine powered machines using liquefied petroleum gas (LPG) shall be constructed in accordance with the additional requirements specified in Annex BB. Requirements for the LPG container itself are not part of this standard.

Compliance is checked by inspection and measurement.

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 that may be expected in normal use, during transportation, assembly, dismantling, scrapping and any other action involving the machine.

Modification in the third paragraph:

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

21.1DV DE *Modification of Clause 21.1 of the Part 2 by addition of the following note:*

NOTE 1DV Clauses 21.1DV.1 and 21.1DV.2 of the Part 1 remain applicable.

21.101 Those parts of the machine that are subjected to impact in normal use are tested as follows.

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

21.102 Current-carrying hoses shall be resistant to crushing.

Compliance is checked by the following test.

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

The steel plates are pressed together at a rate of 50 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 can 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 ± 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.

22 Construction

This clause of Part 1 is applicable except as follows.

22.3DV.1 D2 *Modification to add the following to (after) 22.3DV of the Part 1:*

AFCIs and LCDIs shall be installed as an integral part of the attachment plug or located in the supply cord within 102 mm of the attachment plug.

22.6 *Addition:*

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 Clause 22.6 of the Part 1:*

22.6DV.1 Leakage from a polymeric liquid reservoir is not considered likely to occur, if the reservoir is subjected to Clause 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 Oven Conditioning test

The reservoir shall be subjected to the test of Clause 7.1 and 7.3 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 Impact test

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.

22.7 *Replacement:*

Pressurized hoses, lines and components shall be located or shielded so that in the event of rupture, the fluid cannot be discharged directly on to and cause a hazard for the OPERATOR when in the operating position.

Compliance is checked by inspection.

22.7DV D2 *Modification by adding the following to Clause 22.7 of the Part 1:*

For machines with air conditioning systems, adequate pressure relief on the refrigeration system shall be located on the refrigeration system in case there is a fire. Acceptable pressure relief would be the use of rubber hoses that would melt in a fire and allow the refrigerant to be released. If metal tubing with metal fittings is used, an appropriate refrigerant pressure relief device shall be used.

22.9DV D2 *Modification by adding the following to Clause 22.9 of the Part 1:*

Wiring and cables routed beneath user-serviceable fluid confining components (e.g. fuel filters) shall be rated for continuous exposure to the fluid involved unless protection is provided by sheathing, sleeving, conduit, or similar that is resistant to the fuel.

22.32 *Addition:*

Machines applying vacuum for picking up of dirt shall be so constructed that windings, internal wiring and electrical connections are not subjected to deposition of dust or dirt entering with the air that is drawn in.

Compliance is checked by inspection.

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

22.40 *Modification:*

Delete the 2nd paragraph and the note.

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 shall be at least 30 mm distance from the surface of the floor, measured in vertical direction through existing holes.

Compliance is checked by inspection and measurements.

22.102 For battery powered machines, secondary circuits shall not rely upon the chassis for electrical continuity. Non-SELV voltages shall be fully isolated from accessible conductive parts.

Bare conductors and terminations shall be installed so that short-circuiting is considered unlikely to occur.

Circuits for lighting or signalling may be installed with single-pole wiring and using the body if such circuits are firmly isolated from circuits of operational functions.

Compliance is checked by inspection.

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

The requirements in 22.102 do not apply.

22.103 The batteries of battery powered machines shall be located in a compartment separated from components liable to produce sparks, open flames, electric arcs or glowing objects (max. surface temperature 300 °C). If this is not the case, adequate ventilation shall ensure that no explosive atmosphere can build up in the area of spark producing components.

Plug connection devices are considered to produce sparks only if they are employed for emergency switching.

Compliance is checked by inspection and measurement.

22.104 Battery powered machines shall not cause a hydrogen gas explosion risk during charging of batteries. This requirement is met by the following:

– all power-consuming circuits shall be positively interrupted, or

– batteries, except those which produce no hydrogen or other explosive gases, such as gel batteries, shall have all-pole disconnection from all power consuming circuits either by a changeover switch or by disconnecting the plug that connects the battery to the machine.

This requirement is not applicable if the charging circuitry is also used as a power source to operate the machine when mains connected.

Compliance is checked by inspection and by manual test.

22.104DV D2 *Modification of Clause 22.104 of the Part 2:*

Delete the penultimate paragraph.

22.105 It shall not be possible to drive battery powered machines during charging of batteries, except those with built-in battery chargers with power supply function.

Compliance is checked by inspection.

NOTE This requirement is considered to be fulfilled by the requirements of 22.104.

22.105DV D2 *Modification of Clause 22.105 of the Part 2:*

Replace the first sentence with "It shall not be possible to drive BATTERY powered machines during charging of BATTERIES".

22.106 Machines with batteries shall be designed in such a way that electrolyte leakage from the battery does not impair compliance with this standard; in particular there shall be no trace of electrolyte on insulation that reduces CLEARANCES or CREEPAGE DISTANCES below the values specified in Clause 29.

The battery housing shall be designed and constructed in such a way as to prevent the electrolyte being ejected on to the OPERATOR and to avoid the accumulation of vapours in places occupied by OPERATORS.

Compliance is checked by inspection and measurement.

22.107 CLASS I and 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.

22.108 Machines shall be constructed so that parts related to the driving operation, such as the seat, steering wheel and controls, are in accordance with the relevant ergonomic principles of ISO 3411. The distance between the seat, if any, and the control devices must be suitable or capable of being adapted for the OPERATOR.

Compliance is checked by inspection and measurement.

22.109 Machines shall be constructed so that OPERATOR cabins are adequately ventilated in order to avoid the accumulation of exhaust gases or lack of oxygen. It shall be possible to evacuate the cabin rapidly. An emergency exit shall also be provided in an appropriate direction which is different from the one of the normal exit.

NOTE Examples of suitable exits are a second door, a window designed specifically for this purpose or an aperture in the cabin roof.

The opening to permit passage of a person shall be at least 400 mm by 600 mm.

Compliance is checked by inspection and measurement.

22.110 Where it is likely for the OPERATOR to be hit by falling objects, RIDE-ON MACHINES shall be provided with a falling objects protection system (FOPS). This system shall have an adequate deformation limit volume (DLV).

Compliance is checked in accordance with Annex CC.

NOTE It is not the intention that FOPS are required. The use of these systems will depend on the user and the place where the machine will be used.

22.111 When split rims are used with pneumatic tyres, the machine shall be provided with devices to prevent the user from separating the rims of the wheel before removing the wheel from the axle, e.g. by welded nuts or screws removable with the aid of a special tool only.

Compliance is checked by inspection.

22.112 Guards

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

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

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

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

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

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

Adjustable GUARDS may be used only to restrict access to those areas of the moving parts strictly necessary for the work. They shall be manually or automatically adjustable based on the type of work involved and shall be adjustable without the aid of a tool.

Compliance is checked by inspection.

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

Compliance is checked by inspection.

22.114 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.

22.115 On machines with combustion engines, the engine exhaust shall not be directed towards the OPERATOR.

On machines equipped with a cabin for the OPERATOR, the engine exhaust shall not be directed towards the cabin or the air inlet to the cabin.

Compliance is checked by inspection.

22.116 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.

22.117 Machines with TRACTION DRIVE shall be provided with an OPC to prevent unintentional movement of the machine.

Compliance is checked by inspection and functional test.

If compliance relies on the operation of an electronic circuit and the traction drive is controlled by an OPC, the functional test is repeated under the following conditions applied separately:

– the fault conditions in a) to g) of 19.11.2 applied one at a time to the ELECTRONIC CIRCUIT;

– the electromagnetic phenomena tests of 19.11.4.2 and 19.11.4.5 applied to the appliance.

It shall not be possible to activate the traction drive unintentionally.

If the ELECTRONIC CIRCUIT is programmable, the software shall contain measures to control the fault/error conditions specified in Table R.1 and is evaluated in accordance with the relevant requirements of Annex R.

Alternatively, the OPC shall provide an adequate performance level, determined according to ISO 13849-1 or ISO 25119, or an adequate safety integrity level, determined according to IEC 62061. In this case, compliance is checked by inspection and functional test, without the repetition as required above. It shall not be possible to activate the traction drive unintentionally.

22.118DV D2 *Add Clause 22.118.DV to the Part 1:*

22.118.DV Electrical accessories for field installation by qualified personnel

22.118.DV.1 An electrical accessory intended for field installation by qualified personnel shall be provided with all necessary wiring and hardware such that the installation can be made by qualified personnel without major disturbance of factory-installed wiring, the accessory assembly, or the machine.

22.118.DV.2 Removal of a cover plate or the like is acceptable, but rearrangement of wiring or components, cutting or splicing of existing wiring, and soldering of connections are not acceptable.

22.118.DV.3 After field installation of an electrical accessory by qualified personnel, a machine shall comply with the applicable requirements in this Standard. (In particular, see Clauses 8 and 15.)

23 Internal wiring

This clause of Part 1 is applicable.

23.101DV D2 *Add the following Clause to the Part 1:*

All wiring not part of an LVLE CIRCUIT shall comply with the standards specified in Annex DVA of the Part 1 or Annex 101.DVB.

23.102DV D2 *Add the following Clause to the Part 1:*

Wiring in an LVLE CIRCUIT is not required to be protected against mechanical damage.

23.103DV D2 *Add Clauses 23.103DV.1 to 23.103DV.3 to the Part 1:*

23.103DV.1 Wiring connections to a continuously moving part, or a part for which the degree of movement is appreciable, shall be a type such as S, SJ, SJE, SJO, SEO, SJT, SJTO, SJEO, SO, ST, SE, or STO flexible cord, or the cord shall be of a type at least equally as serviceable for the intended use.

23.103DV.2 Individual conductors having flexible stranding and enclosed in flexible tubing such as flexible nonmetallic conduit, nonmetallic insulated tubing, or other suitable method in which the wiring is protected sufficiently against mechanical damage, may be used in place of flexible cord. For other than mains supplied machines, the tubing is not required on exposed moving conductors that are readily visible to the OPERATOR and are therefore subject to replacement when damaged.

23.103DV.3 Cords determined to be equivalent to those within UL 62 / CSA C22.2 No. 49 or; CSA C22.2 No. 96, but with an increased number of conductors, may be acceptable.

24 Components

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

24.1DV D2 *Modification by adding the following text to Clause 24.1 of the Part 1:*

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.

24.1.3 *Addition:*

Switches for frequent operation, mains isolating switches and switches for machines that are supplied by safety-extra-low voltage or by batteries shall be tested for 50 000 cycles of operations.

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

24.1.3.ADV.1 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 24.1.3.ADV.2.

Compliance is checked by inspection and test.

24.1.3.ADV.2 Overload test

24.1.3.ADV.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 24.1.3.ADV.2.2 – 24.1.3.ADV.2.5 as applicable. Results are 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.

Exception No. 1: A device interlocked so that it will never break the locked-rotor motor current need not be tested for overload.

Exception No. 2: For battery connected machines, temperature-limiting devices and current-limiting devices (such as electronic monitoring circuits) of a power controller shall be allowed in the power circuit to limit the current or open the circuit under the test conditions. When one of those devices causes an interruption of the power, the test shall be discontinued.

24.1.3.ADV.2.2 Exposed dead metal parts of the product shall be connected to ground through:

a) a 3-ampere plug fuse, and the product shall be connected to a grounded supply circuit of rated frequency for main connected machines; or

b) a 30-ampere non-time delay connected between the non-energized metal part of the switch for battery connected machines.

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

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

24.1.3.ADV.2.4 The rotor of the motor shall be locked in position. For a mains operated machine, the product shall be connected to a supply circuit of maximum rated voltage. For a battery powered machine, a fully charged battery shall be used.

24.1.3.ADV.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.

24.101 Components for machines with a TRACTION DRIVE shall be of adequate construction so that they are able to withstand any impact or vibrations occurring during operation, without impairing their performance. Switches or other controls shall not change their switching position under the effects of impacts or vibrations.

Compliance is checked by inspection and functional test.

24.102 The contacts of switches, contactors in circuits of the braking-system, etc., that are supplied at a RATED VOLTAGE of up to 48 V, and contacts in circuits for self-excited electric braking shall have highly reliable conductivity (for example, self-cleaning contacts).

Compliance is checked by inspection.

24.103.DV D2 *Add Clauses 24.103.DV.1 to 24.103.DV.3 the Part 1:*

24.103.DV.1 A motor located in an LVLE CIRCUIT is not required to comply with requirements for clearances and creepage distances.

24.103.DV.2 The removable portion of a BATTERY connector shall be provided with means for being grasped during removal. Raised gripping surfaces are an example of means for being grasped.

24.103.DV.3 A motor that complies with the requirements of UL 1004-1 / CSA C22.2 No. 100 is acceptable when used within its acceptable insulation systems ratings.

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.

25.1DV D2 *Modification by adding the following to Clause 25.1 of the Part 1:*

25.1.DV.1 The length of the detachable or nondetachable supply cord shall be at least 4,6 m, including fittings, except for supply cords used exclusively for on-board charging.

25.1.DV.2 Alternatively to the requirement of Clause 25.1.DV.1, a product may be provided with not more than 0,5 m of nondetachable supply cord if the plug connection cannot be placed within 75 mm of the floor and:

a) It is likely that the product will be connected by means of an extension cord during operation, and the manufacturer recommends the use of a suitably rated extension cord and provides the ratings; or

b) The manufacturer provides with the product a suitably rated extension cord that is not less than 4.6 m long, including fittings.

25.1.DV.3 A three-to-two-wire, earthing-type adapter shall not be provided with a product.

25.7 *Replacement:*

SUPPLY CORDS shall be one of the following types:

– Polychloroprene sheathed

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

– Cross-linked polyvinyl chloride sheathed

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

NOTE 101 These cords are suitable for machines when they can come into contact with hot surfaces. Due to the composition of the conductors, the cords are suitable for applications where high flexibility is required.

– Polyvinyl chloride sheathed

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

– Heat resistant polyvinyl chloride sheathed

These cords shall not be used for TYPE X ATTACHMENT 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.

25.7.DV D2 *Modification by replacing the text of 25.7 of the Part 2 with the following:*

25.7.DV.1 A heater cord is required where the temperature measured during the test of Clause 11 exceeds 121°C on any surface that the cord is likely to touch when the machine is used as intended.

25.7.DV.2 For rug shampooers, the cord shall be Type SJ, SJO, SJT, or SJTO; for all other products, the cord shall be Type S, SO, ST, or STO. Alternatively, the cord shall be of a type at least equally as serviceable for the intended use.

25.14 *Addition:*

For machines incorporating a TYPE X ATTACHMENT or TYPE Y ATTACHMENT, the number of flexings is 20 000.

25.15 *Modification:*

Replacement of 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.

25.22.DV D2 *Modification by adding the following to 25.22 of the Part 1:*

If a product incorporates a disconnecting means (such as a cord connector in the cord between the handle and the motor), the construction shall be such that no live part will be exposed when used as intended. The probe illustrated in Figure 12DV of the Part 1 shall be used to determine if live parts are accessible.

26 Terminals for external conductors

This clause of Part 1 is applicable.

27 Provision for earthing

This clause of Part 1 is applicable.

28 Screws and connections

This clause of Part 1 is applicable.

29 Clearances, creepage distances and solid insulation

This clause of Part 1 is applicable except as follows.

29.2 *Addition:*

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

30 Resistance to heat and fire

This clause of Part 1 is applicable except as follows.

30.1 Addition:

The cabin and its fittings are considered to be external parts.

30.2 *Addition:*

Subclause 30.2.2 is applicable for

– mains supplied machines;

– parts of battery powered machines not energized during charging process.

Subclause 30.2.3 is applicable for

– parts of battery powered machines energized during charging process.

30.2.DV D2 *Modification by adding the following to Clause 30.2 of the Part 2:*

A nonmetallic enclosure of a switch or relay located in other than an LVLE circuit shall have a minimum flammability rating of V-2.

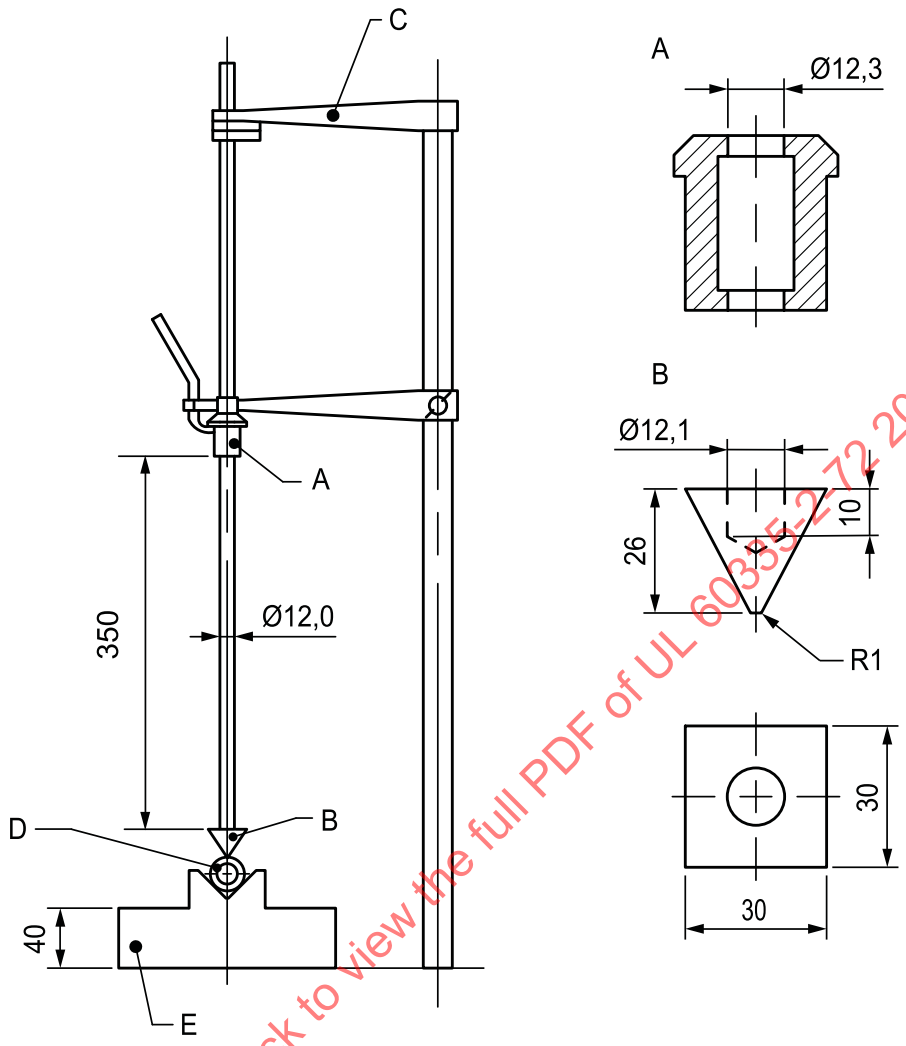
NOTE 1DV A switch complying with the standards specified in Annex 101.DVA are considered to comply with this requirement.

31 Resistance to rusting

This clause of Part 1 is applicable.

32 Radiation, toxicity and similar hazards

This clause of Part 1 is applicable.



Key

A weight

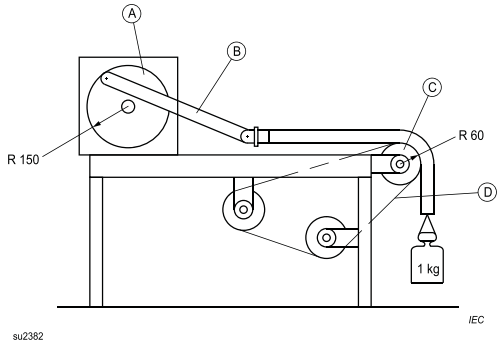
B chisel

C fixing arm

D sample

E base having mass of 10 kg

Figure 101 – Impact test apparatus



Key

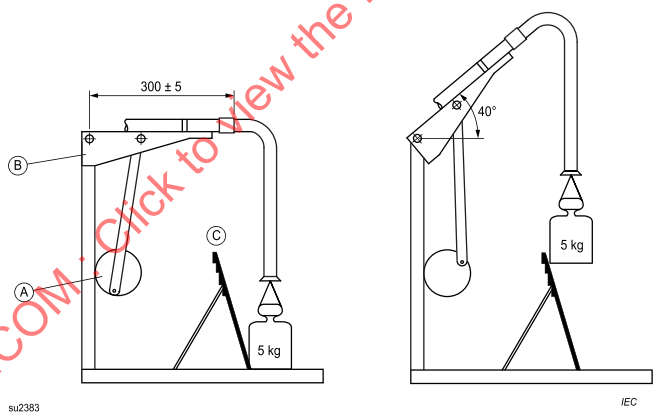
A crank mechanism

B connecting rod

C roller, diameter 120 mm

D abrasive cloth belt

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



Key

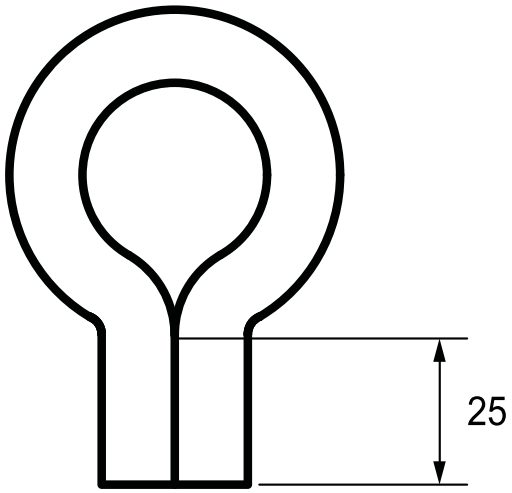
A crank mechanism

B arm

C inclined plane

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

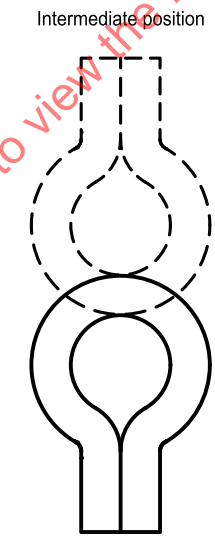
Dimesions in millimetres



IEC

su1186a

Figure 104 – Configuration of the hose for the freezing treatment



IEC

su2384

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

IEC 1257/07

su0950

Figure 106 – Warning symbol: Do not inhale exhaust fumes

Figure 107.DV DR *Add the following figure:*

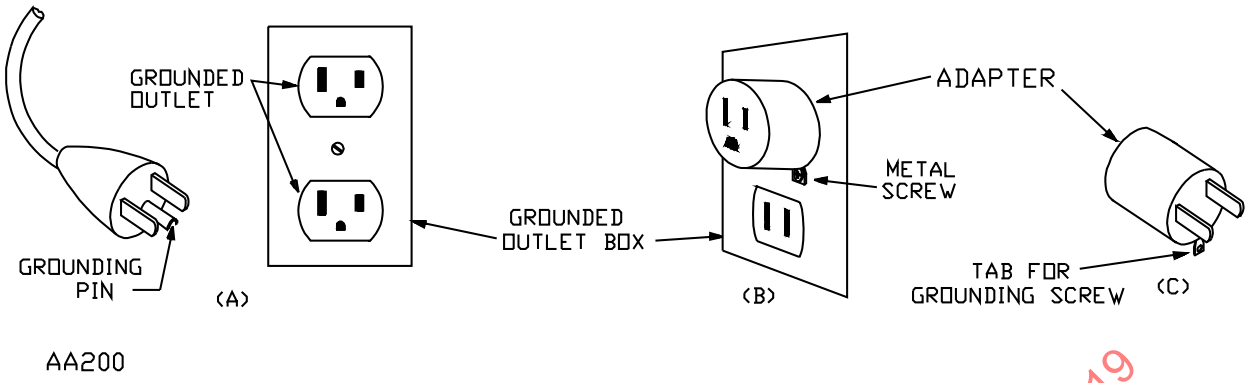


Figure 107.DV – Earthing methods

Annexes

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

Annex A
(informative)
Routine Tests

ADV.1 D2 ***Modification of the title:***

Replace "informative" with "normative."

ADV.2 D2 ***Modify the Introduction in the Part 1 by adding the following:***

The tests of Clauses A.1 and A.2 do not apply to battery-powered products.

A.101DV D2 ***Add Clauses A.101DV.1 and A.101DV.2 to Annex A of the Part 1:***

A.101DV.1 Each internal combustion engine powered machine using liquefied petroleum gas shall be tested for leaks of an LP-Gas system. All fuel-system connections, including the container with associated valves and fittings, shall be tested for leaks with a soap-and-water or equivalent solution while the system is under LP-Gas pressure of not less than 621 kPa. All leaks detected shall be repaired.

A.101DV.2 The fuel container and associated valves and fittings may be tested separately using air pressure.

Annex B
(normative)
Appliances powered by rechargeable batteries

Replace Annex B of Part 1 by the following:

The following modifications to this standard are applicable for appliances powered by batteries that are recharged in the machine by BUILT-IN CHARGERS.

NOTE 101 This annex does not apply to stand-alone battery chargers (IEC 60335-2-29).

These chargers take one of the following two forms of construction:

Scenario 1: The charger can be supplied directly from the supply mains, the battery charging circuitry and other supply unit circuitry being incorporated within the machine.

Scenario 2: The charger can be supplied directly from the supply mains, the battery charger not being incorporated within the machine, but mounted on the machine and incorporated within the enclosure of the machine. The charging circuitry is electronically independent from the machine's electrical system.

NOTE 102 Forms of construction covered by this annex are shown in Figure B.101.

NOTE 103 If the machine incorporates a battery that must be removed from the machine for charging, then Annex B is not applicable. In this case, the machine is simply a battery-operated machine and the safety requirements for the battery charger for charging the battery are contained in IEC 60335-2-29.

NOTE 104 Since the requirements of IEC 60335-2-29 were met by built-in chargers as components, then integrated into machines covered by IEC 60335-2-72, the tests of this annex are not repeated, except for Clauses 6, 7, 11, 15, 19 and 22.

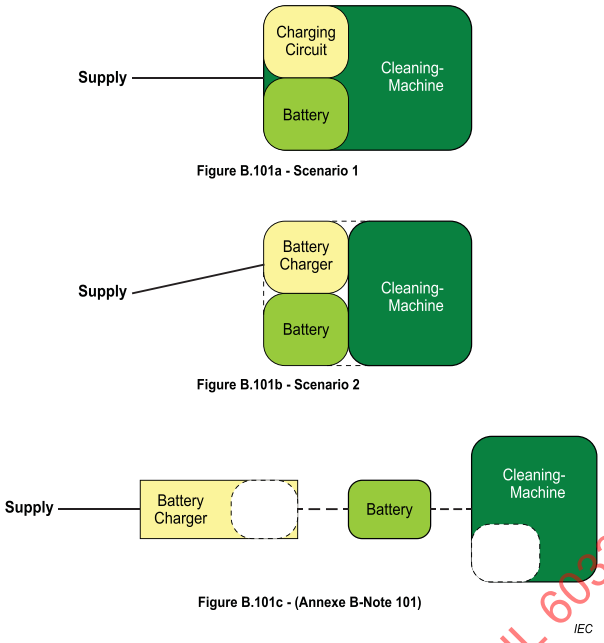


Figure B.101 – Forms of constructions for cleaning machines covered by Annex B

3 Terms and definitions

3.1.9 *Replacement:*

NORMAL OPERATION: operation of the machine under the following conditions:

Battery chargers are connected to the circuit of Figure B.102. The variable resistor is adjusted so that the current in the circuit is the RATED D.C. OUTPUT CURRENT when the battery charger is supplied at RATED VOLTAGE.

When the charging current is controlled by the state of charge of the battery, the variable resistor and the capacitor are replaced by a discharged battery of the type and having the largest capacity specified in the instructions.

Addition:

3.6.2 NOTE If a part has to be removed in order to discard the battery before scrapping the appliance, this part is not considered to be detachable even if the instructions state that it is to be removed.

3.B.101 RATED D.C. OUTPUT VOLTAGE: output voltage assigned to the battery charger by the manufacturer

3.B.102 RATED D.C. OUTPUT CURRENT: output current assigned to the battery charger by the manufacturer

5 General conditions for the tests

5.B.101 *When appliances are supplied from the supply mains, they are tested as specified for MOTOR-OPERATED APPLIANCES.*

5.B.102 *Compliance is checked only when the BUILT-IN CHARGER is mounted on or into the machine.*

6 Classification

6.1 *Addition:*

NOTE 101 Attention is drawn to 5.3, Note 6, of IEC 62638, where information is given about earthing contact used exclusively for EMC purposes.

7 Marking and instructions

7.1 *Addition:*

The battery compartment of appliances incorporating batteries that are intended to be replaced by the user shall be marked with the battery voltage and the polarity of the terminals.

The positive terminal shall be indicated by symbol IEC 60417-5005 (2002-10) and the negative terminal by symbol IEC 60417-5006 (2002-10).

7.6 *Addition:*

\+ [Symbol IEC 60417-5005 (2002-10)] plus; positive polarity

– [Symbol IEC 60417-5006 (2002-10)] minus; negative polarity

7.12 *Addition:*

The instructions shall

– explain the automatic function, stating any limitation (for automatic battery chargers).

7.15 *Addition:*

Markings, other than those associated with the battery, shall be placed on the part of the appliance that is connected to the supply mains.

The marking specified in 7.1 related to the battery voltage charger input and output ratings shall be on the type plate of the machine itself if they do not comply with this clause of Part 1.

8 Protection against access to live parts

8.2 *Addition:*

Machines having batteries that according to the instructions may be replaced by the user need only have BASIC INSULATION between LIVE PARTS and the inner surface of the battery compartment. If the appliance can be operated without the batteries, then DOUBLE INSULATION, interlocking switches on the enclosure of the battery compartment, or REINFORCED INSULATION is required.

9 Starting of motor-operated appliances

This clause is not applicable.

11 Heating

11.5 *Addition:*

BUILT-IN CHARGERS are operated under NORMAL OPERATION and supplied with the most unfavourable voltage between 0,9 times and 1,1 times the RATED VOLTAGE.

In addition, for BUILT-IN CHARGERS WITH POWER SUPPLY FUNCTION, the test is repeated with a discharged battery.

11.7 *Addition:*

The battery is charged for the period stated in the instructions or for 24 h, whichever is longer. The battery with the largest Ah capacity, recommended by the manufacturer, shall be used. The battery shall be fully discharged, in accordance with the instructions, at the start of the test.

13.101.DV D2 *Delete Clause 13.1DV.1 of the Part 1:*

The requirements of 13.1DV.1 do not apply.

13.102.DV D2 *Add the following Clause to the Part 1:*

Printed wiring assemblies and other electronic circuit components that would be damaged by application of the test potential, or across which the test potential is applied, shall be removed, disconnected, or otherwise rendered inoperative before the dielectric voltage-withstand tests are made. Testing a representative subassembly instead of an entire unit is permitted. Individually shunting the semiconductor devices in the unit before the test is made to avoid destroying them in the case of a malfunction elsewhere in the secondary circuits is permitted.

15 Moisture resistance

This clause is applicable with the charger integrated into the machine.

16.101.DV D2 *Delete Clause 16.1DV of the Part 1:*

The requirements of 16.1DV do not apply.

16.102.DV D2 *Add the following Clause to the Part 1:*

Printed wiring assemblies and other electronic circuit components that would be damaged by application of the test potential, or across which the test potential is applied, shall be removed, disconnected, or otherwise rendered inoperative before the dielectric voltage-withstand tests are made. Testing a representative subassembly instead of an entire unit is permitted. Individually shunting the semiconductor devices in the unit before the test is made to avoid destroying them in the case of a malfunction elsewhere in the secondary circuits is permitted.

17 Overload protection of transformers and associated circuits

Addition:

The output terminals of the battery charger are short-circuited.

18 Endurance

This clause is not applicable.

19 Abnormal operation

19.1 *Addition:*

Machines are also subjected to the tests of 19.B.101 to 19.B.105.

19.10 Not applicable.

19.13 *Addition:*

During the tests, the values of Table 8 apply.

The battery shall not rupture or ignite.

19.B.101 *Machines are supplied at* RATED VOLTAGE *and operated under* NORMAL OPERATION*, any control that operates during the test of Clause 11 being short-circuited.*

19.B.102 *For appliances having batteries that can be removed without the aid of a tool, and having terminals that can be short-circuited by a thin straight bar, the terminals of the battery are short-circuited, the battery being fully charged*

19.B.103 *Machines having batteries that are replaceable by the user are supplied at* RATED VOLTAGE *and operated under* NORMAL OPERATION *but with the battery removed or in any position allowed by the construction.*

19.B.104 *The battery charger is connected to a fully charged battery, the connections being in reverse to normal use. The battery shall have the largest capacity of the types specified in the instructions. The battery charger is operated while supplied at* RATED VOLTAGE*.*

19.B.105 *The charger is switched on after reverse connection of the battery. The charger is switched on before the battery is connected to the charger. This procedure has to be carried out without impairing compliance with this standard.*

22 Construction

22.26 *Replacement:*

The electrical output of the battery charger shall be supplied through a safety isolating transformer and shall not be connected to accessible metal parts or an earthing terminal. The insulation between parts operating at SELV and live parts shall comply with the requirements for double insulation or reinforced insulation.

Compliance is checked by inspection and by the tests specified for double insulation or reinforced insulation.

22.B.101 Battery charging circuitry within a separate enclosure shall be constructed so that it can be securely fixed to a support.

Keyhole slots, hooks and similar means, without any further means to prevent the battery charging circuitry from being inadvertently lifted off the support, are not considered to be adequate means for fixing the battery charging circuitry securely to the support.

Compliance is checked by inspection.

22.B.103.1DV D2 *Add the following Clause to the Part 1:*

Individual conductors having flexible stranding and enclosed in flexible tubing such as flexible nonmetallic conduit, nonmetallic insulated tubing, or other suitable method in which the wiring is protected sufficiently against mechanical damage may be used in place of flexible cord.

22.B.103.2.DV D2 *Add the following Clause to Annex B of the Part 1:*

Live parts shall be recessed from the face of a BATTERY connector to reduce the possibility of shorting.

Compliance is checked by inspection.

24 Components

24.B.103.DV D2 *Add the following Clause to Annex B of the Part 1:*

For a battery powered machine, a motor that is not located in an LVLE CIRCUIT or that does not comply with UL 1004-1 / CSA C22.2 No. 100 shall comply with the requirements in Clause 16 immediately after being removed from an air circulating oven after being maintained for a period of 7 h at a temperature of 175°C. The potential shall be applied between the terminals and the motor frame. The following are not required to comply with this requirement:

a) a motor located in an LVLE CIRCUIT; and

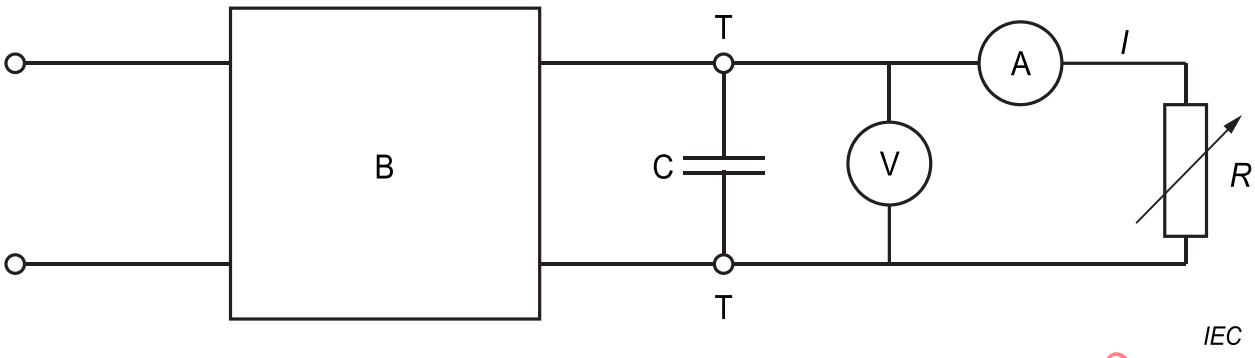
b) a motor that complies with the requirements within UL 1004-1 / CSA C22.2 No. 100, when used within its acceptable insulation systems ratings.

25 Supply connection and external flexible cords

Addition:

25.13 An additional lining or bushing is not necessary for INTERCONNECTION CORDS in CLASS III APPLIANCES or CLASS III CONSTRUCTIONS that do not contain LIVE PARTS.

Add the following new figure:



Key

A mean reading ammeter

B battery charger

C capacitor having a capacitance, in farads, given by: $12{,}5\ [(I_r) / (p \times f \times U_r)]$

where

I_r = RATED D.C. OUTPUT CURRENT, in amperes;

p = 1, for half-wave rectification and 2, for full-wave rectification;

f = supply frequency, in hertz;

U_r = RATED D.C. OUTPUT VOLTAGE, in volts.

I output current

R variable resistor

T output terminals of the battery charger

V mean reading voltmeter

NOTE 101 The capacitor can have a capacitance deviating from the calculated values of ±20 %.

NOTE 102 The capacitor can have to be precharged before the battery charger can operate.

Figure B.102 – Circuit for testing battery chargers (taken from IEC 60335-2-29)

Annex D
(normative)
Thermal motor protectors

Annex DDV D2 *Modification by replacing all of Annex D of the Part 1 following the first paragraph with the following:*

A motor incorporating a thermal protector shall comply with Clause 8 of UL 1004-3:2015-2 / CSA Standard C22.2 No. 77:2014-1 and Clause 17.101 of UL 60730-2-2:2014-9 / CAN/CSA E730-2-2:1994-6 (R2013).

Annex AA
(normative)
Precast paving slabs

The cement in the manufacturing of these paving slabs shall be of, or similar to, one of the following:

– Portland cement (ordinary or rapid hardening);

– Portland blast furnace cement.

The fine and coarse aggregate shall consist of either naturally occurring materials, crushed or uncrushed, or alternatively of coarse aggregate to meet the following requirements:

– 10 % fines test: not less than 10 tons;

– flakeness index: not more than 35 %.

The normal maximum size of the aggregate shall not exceed 14 mm.

The total sulphate content of the concrete mix shall not exceed 4.0 % as SO_3 by weight of the cement. The sulphate of the cement shall be calculated from the known sulphate contents of the cement, aggregates (where applicable) and pulverised fuel ash, as determined by tests.

The slabs may be made by any process. The escape of the finer particles of mortar during the process of manufacture shall be prevented as far as practicable. A slab described as ″pressed″ shall only be made by employing a pressure of not less than 7 MN/m^2 over the entire surface.

After casting, the slabs shall be stored so as to prevent undue loss of moisture, particularly during the early stages of curing.

Slabs shall be manufactured to the following size: 65 mm × 600 mm × 750 mm.

The maximum deviation from a 750 mm straight edge placed in any position on the wearing surface shall not exceed 2 mm. There shall be no special preparation for smoothing of the test surface. The slab should be made under normal production conditions for COMMERCIAL USE.

Annex BB
(normative)
Requirements for internal combustion engine powered machines using liquefied petroleum gas (LPG)

BB.1 Containers

BB.1.1 General

Containers for LPG shall be either permanently fixed on the machine or removable.

Pipe fittings and accessories on containers shall be protected against mechanical damage when used as specified by the manufacturer.

The fuel take-off on the container shall be equipped with an easily and quickly accessible manually operated valve. The position and method of operation of this valve shall be clearly marked on the outside of the machine, near the valve or on each removable container.

It shall be mechanically ensured that the fuel take-off is in a liquid form unless the container and engine are specially equipped for a direct vapour withdrawal. In this case, the direct vapour withdrawal shall also be mechanically ensured.

If containers are installed in a compartment, this compartment shall have permanent openings at the bottom. The total surface area of these ventilation openings shall be at least 200 cm^2 allowing adequate ventilation to the outside atmosphere and without risk to the OPERATOR.

Containers shall be positioned in such a way that they are not exposed to the damaging effects of heat, particularly heat from the engine and the exhaust System. This requirement is deemed to be met if the distance between the container and the exhaust system is at least 300 mm or if a suitable heat shield is fitted which shall not inhibit ventilation under any circumstances.

Containers shall be fitted on the machine in such a way that they are not unduly exposed to abrasion or shock nor to the corrosive action of the products handled by the machine.

Containers and their connections shall be installed in such a way that there are no projections outside the plan view outline of the machine.

If an additional container is carried on the machine, it shall be secured in the same manner as the main container.

BB.1.2 Containers to be filled by the user

Containers to be filled by the user shall have the following fitted:

– A safety pressure relief valve shall be connected to the vapour space of the container. Where such containers are fitted inside compartments of machines, the discharge side of the relief valve shall be piped to atmosphere. The gas shall be led away safely outside of the motor compartment.

– Containers shall not be possible to be filled more than 80 % of the container capacity. Where containers are fitted inside compartments of machines, the discharge side of any maximum level indicating device which relies on bleeding gas to atmosphere shall terminate at a readily visible position on the outside of the machine.

– Maximum level indicating devices which rely on bleeding to atmosphere shall be designed so that the bleed hole is not larger than 1,5 mm in diameter and also so that the parts of the device cannot be completely withdrawn in normal gauging operations.

– Maximum liquid level devices shall be suitable for the LPG in use, indicate the maximum product level and shall not vent to atmosphere.

BB.1.3 Removable containers

Removable containers shall be secured on the machine in such a way that only intentional release is possible.

When containers are removable, their fastenings shall permit easy handling and checking of the installation after the exchange of containers.

Removable containers which incorporate a safety pressure relief valve shall be so positioned on the machine that the safety pressure relief valve opening is always in communication with the vapour space at the top of the container. This may be accomplished by an indexing pin which positions the container when the container is properly installed.

BB.1.4DV ***Add Clause BB.1.4DV.1 and Figure BB.1.DV to Clause BB.1 of the Part 2:***

BB.1.4DV.1 LP-Gas Container Bracket Load Test

BB.1.4DV.1.1 *An LP-Gas fuel container shall be secured in place on the vehicle in a manner that will withstand, without visible permanent deformation, loadings in any direction equal to four times the filled weight of the container.*

BB.1.4DV.1.2 *For this test, the container shall be empty of fuel and shall be secured in the manner covered by the manufacturer's instructions. Loadings shall be applied in any convenient manner capable of being measured by gauges or weights. The load shall be applied in no less than the six directions shown Figure BB.1.DV, as applicable to the design.*

Exception: When a design incorporates a swing-out, swing-down, or other similar construction, the load directions shall be adjusted accordingly to demonstrate compliance.

Add the following figure:

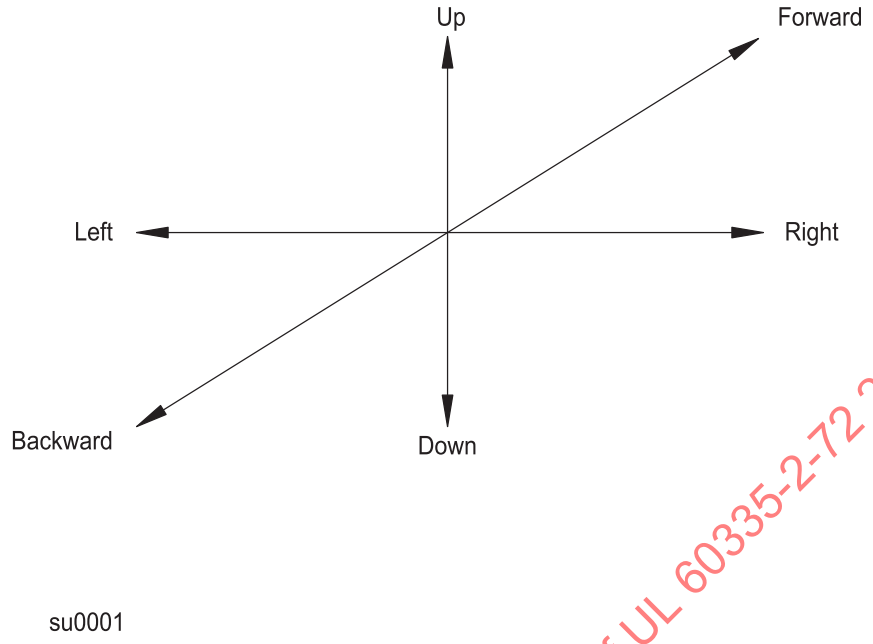


Figure BB.1.DV – Load directions

BB.1.5.DV D2 *Add Clause BB.1.5.DV to Clause BB.1 of the Part 1:*

BB.1.5.DV Non-removable containers

BB.1.5.DV.1 When a machine incorporates a non-removable ASME fuel container, the container shall have a maximum allowable working pressure of 2.15 MPa. It shall be marked with the ASME "U" symbol and the design working pressure.

BB.1.5.DV.2 When a machine incorporates a non-removable DOT fuel container, the container shall be constructed, tested, and marked for a minimum service pressure of 1.7 MPa. It shall bear the marking DOT-4B240, DOT-4BA240, DOT-4BW240, or DOT-4E240. A DOT fuel container assembly shall comply with the requirements in UL 2003.

BB.2 LPG piping

BB.2DV.1 DE *Replace the title of Clause BB.2 with the following:*

LPG piping and hoses

Connecting piping and all associated parts shall be easily accessible, protected against damage and wear, and flexible enough to withstand vibration and deformation in service, as follows.

– Piping shall be so arranged that damage or leaks are easily detectable.

– Piping shall be installed in such a way that it cannot be damaged by the hot parts of the engine or the exhaust system.

– Fully rigid pipes shall not be used for connecting the container to equipment on the engine.

Pressure flexible hoses above 0,1 MPa shall be supported at least every 500 mm. Rigid pipes shall be supported at least every 600 mm.

Hoses, pipes and all connections operating at pressures above 0,1 MPa shall be suitable for a working pressure of 2,4 MPa and shall withstand without bursting a test pressure of 7,5 MPa. Hoses, pipes and all connections operating below 0,1 MPa shall withstand without bursting a test pressure of five times the maximum pressure likely to be encountered in service.

Excessive pressure shall be avoided in any section of pipe work containing LPG in liquid form between two shut-off valves which may be closed; e. g. a pressure relief valve or other suitable means may be used if necessary. The gas shall be led away safely outside of the motor compartment.

Aluminium piping shall not be used in LPG lines.

Hose lengths shall be as short as practical.

Pressure unions and joints above 0,1 MPa shall be made of metal except for any constrained sealing washers.

BB.2DV.2 D2 *Modification by adding the following paragraph:*

Tubing burst test requirements are considered to be met if the wall thickness is at least 1,25 mm for steel and 0,81 mm for annealed copper.

BB.2DV.3 D2 *Modification by adding the following paragraph:*

Flexible hose and hose assemblies shall comply with the requirements in UL 21 and UL 569 / CAN/CGA 8.1 and CAN 1-8.3.

BB.2DV.4 D2 *Modification by adding the following paragraph:*

A tubing fitting or other fuel line fitting, including a pipe threaded fitting, shall comply with one or more of the following:

a) UL 109 / (No CSA equivalent);

b) ASTM F1387 / (No CSA equivalent);

c) CGA V-1; and

d) ASME B31.3 / No CSA equivalent.

BB.2DV.5 D2 *Modification by adding the following paragraph:*

A cast fitting shall not be employed for either piping or tubing.

BB.2DV.6 D2 *Modification by adding the following paragraph:*

A fuel line shall be supported to reduce the likelihood of chafing and to maintain at least a 51 mm clearance from exhaust- and electrical-system parts.

BB.2DV.7 D2 *Modification by adding the following paragraph:*

Flexible hose passing through sheet metal shall be installed to reduce the likelihood of hose abrasion, such as by use of clamps and grommets.

BB.2DV.8 D2 *Modification by adding the following paragraph:*

A pipe-threaded fuel-system fitting, including a container fitting, shall be assembled using a pipe-joint sealing compound intended for use with LP-Gas.

BB.2DV.9 D2 *Modification by adding the following paragraph:*

Each vaporizer shall be marked with the design working pressure in MPa.

BB.2DV.10 D2 *Modification by adding the following paragraph:*

A vaporizer shall not be equipped with a fusible plug. A vaporizer shall comply with the requirements in the Outline for LP-Gas Automotive Accessories, UL 1337.

BB.3 Equipment

The supply of gas shall be automatically cut off when the engine stops irrespective of whether or not the ignition system has been switched off.

For multi-fuel applications, the system shall be designed to avoid the possibility of LPG entering any other fuel container, and to shut off each fuel source before the alternative one is opened.

If the machine is equipped with two or more containers to supply fuel, they shall be connected via a multiway valve, or other suitable means, so that LPG can only be drawn from one container at a time. The use of two or more containers at the same time shall not be possible.

Safety pressure relief valves or liquid level indicators shall be installed in such a way that they cannot discharge in the direction of the OPERATOR or onto machine components which may be a source of ignition.

All fuel system components shall be firmly secured to the machine.

Pressure reducing valves shall be readily accessible for inspection and maintenance.

BB.3DV D2 *Add the following text to Annex BB:*

BB.3DV.1 An automatic shutoff valve shall permit the back flow of fuel from a vaporizer in the event of a pressure build-up in the vaporizer. Automatic shut-off valves shall comply with the requirements in UL 1337.

BB.3DV.2 Each vaporizer shall have a valve or plug located at or near the lowest portion of the section occupied by the water or other heating medium to permit substantially complete draining of the vaporizer. A vehicle cooling-system drain or water hose that completely drains the vaporizer is considered to comply with the intent of the requirement.

BB.3DV.3 Each applicable LP-Gas component, excluding fuel lines, hoses, and tanks, shall comply with the requirements in the UL 1337.

BB.3DV.4 A nonmetallic part in contact with LP-Gas shall not show a volume change or loss of weight exceeding the requirements in the UL 1337.

BB.101DV D2 *Add the following clause and Figure BB.101.DV to Annex BB: Marking*

Machines equipped to use a removable fuel container shall be marked to identify the correct fuel container assembly to be used. The markings shall be on or adjacent to the container mounting hardware.

Machines equipped to use a removable fuel container may be shipped without the fuel container if a nameplate that identifies all of the following is attached adjacent to the container-mounting hardware:

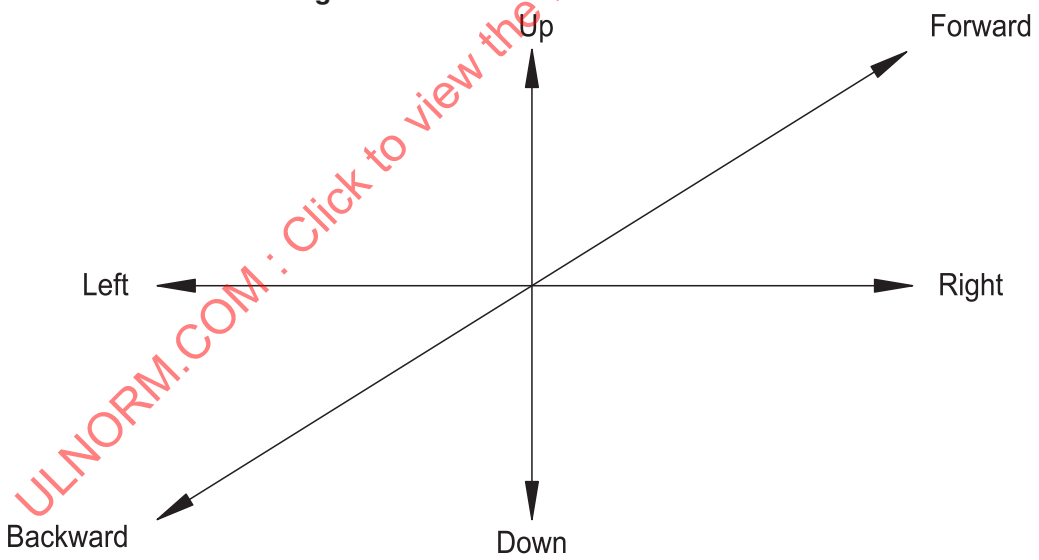
a) Fuel container (tank) capacity (weight),

b) Type of mounting (horizontal or vertical),

c) Disconnect coupling (thread type), or

d) Type of withdrawal (liquid or gas).

Figure BB.101.DV - Load Directions



su0001

Annex CC
(normative)
Falling-object protective structures (FOPS) – Dynamic test and performance requirements

The following modifications to this standard are applicable to dynamic test and performance requirements for falling-object protective structures (FOPS).

NOTE 1 Additional subclauses and notes in this annex are numbered starting with 201.

21 Mechanical strength

21.201 A dynamic type test shall be carried out on a GUARD fitted to a cleaning machine for which it has been designed. Alternatively, the GUARD may be mounted on a test chassis provided that the mounting is the same as that on the cleaning machine for which it is designed.

The test is made to determine the resistance to permanent deflection of the portion of the overhead GUARD under which the OPERATOR sits.

The overhead GUARD and its mountings shall be capable of withstanding the impact of the test object under the mentioned conditions.

Compliance is checked by the following tests.

The test object shall be a mass of 20 kg having a square striking face with a side dimension of 300 mm. The striking face shall be of oak wood or similar density, at last 50 mm thick, the corners and edges shall be radiused to 10 mm to 15 mm.

The test object shall be positioned to drop in free fall with the striking face approximately parallel to the top of the overhead GUARD, so as not to strike with a corner or edge. Drop the test object 5 times from a height of 1,5 m.

One of the drops shall be from a point with the centre of the test object vertically above the seat index point of the OPERATOR's seat in accordance with ISO 5353 and, if applicable, with the seat at its midpoint of adjustment. The other 4 drops shall be made from points with the centre of the test object randomly spaced on a 600 mm diameter circle, the centre of which is vertically above the seat index point of the OPERATOR's seat.

NOTE It is recognized that in some positions, a portion of the test object can overlap the edge of the overhead GUARD when striking.

After the test, the GUARD shall show no fracture, separation of parts or permanent vertical deformation exceeding 20 mm, measured on the underside of the GUARD within a 600 mm diameter circle whose centre is vertically above the centre point of the OPERATOR's seat in, if applicable, its midpoint of adjustment. Failure during the dynamic test of material fitted across the openings permitted in CC.201.3 (such as wire mesh cloth, toughened glass, transparent panel, etc.) shall be ignored. See also Figures CC.2 and CC.3.

22 Construction

22.201.1 The overhead GUARD shall extend the OPERATOR when he/she is in the operating place, operating the controls as provided by the cleaning machine manufacturer.

The control levers (in their neutral position), any unprotected pedals, feet and the steering wheel may project in the front direction up to a maximum distance of 150 mm beyond the vertical projection of the outline of the overhead GUARD onto a horizontal plane (see Figure CC.1). No account is taken of the PARKING BRAKE in its “off” position.

Protection of the OPERATOR’s legs and feet is regarded as satisfactory if the distance, vertically projected onto a horizontal plane, between the front of the overhead GUARD and the rear of the forward structure of the chassis providing the protection, does not exceed 150 mm (see Figure CC.1).

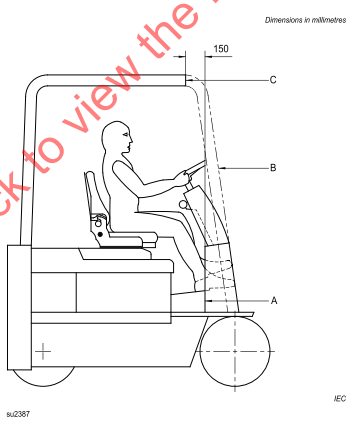
Compliance is checked by inspection and measurements.

22.201.2 The GUARD shall be constructed in a manner that does not interfere with good visibility.

Compliance is checked by inspection.

22.201.3 Openings in the top of the overhead GUARD shall not exceed 150 mm in one of the two dimensions; i.e. width or length.

Compliance is checked by inspection and measurements.



Key

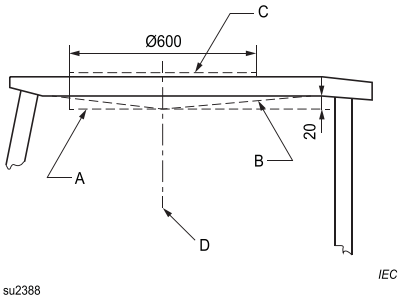
A rear of forward structure

B phantom view of rear support

C edge of overhead GUARD

Figure CC.1 – Satisfactory protection by the overhead guard

Dimensions in millimetres



Key

A deformation limiting line

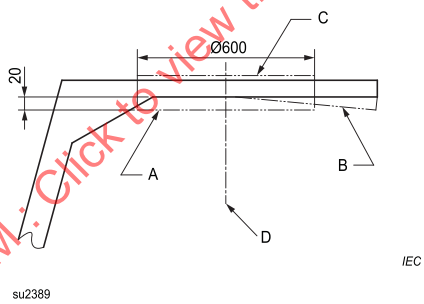
B deformed underside

C measuring area of deformation

D centre of the OPERATOR's standing position or seat index point with the seat, if applicable, at its midpoint of adjustment.

Figure CC.2 – Admissible deformation when the overhead guard is supported at all sides

Dimensions in millimetres



Key

A deformation limiting line

B deformed underside

C measuring area of deformation

D centre of the OPERATOR's standing position or seat index point with the seat, if applicable, at its midpoint of adjustment.

Figure CC.3 – Admissible deformation when the overhead guard is supported at one side

Annex DD
(informative)
Emission of acoustical noise

DD.1 Noise reduction

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

The major sound sources in floor-treatment machines are: motors, fan, brushes, pads.

DD.2 Noise test code

DD.2.1 Emission sound pressure level determination

The emission sound pressure level is measured in accordance with ISO 11201, grade 2.

The microphone is placed for

– WALK-BEHIND MACHINES at a distance of 0,40 m ± 0,025 m behind the handle at a height of 1,55 m ± 0,075 m,

– RIDE-ON MACHINES with an OPERATOR platform at a distance of 0,40 m ± 0,025 m behind the handle (from the central axis of a steering wheel, if applicable) at a height of 1,55 m ± 0,075 m above the OPERATOR platform,

– RIDE-ON MACHINES with an OPERATOR seat 0,80 m ± 0,05 m above the middle of the seat plane,

– machines with sit-on sulkies 0,80 m ± 0,05 m above the middle of the seat plane,

– machines with stand-on sulkies at a distance of 0,40 m ± 0,025 m behind the handle at a height of 1,55 m ± 0,075 m above the OPERATOR platform,

and directed towards to the geometrical centre of the machine.

DD.2.2 Sound power level determination

The sound power level is measured in accordance with ISO 3744, applying the parallelepiped measurement surface with a nine microphone arrangement. The sound power level can be measured alternatively for all machines, except outdoor sweeping machines, in accordance with ISO 3743-1 if a suitable hard-walled test room is available, or with ISO 9614-2.

DD.2.3 Operating conditions

The operating condition shall be identical for the determination for both sound power and emission sound pressure level at the specified positions. The machine shall be operated while loaded to the GVW rating. The machine shall be operated for at least 10 min before the measurements.

The machines shall be tested in a stationary position with the TRACTION DRIVE off. The engines and auxiliary units operate at the speed provided by the manufacturer for the operation of the working equipment. The cleaning head operates at its highest speed; it is not in contact with the ground. The suction system (if applicable) operates at its maximum suction power with the distance between ground and mouth of the suction system not exceeding 25 mm. The machine shall be placed on a surface in accordance with 3.1.9.101 to 3.1.9.103, as applicable. The measurement time shall be at least 15 s.

DD.2.4 Measurement uncertainties

A standard deviation of reproducibility σ_{RO} of less than 1,5 dB is expected for the A-weighted sound power level determined according to ISO 3744 or ISO 3743-1, and the A-weighted emission sound pressure level determined according to ISO 11201, grade 2.

DD.2.5 Information to be recorded

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

DD.2.6 Information to be reported

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

DD.2.7 Declaration and verification of noise emission values

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

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

For both, the declaration of the emission sound pressure level and the sound power level, the uncertainty K_{pA} and K_{WA} shall be calculated in accordance with ISO 4871.

Alternatively, if a minimum sample size of $n = 5$ is measured with at least 9 microphones simultaneously, both the uncertainty K_{pA} and K_{WA} may be determined as follows if measurement is done with enhanced accuracy at an ambient temperature of 20 ° ± 10 °C.

NOTE 1 Where the uncertainty is not calculated in accordance with the given standards or procedure, K_{pA} and K_{WA} are usually expected to be 3 dB.

$$K_{pA} = K_{WA} = 1{,}5 \cdot \sigma_t$$

with

– the total standard deviation

$$\sigma_t = \sqrt{\sigma_R^2 + \sigma_P^2}$$

– the standard deviation of reproducibility

$$\sigma_R = \sqrt{\sigma_{R0}^2 + \sigma_{omc}^2}$$

– and the standard deviation of production σ_P which has to be assumed for later (mass-)production.

Values for σ_R may be estimated to σ_R = 0,5 dB, if the environment correction K_2 (according to ISO 11201 and ISO 3744, see DD.2.1 and DD.2.2) is determined using a calibrated reference sound source (measurement and correction) with a value of not more than 0,4 dB.

NOTE 2 If K_2 is more than 0,4 dB, a value of σ_R = 0,5 dB as proposed here cannot be achieved. Correction of K_2 needs a lot of experience and comparison-measurements at optimal conditions.

The value for σ_P shall be calculated individually from the measurement results of at least the first 5 machines produced after determination of s_P for a sample size of $n \geq 5$ machines. Because the production variation may change under later production conditions, it is recommended to calculate σ_P as follows:

$$\sigma_p = SF \cdot s_p$$

The necessary size of the safety factor SF depends on the relation between s_P and σ_R as well as on the sample size n as shown in Table DD.1.

Table DD.1 – Determination of uncertainty

n	$s_P \leq \sigma_R$	$s_P > \sigma_R$
5 to 7	1,3	1,5
8 to 12	1,2	1,3
13 to 19	1,0	1,1
≥ 20	1,0	1,0

The noise declaration shall state that the noise emission values have been obtained according to the given standard or procedure. The noise declaration shall indicate clearly which standard or procedure was used regarding measurement as well as statistical calculation.

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

Annex EE
(informative)
Emission of vibration

EE.1 Reduction of vibration

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

The handles of WALK-BEHIND MACHINES shall be designed and constructed in such a way as to reduce the vibrations transmitted to the upper limbs of the OPERATOR to the lowest level that is reasonably possible.

Seats and platforms shall be selected or designed and constructed in such a way as to reduce the vibrations and shocks transmitted to the whole body of the OPERATOR to the lowest level that is reasonably possible. The seat and platform mountings shall withstand all stresses to which they can be subjected.

NOTE The main sources causing vibration are the

– unbalanced moving parts;

– impact in gears, bearings and other mechanisms;

– interaction between OPERATOR, machine and material being worked;

– working surface, travelling speed, tyre pressure.

EE.2 Information on vibration emission

The instructions shall give the following information:

– for all machines: the vibration total value to which the hand-arm system is subjected, measured in accordance with ISO 5349-1 for arm vibrations, the machine being supplied at RATED POWER INPUT or at the maximum RATED POWER INPUT for machines with a range of power, if the vibration total value exceeds 2,5 m/s^2. Where this value does not exceed 2,5 m/s^2, this fact may be stated in place of the emission value and uncertainty, e.g. by declaring $a_h \leq 2{,}5\ m/s^2$;

– additionally, for RIDE-ON MACHINES and WALK-BEHIND MACHINES with SULKY: the highest root mean square value of weighted acceleration to which the whole body is subjected, measured in accordance with ISO 2631-1, the machine being supplied at RATED POWER INPUT and operated under NORMAL OPERATION, if the highest root mean square value of weighted acceleration exceeds 0,5 m/s^2. Where this value does not exceed 0,5 m/s^2, this fact may be stated in place of the emission value and uncertainty, e.g. by declaring $a_w \leq 0{,}5\ m/s^2$;

– the uncertainty surrounding these values in accordance with the above given standards.

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

Regarding operating conditions during measurement and the methods used for measurement, the reference of the standard applied (IEC 60335-2-72) must be specified. The machine shall be operated while loaded to the GVW rating.

Annex DVA
(normative)

Component standards cross reference

DVA.1 D2 *Modification of Table DVA.3.1 by adding the following to the Clause 24 rows:*

Clause: 24

Component: Automotive-type overcurrent protective devices

IEC/ISO: –

Canada: SAE J554

Mexico: –

U.S.: ISO 8820, SAE J554, UL 275, or UL Outline of Investigation 275A

IEC/ISO: —

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Clause: 24

Component: Arc-fault circuit interrupters (AFCIs) and leakage current detector-interrupters

Annex 101.DVA
informative

Requirements for internal combustion engine powered machines using fuels such as, but not limited to, ethanol-gasoline blends, gasoline, biodiesel, and diesel

Annex 101.DVA D2 ***Add Annex 101.DVA to the Part 2 as follows:***

101.DVA.1 Test liquids

101.DVA.1.1 Ethanol test liquids

101.DVA1.1.1 *Ethanol test fluids are designated by a format that fits the form of CEXXa; where "C" indicates ASTM Reference Fuel C (50% Isooctane, 50% Toluene on a volumetric basis); "E" indicates synthetic ethanol (designated CDA20); "XX" indicates percentage amount of the ethanol that is added to the solution; and "a" indicates aggressive elements that are added to the synthetic ethanol. The aggressive elements are used to represent contaminants that can be found in actual use and are used to help represent the worst-case test fluid. The aggressive elements are mixed in accordance with SAE J1681.*

101.DVA1.1.1.2 *The aggressive elements described in 101.DVA1.1.1 include deionized water, sodium chloride, sulfuric acid, and glacial acetic acid. Table 101.DVA.1 outlines the amounts of each of these elements in one liter of aggressive ethanol.*

Table 101.DVA.1 – Aggressive ethanol test liquid

Component	Units	1 Liter of CE85a	1 Liter of CE25a
ASTM Reference Fuel C	Liter	0.150	0.750
Synthetic Ethanol	Liter	0.843	0.248
Deionized Water	Liter	0.007	0.002
Sodium Chloride	Gram	0.003	0.001
Sulfuric Acid	Milliliter	0.010	0.003
Glacial Acetic Acid	Milliliter	0.050	0.010

101.DVA1.1.3 *CE25a consists of a 75% ASTM Reference Fuel C and 25% aggressive ethanol mixture. CE85a consists of a 15% ASTM Reference Fuel C and 85% aggressive ethanol mixture. These two fluids may be used to condition samples as noted in each specific test that indicates that these fluids are to be used. The test fluids shall be prepared just prior to use to minimize effects on the test fluid. The aggressive ethanol is corrosive and changes can occur to the solution from interactions with the storage and transfer containers that are not inert. Exposure to air and/or moisture can also affect the test fluid. These changes should be minimized.*

101.DVA1.1.4 *Products intended to be rated for use with gasoline or gasoline/ethanol blends with nominal ethanol concentrations up to 25 % (E0 – E25) shall be evaluated using the CE25a test fluid as the only applicable test fluid. Products intended to be rated at gasoline/ethanol blends with nominal ethanol concentration greater than 25 percent shall be evaluated using both the CE25a test fluid and the CE85a test fluid.*

101.DVA1.1.5 *For products evaluated using the CE25a test fluid, one sample shall be conditioned in accordance with the test exposure sequences. For products using both test fluids, two samples shall be conditioned in accordance with the test exposure sequences.*

101.DVA.1.2 Biodiesel test liquids

101.DVA.1.2.1 *B100a biodiesel fluid consists of ASTM D6751 B100 biodiesel from soy feedstock combined with an aggressive stock containing <0.3 % volume combined water and decanoic acid. Each source of biodiesel may have minor variations in specific gravity and initial Acid Number that require measurement and final adjustment. The blending of the test fluid shall be based on the following formula to achieve a final Acid Number of 1.00 ± 0.02 for the mixture in accordance with ASTM D664: 0.2 % volume Acid Water [1.80 g decanoic acid / 1000 g DI H2O].*

101.DVA.1.2.2 *Decanoic acid crystals are insoluble in water. Decanoic acid crystals shall be finely ground and thoroughly mixed in the overall solution before acid number measurements are taken.*

101.DVA.1.2.3 *Final adjustments to the B100a fluid shall be made by adding biodiesel or decanoic acid as necessary to achieve the Acid Number of 1.00 ±0.02.*

101.DVA.1.2.4 *FB25a test fluid is blended by mixing 25 volume parts of B100a biodiesel fluid and 75 volume parts of ASTM Fuel F.*

101.DVA.1.2.5 *Biodiesel fluids have limited stability periods, and changes can occur to the fluid if stored for extended periods. Generally, at 25°C, B100a should be stable for at least a 30-day period, and FB25a should be stable for 12 months. Exposure to air, moisture, and/or widely variant temperatures can also affect the test fluid and should be minimized. Changes can also occur from test fluid interactions with storage and transfer containers that are not inert. These changes should be minimized.*

101.DVA.2 Marking and instructions

101.DVA.2.1 Add the following to Clause 7 of the Part 1:

Each electrical -component that is evaluated only according to the requirements of this standard, such as an electric fuel pump, shall be marked with the following:

a) The manufacturer's or private labeller's identification.

b) A distinctive model, catalogue, or equivalent identification.

c) The electrical ratings applicable to motors, switchgear, windings, and the like.

d) The capacity and pressure ratings for fuel pumps.

101.DVA.3 Moisture resistance

Clause 15.2 of the Part 1 does not apply to fuel tanks.

101.DVA.4 Stability and mechanical hazards

101.DVA.4.1 Nonmetallic fuel tanks

101.DVA.4.1.1 Fuel tanks shall comply with 101.DVA.4.1.2 and 101.DVA.4.1.3.

101.DVA.4.1.2 Internal pressure resistance test

101.DVA.4.1.2.1 The tank material shall show no signs of rupture, cracks, or leakage when tested in accordance with Clauses 101.DVA.4.1.2.2 - 101.DVA.4.1.2.5.

101.DVA.4.1.2.2 Three fuel tanks shall be filled to their total volume with water at 24 ±3°C and the closures shall be secured.

101.DVA.4.1.2.3 The internal pressure shall be increased uniformly to a gauge pressure of 34 kPa over a period of 30 to 60 s and maintained for 2 min.

101.DVA.4.1.2.4 Pressure shall be applied by inserting and securing an adapter through a drilled hole in a flat, heavy section of the tank wall, rather than a pinch-off or parting line.

101.DVA.4.1.2.5 The above test shall be repeated with the tanks filled to their total volume with water at 70 ±3°C.

101.DVA.4.1.3 Nonmetallic tanks used for gasoline or diesel fuel

101.DVA.4.1.3.1 Nonmetallic tanks used for gasoline or diesel fuel shall comply with Clause 101.DVA.4.2.1; those used for ethanol blended gasoline or biodiesel fuel shall comply with Clause 101.DVA.4.2.2.

101.DVA.4.2 Nonmetallic parts in contact with fuel

101.DVA.4.2.1 Gasoline or diesel fuel

101.DVA.4.2.1.1 A nonmetallic part in contact with gasoline or diesel fuel shall not show excessive volume change or loss of weight, considered on the basis of its intended function, following immersion for 70 h at a temperature of 23 ± 2°C in the test liquid specified in Table 101.DVA.2. See Clause 101.DVA.4.2.2 for nonmetallic parts in contact with ethanol blended gasoline or biodiesel fuel.

Exception No. 1: This requirement does not apply to fuel lines that conform to Clause 101.DVA.6.2.3.

Exception No. 2: This requirement does not apply to fuel system assemblies that conform to Clause 101.DVA.6.2.4.

Exception No. 3: This requirement does not apply to quick connect fittings that conform with Clause 101.DVA.6.2.5.

Exception No. 4: This requirement does not apply to gaskets and seals that have been investigated to UL 157.

Table 101.DVA.2
Fuel exposure test liquids for nonmetallic materials

Liquid in contact with part	Test liquid
Gasoline Diesel oil	A and C Reference Fuels (ASTM D471) IRM 903 oil

101.DVA.4.2.1.2 A change in volume of not more than 25 % swelling or 5 % shrinkage, and a weight loss (extraction) of not more than 10 % indicates compliance with Clause 101.DVA.4.2.1.1.

101.DVA.4.2.2 Ethanol blended gasoline or biodiesel fuel

101.DVA.4.2.2.1 A nonmetallic part in contact with ethanol blended gasoline or biodiesel fuel shall be evaluated in accordance with UL 157, modified according to Clauses 101.DVA.4.2.2.2 and 101.DVA.4.2.2.3.

101.DVA.4.2.2.2 The Volume Change and Extraction Test shall be used. with the following modifications:

a) The test duration shall be 1000 h;

b) The applicable test liquids shall be as described in Clause 101.DVA.1.1; and

c) For all materials, the average volume change shall not exceed 40% swell (increase in volume) or 1% shrinkage (decrease in volume). In addition, the weight loss shall not exceed 10%.

Exception: This requirement does not apply to composite gasket materials as defined in accordance with UL 157.

101.DVA.4.2.2.3 The Compression Set Test shall be used, with the following modifications:

a) The test duration shall be 1000 h.

b) The samples shall be immersed, at room temperature, in the test liquids (see c) while compressed for the entire test duration. No oven conditioning is required.

c) The applicable test liquids shall be as described in Clause 101.DVA.1.2.

d) The recovery period shall consist of removing the sample from the compression device and immersing it in the applicable test fluid for 30 min. at room temperature. The sample shall not be allowed to dry out due to exposure to air. The 30-min. immersion should use the same liquid as the test liquid for each sample.

e) For all materials, the average compressions set shall be calculated and shall not exceed 35%.

Exception: This requirement does not apply to composite gasket materials as defined in accordance with UL 157.

101.DVA.5 Mechanical strength

101.DVA.5.1 D2 Hydrostatic strength test for electric pumps

101.DVA.5.1.1 An enclosure for an electric fuel pump located outside of the fuel tank shall be capable of withstanding, for a duration of 1 min without rupture or distortion, a hydrostatic pressure of five times the maximum pressure recorded during the explosion test.

101.DVA.5.1.2 The samples of pumps previously subjected to the explosion test shall be connected to a source of hydrostatic pressure. A positive shut-off valve and a pressure indicating device shall be installed in the supplying piping. The pressure indicating device shall be installed in the piping between the shut-off valve and the test pump. The pressure indicating device shall comply with one of the following:

a) An analog gauge having a pressure range such that the test pressure is between 30 and 70 % of the maximum scale reading of the gauge;

b) A digital pressure transducer, or other digital gauge, that is calibrated over a range of pressure that includes the test pressure; or

c) Other device that is equivalent to the devices in (a) or (b).

101.DVA.5.2 Vibration tests for electric fuel pumps

101.DVA.5.2.1 A pump located outside of the fuel tank shall withstand the test described in Clauses 101.DVA.5.2.2 - 101.DVA.5.2.4 and shall operate without developing leaks, cracks, and the like, and without increasing the risk of fire or injury to persons.

101.DVA.5.2.2 The pump and all components, with the manufacturer's recommended fuel line attached, shall be mounted on a vibration machine so as to simulate as closely as possible an actual installation. The means used for such mounting shall be sufficiently rigid to preclude resonant frequencies of the mounting means.

101.DVA.5.2.3 The sample shall be subjected to variable frequency vibration along each of three axes (horizontal, lateral, and vertical) for 8 h in each plane (24 h total) at a peak-to-peak amplitude of 1.3 ±0.00004 mm. The frequency of vibration shall be continuously varied, at a uniform rate, from 10 to 60 to 10 hertz every 4 min.

101.DVA.5.2.4 For this test, peak-to-peak amplitude is defined as the maximum displacement of sinusoidal motion (total table displacement).

101.DVA.5.3 Explosion tests for electric fuel pumps

101.DVA.5.3.1 An electric fuel pump assembly shall not permit the passage of sparks or flame from the interior of the casing to the outside surrounding atmosphere as the result of exploding a gasoline-air mixture within the assembly. As an alternative, this test shall be conducted with a propane-air mixture over the range of 3.0 to 7.0 % concentrations. The explosion pressure shall be measured during the test.

101.DVA.5.3.2 The gasoline used in this investigation shall be a nonleaded petroleum distillate consisting essentially of aliphatic hydrocarbon compounds. It shall have a specific gravity of 0,706 at 15,6 °C. The boiling point range of a typical sample of this gasoline, determined according to ISO 3405, is shown in Table 101.DVA.3.

101.DVA.5.3.3 For the explosion tests, the pump shall be installed in a test chamber provided with gas-inlet and -outlet connections to the pipes carrying the explosive mixtures. The pump shall be drilled and tapped for connection to the inlet and outlet pipes carrying the explosive vapor-air mixture and also shall be tapped for attachment of the explosion-pressure recording device and spark plugs for ignition.

101.DVA.5.3.4 The explosive vapor-air mixture shall be allowed to flow into each enclosure and the surrounding test chamber until all of the original air has been displaced. Samples then shall be taken for analysis from the test chamber, the enclosure, and the line carrying the explosive vapor-air mixture. The mixture shall then be fired on the interior of the enclosure, either by arcs produced by the device or by a spark from the spark plug.

101.DVA.5.3.5 A minimum of ten tests shall be conducted.

Table 101.DVA.3
Result of distillation test of gasoline

Volume distilled (ml)	Temperature (°C)
initial boiling point	48.0
5	63.0
10	66.0
20	70.0
30	74.0
40	77.5
50	81.5
60	85.5
70	90.0
80	96.0
90	106.5
95	116.5
Endpoint	126.5
Recovery, ml 98.5	
Residue, ml 1.0	
Distillation loss, ml 0.5	
Barometric pressure, ml Hg [mldr][mldr]..... 746.5	

101.DVA.5.4 Exhaust system test - spark ignition engines

101.DVA.5.4.1 The engine shall be continuously operated until it is in a heated state. This state shall be assumed to have been reached when the exhaust manifold has been heated to approximately 315°C.

Exception: If the exhaust manifold temperature of 315°C cannot be reached, the engine shall be operated for no less than 10 min.

101.DVA.5.4.2 Ten backfires shall be obtained by alternately racing and idling the engine. An auxiliary spark plug may be installed as close as possible to the exhaust manifold. The spark plug shall be connected to a spark coil which can be energized from a BATTERY through a momentary contact switch, to assist in creating a backfire in the following conditions:

a) The spark timing shall be retarded;

b) Spark plug leads shall be interchanged; or

c) The ignition switch shall be operated to alternately energize and de-energize the ignition system, or a switch may be added to the ground circuit leading directly to the coil to alternately energize and de-energize the ignition system.

Exception: If it is determined that the conditions above do not result in a backfire, the Exhaust System Test for spark ignition engines may be waived.

101.DVA.5.4.3 If an exhaust turbocharger is utilized, the standpipe arrangement may be mounted as close as possible to the output of the turbocharger.

101.DVA.5.4.4 The exhaust system, including the muffler and tailpipe, shall not rupture under conditions of backfire.

101.DVA.6 Construction

101.DVA.6.1 Metal fuel tanks

101.DVA.6.1.1 A metal fuel tank shall comply with one of the following:

- be constructed of painted mild steel having a minimum thickness of 0.76 mm), or;

- pass the impact test of Clause 21.1 or 21.101 as applicable.

101.DVA.6.1.2 Joints in metal fuel tanks shall be welded, brazed, soldered, or bonded. If soldered or bonded, the joints shall be of a construction that will retain the heads if the solder or bonding melts. Fittings and fill pipe, if soldered or bonded, shall be mechanically secured to the tank in addition to soldering or bonding.

101.DVA.6.2 Fuel systems (other than tanks)

101.DVA.6.2.1 Metallic fuel lines, except those used in a high-pressure injection system, shall be of seamless annealed copper or steel tubing. Flexible tubing, hose, or a vibration loop shall be used where necessary to absorb vibration. Flexible tubing or hose shall be of the length necessary to span between the fixed and moving parts.

101.DVA.6.2.2 A tank on a gravity-feed systems or on a systems where the fuel in the tank is subject to discharge by siphon action if the fuel line breaks, and having a volume greater than 10 l, shall be provided with a shut-off valve in an accessible location.

101.DVA.6.2.3 Nonmetallic fuel tubing or hoses shall be provided with appropriate traceability to validate conformance with SAE J2260, or SAE J30.

101.DVA.6.2.4 Fuel system assemblies (e.g., each fuel line and fitting configuration) shall be provided with appropriate traceability to validate conformance with SAE J2045.

Exception: Fuel system assembly (e.g., each fuel line and fitting configuration) shall not pull off fittings or fail when subjected to an 89 N axial pull test applied over a 1 min period. The test shall be conducted at ambient conditions of 21 ± 5°C with tubing or hose wetted with fuel. Hose shall also be subjected to 70 h at 100°C aging and 48 h of 3.2 mm amplitude vibration at 17 Hz before the pull test.

101.DVA.6.2.5 Fuel system assemblies that utilize quick connect fittings shall conform and be provided with appropriate traceability to validate conformance with SAE J2044.

Exception: Fuel system assembly (e.g., each fuel line and fitting configuration) shall not pull off fittings or fail when subjected to an 89 N axial pull test applied over a 1 min period. The test shall be conducted at ambient conditions of 21 ± 5°C with tubing or hose wetted with fuel. Hose shall also be subjected to 70 h at 100°C aging and 48 h of 3.2 mm amplitude vibration at 17 Hz before the pull test.

101.DVA.6.2.6

Exception: Clearances between fuel lines and wiring may be reduced to 13 mm if both are supported so as to maintain clearances.

101.DVA.6.2.7 A downdraft carburetor, if used, having an external float bowl vent opening, shall have a vent overflow tube to direct fuel away from the engine in case of fuel overflow.

101.DVA.6.3 Electric Fuel Pumps

101.DVA.6.3.1 The fuel-containing portion of the pump shall be separated from the electrical compartment or components by metal partitions secured and sealed using soldered, welded, or brazed joints, or the pump assembly shall conform to the requirements of the Explosion tests for electric fuel pumps, Clause 101.DVA.5.3.

101.DVA.6.3.2 Vent holes shall be provided for the electrical enclosure when the fuel containing portion of the pump is separated from the electrical compartment.

101.DVA.7 Resistance to heat and fire

101.DVA.7.1 Fuel pump

When the case or other external components of a fuel pump located outside of the fuel tank are non-metallic, tests described in Clause 101.DVA.4.2 and the following requirements under Path II in UL 746C shall be conducted:

a) flame test or flammability rating V-2 or better according to IEC 60695-11-20;

b) The end use conditions shall not exceed the Relative Thermal Index according to IEC 60216-6 for that material; and

c) Mould-Stress relief distortion test according to IEC 60695-10-3.

101.DVA.7.2 Backfire deflector element test

101.DVA.7.2.1 If it is determined that altering the ignition timing, interchanging spark plug leads, or alternately energizing and de-energizing the ignition system, do not result in a backfire, the backfire deflector element test is not required. Tests are not required on backfire deflectors employed on diesel engines.

101.DVA.7.2.2 A dry-type filter element shall be subjected to five consecutive washing and drying cycles. Washing shall consist of 60 up-down strokes at a rate of approximately one stroke per second, completely immersing and removing the sample from a distilled water bath maintained at 23 ± 2°C. The samples shall then be allowed to dry for no less than 72 h. The samples shall be dried in an environment maintained at 23 ± 2°C and 50 ± 5 % relative humidity. Disposable elements need not be washed.

101.DVA.7.2.3 The side of the filter media normally exposed to backfire shall then be subjected to a flame source of sufficient intensity to cause the media to burn or glow. The flame source shall then be removed, and an acceptable filter media shall not continue to burn or smolder.

101.DVA.7.2.4 The flame employed shall be produced by a 9.53 ± 1 mm diameter single tube Tirrill burner. The flame shall be adjusted to a height of 50.8 ± 1 mm and shall be essentially blue in color with no appreciable inner cone. Flame impingement shall be accomplished by laying the element horizontally on a LEVEL SURFACE and applying the flame to the side normally exposed to backfire at an angle forming 45 ± 5 degrees with horizontal. The distance from the burner orifice to the sample shall be maintained at 19 ± 1 mm. The flame shall be applied until burning or glowing (red) of the paper material is evident over an area approximately equal to the burner orifice, but for no more than 5 min, at which point the flame source shall be removed.