

# INTERNATIONAL STANDARD



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

IEC 60335-2-72:2021

<https://standards.iteh.ai/catalog/standards/sist/95186a20-e80a-4e42-8d30-f77320881ac/iec-60335-2-72-2021>



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INTERNATIONAL  
ELECTROTECHNICAL  
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## 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**

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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. It is an International Standard.

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

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

- editorial and technical alignment with IEC 60335-1:2020;
- rearrangement of subclauses to consistent numbering 22.101 to 22.113.

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

CDV	Report on voting
61J/738/CDV	61J/744A/RVC

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

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

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

This part 2 is to be used in conjunction with the latest edition of IEC 60335-1 and its amendments. It was established on the basis of the sixth edition (2020) of that standard.

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

This part 2 supplements or modifies the corresponding clauses in IEC 60335-1, so as to convert that publication into the IEC standard: Particular requirements for 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: <https://standards.iteh.ai/catalog/standards/sist/95186a20-e80a-4e42-8d30-477326891ed1/iec-60335-2-72-2021>

- 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.

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

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

The following differences exist in the countries indicated below.

- Annex AA: The CO-emission of LPG driven machines, intended to be used indoors, has to comply with the value specified in Annex BB. The result shall be documented (Germany).
- Annex BB: For machines intended to be used indoors, except single cylinder engines, the exhaust gas shall not contain more than 0,1 % volume of carbon monoxide (CO). If adjustments are necessary, the adjusting means shall be easily accessible. The measurement shall be carried out with a warm engine, idling, using 98 % propane. The revolution speed of the engine shall be documented (Germany).

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

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

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under [webstore.iec.ch](http://webstore.iec.ch) in the data related to the specific document. At this date, the document will be

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

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## INTRODUCTION

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

This standard recognizes the internationally accepted level of protection against hazards such as electrical, mechanical, thermal, fire and radiation of appliances when operated as in normal use taking into account the manufacturer's instructions. It also covers abnormal situations that can be expected in practice and takes into account the way in which electromagnetic phenomena can affect the safe operation of appliances.

This standard takes into account the requirements of IEC 60364 as far as possible so that there is compatibility with the wiring rules when the appliance is connected to the supply mains. However, national wiring rules may differ.

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

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

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

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

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

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

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

## HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

### Part 2-72: 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 part of IEC 60335 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.

These machines have a cleaning motion which is more linear than lateral or periodic.

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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.

These machines 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-operated machines**.

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

This standard does not apply to

- floor treatment appliances for household use (IEC 60335-2-10);
- floor treatment machines for **commercial use** (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);

NOTE 103 IEC 60335-2-67, IEC 60335-2-68 and IEC 60335-2-69 cover only machines without **traction drive**.

- road sweepers;

NOTE 104 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 105 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.).

NOTE 106 Requirements for fuel-cells are under consideration.

## 2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

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IEC 62061, *Safety of machinery – Functional safety of safety-related control systems*

IEC 62485-3:2014, *Safety requirements for secondary batteries and battery installations – Part 3: Traction batteries*

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

ISO 3411, *Earth moving machinery – 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 13857:2019, *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 60068-2-78:2012, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

### 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. Internal combustion engine driven machines are operated with the fuel specified by the manufacturer except where otherwise stated in this standard.

Operational functions include all treatment and driving functions.

Operation of the machine under following conditions:

- the battery is charged, the battery being initially discharged to such an extent that the appliance cannot operate;
- if possible, the appliance is supplied from the supply mains through its standalone battery charger, the battery being initially discharged to such an extent that the appliance cannot operate. The appliance is operated as specified in the main part of this standard;
- if possible, **built-in battery chargers** are connected to the circuit of Figure 107. The variable resistor is adjusted so that the current in the circuit is the **rated DC 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.
- if the appliance incorporates inductive coupling between two parts that are detachable from each other, the appliance is supplied from the supply mains with the detachable part removed.

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 normative 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 TS 62885-1, 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.

### 3.6.9 Addition:

Note 101 to entry: Sets of batteries are regarded as a single battery if they require tools to disconnect the individual battery interconnections.

#### 3.101

##### **traction drive**

system used to propel the machine, e.g. by powered wheels

Note 1 to entry: 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 in direct physical contact with the machine and performing one or more of the following tasks: 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

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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 battery 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

**3.122****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.

**3.123****battery low voltage  
BLV**

battery-supplied floating DC working voltage in the range of  $>42$  V and  $\leq 60$  V

Batteries of **BLV** systems may be charged with voltages up to 75 V DC. All voltages are regarded as DC if the peak-to-peak value does not exceed 10 % of the average value.

Note 1 to entry: **BLV** is not considered to be of class I, class II, or class III.

**3.124****hazardous voltage**

voltage between parts having an average value exceeding 60 V DC or 42 V peak when the peak-to-peak ripple exceeds 10 % of the average value

**3.125****battery connector**

plug connecting system applied for the connection of the battery either with the charging system, or with the machine, which can be engaged and disengaged without the use of any tools

**3.126****BLV insulation**

insulation applied to **live parts** to provide basic protection against electric shock and which is identical with **basic insulation** in the voltage range defined by **BLV**

**3.127****rated DC output voltage**

output voltage assigned to the battery charger by the manufacturer

**3.128****rated DC output current**

output current assigned to the battery charger by the manufacturer