

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE



**Automatic floor treatment machines for commercial use –  
Particular requirements**

**(standards.iteh.ai)**

**Machines automatiques de traitement des sols à usage commercial –  
Exigences particulières**

<https://standards.iteh.ai/catalog/standards/sist/30cf010c-8bbb-48d0-8852-b93e69707b9f/iec-63327-2021>



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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**AUTOMATIC FLOOR TREATMENT MACHINES FOR COMMERCIAL USE –  
PARTICULAR REQUIREMENTS**

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IEC 63327 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.

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

CDV	Report on voting
61J/734/CDV	61J/747A/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).

The requirements for the construction and testing covered by this document are applied in addition to the particular requirements for floor treatment machines with or without traction drive, for commercial use given in IEC 60335-2-72:2021.

NOTE 1 The following print types are used:

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

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

NOTE 2 The 100 numbering is applied in certain clauses of this standard as these are additions to certain existing clauses of IEC 60335-1, IEC 60335-2-69, and IEC 60335-2-72.

NOTE 3 The 200 numbering in certain clauses of this standard is applied to avoid overlap with the numbering of the corresponding clauses of IEC 60335-1, IEC 60335-2-69, and IEC 60335-2-72.

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

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- 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.

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 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.

## AUTOMATIC FLOOR TREATMENT MACHINES FOR COMMERCIAL USE – PARTICULAR REQUIREMENTS

### 1 Scope

This International Standard deals with the safety of powered **automatic floor treatment machines** intended for **commercial use** indoors for the following applications:

- sweeping,
- scrubbing,
- wet or dry pick-up,
- polishing,
- application of wax, sealing products and powder-based detergents,
- shampooing

of floors.

The requirements given by this standard are applied in addition to the requirements for commercial floor treatment machines in IEC 60335-2-72, as far as applicable.

For **automatic floor treatment machines** solely designed for wet or dry pick-up, additional or modified requirements of IEC 60335-2-69 where stated are applicable.

Machines covered by this standard can operate in **automatic or manual mode**.

Modified requirements are given in Annex FF of this standard for **automatic floor treatment machines** not equipped with a **manual mode**.

The **automatic floor treatment machines** covered by this standard are designed to avoid hazardous contact with persons in the environment applied. It is recognized that **automatic floor treatment machines** for **commercial use** might require operation within close proximity to large groups of people, such as in shopping malls and schools.

Throughout this standard, the term “machine” is used to refer to an **automatic floor treatment machine**.

The following power systems are covered:

- rechargeable batteries that are recharged by **built-in battery chargers** or off-board battery chargers which may be incorporated within the circuitry of the machine, or mounted on the machine and incorporated within the enclosure of the **automatic floor treatment machine**; or powered by batteries that need to be removed to be recharged with a charger that is external to the machine,
- Other systems are under consideration.

This standard does not apply to

- vacuum cleaners and water-suction cleaning appliances and automatic battery-operated cleaners for household use (IEC 60335-2-2);
- floor treatment machines and wet scrubbing machines for household use (IEC 60335-2-10);
- battery chargers (IEC 60335-2-29);



- floor treatment machines for **commercial use** (IEC 60335-2-67);
- spray extraction machines for **commercial use** (IEC 60335-2-68);
- road sweepers;

NOTE 101 In Europe, the EN 17106 series 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 use in vehicles or on board of ships or aircraft.
- vacuum cleaners designed for pickup of combustible dust;
- appliances for medical purposes (IEC 60601-1);
- driverless industrial trucks and their systems (ISO 3691-4);
- robots and robotic devices: Safety requirements of personal care robots (ISO 13482)
- machines with parts that extend beyond the **contact zone** of the machine;

NOTE 102 Components of the machine that operate outside the **contact zone** can be evaluated differently.

- machines designed for picking up liquids with a flash point below 55 °C.

NOTE 103 The flash point temperature limit can vary in different countries. National regulations will need to be taken into account.

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.

## 2 Normative references

[IEC 63327:2021](https://standards.iteh.ai/catalog/standards/sist/30cf010c-8bbb-48d0-8852-302670b5-iec-63327-2021)

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The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60335-1:2020, *Household and similar electrical appliances – Safety – Part 1: General requirements*

IEC 60335-2-69:2021, *Household and similar electrical appliances – Safety – Part 2-69: Particular requirements for wet and dry vacuum cleaners, including power brush, for commercial use*

IEC 60335-2-72:2021, *Household and similar electrical appliances – Safety – Part 2-72: Particular requirements for floor treatment machines with or without traction drive, for commercial use*

IEC 61032, *Protection of persons and equipment by enclosures – Probes for verification*

IEC 61058-1, *Switches for appliances – Part 1: General requirements*

IEC 61770:2008, *Electric appliances connected to the water mains – Avoidance of backsiphonage and failure of hose-sets*

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

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 upper and lower limbs*

ISO 18646-1:2016, *Robotics – Performance criteria and related test methods for service robots – Part 1: Locomotion for wheeled robots*

### 3 Terms and definitions

Clause 3 of IEC 60335-2-69:2021 and IEC 60335-2-72:2021 applies, except as follows:

NOTE The 200 numbering in Clause 3 of this standard is applied to avoid overlap with the numbering of Clause 3 of IEC 60335-2-69 and IEC 60335-2-72.

*Addition:*

#### 3.201

##### **automatic floor treatment machine**

machine that operates automatically on a defined working area and that may also be able to be operated in a **manual mode**

Note 1 to entry: Definition of the work area and floor surface can be done by **operator** action, (temporary) physical limitations or by autonomous (initial) exploratory mode of the machine.

#### 3.202

##### **type 1 machine**

**automatic floor treatment machine** having

- a maximum **rated automatic speed** not exceeding 3 km/h, and
- a height during **normal operation** not exceeding 50 cm above the ground, and
- a mass during **normal operation** not exceeding 20 kg

Note 1 to entry: If a **GVW** is available, the mass is replaced by this value.

#### 3.203

##### **type 2 machine**

**automatic floor treatment machine** other than a **type 1 machine**

#### 3.204

##### **control system**

set of logic control and power functions which allows to monitor and control the mechanical structure of the machine and to communicate with the environment (equipment and **operators**)

[SOURCE: ISO 8373:2012, 2.7 modified – "monitoring" has been changed to "to monitor", "robot" has been changed to "machine", "communication" has been changed to "communicate" and "users" has been changed to "operators"]

#### 3.205

##### **manual mode**

operating mode in which the machine can be operated by, for example, pushbuttons or a joystick and that excludes operation in **automatic mode**

Note 1 to entry: It includes manual cleaning and transportation modes.

[SOURCE: ISO 8373:2012, 5.3.10.2, modified – "robot" has been changed to "machine", "operation" has been changed to "mode" and the note to entry has been added]

**3.206****automatic mode**

operating mode in which the machine accomplishes its assigned mission without direct human intervention

**3.207****locked state**

condition in which the driving wheels are being prevented from moving with a locking mechanism that can be unlocked by the intervention of the authorized **operator** only

Note 1 to entry: A locking mechanism can be the **traction drive** or the service brake.

**3.208****rated automatic speed**

maximum speed of the machine during operation in **automatic mode** in **open space**

**3.209****access control**

security measure enabling the **operator** to gain access to the control of the machine

Note 1 to entry: It includes, but is not limited to, a key-protected control device.

**3.210****stopping distance**

maximum distance travelled by the **machine** between the initiation of the stop and the complete standstill

Note 1 to entry: The **stopping distance** in 7.3 includes machine reaction time.

[SOURCE: ISO 18646-1:2016, 3.10, modified – "mobile platform origin" has been changed to "machine", "full stop of the mobile platform" has been changed to "complete standstill" and the note to entry has been added]

**3.211****stop category 0**

stopping by immediate removal of power to the machine actuators (i.e., an uncontrolled stop)

Note 1 to entry: It is understood that **operator** attention will be required to re-enable power to the actuators.

[SOURCE: IEC 60204-1:2016, 9.2.2, modified – Note to entry has been added]

**3.212****stop category 1**

controlled stop with power available to the machine actuators to achieve the stop and then removal of power when the stop is achieved

Note 1 to entry: It is understood that **operator** attention will be required to re-enable power to the actuators.

[SOURCE: IEC 60204-1:2016, 9.2.2, modified – Note to entry has been added]

**3.213****stop category 2**

controlled stop with power left available to the machine actuators

Note 1 to entry: It is understood that **operator** attention is not required to re-enable power to the actuators.

[SOURCE: IEC 60204-1:2016, 9.2.2, modified – "remaining" has been changed to "left" and the note to entry has been added]

### 3.214 stopping zone

fixed or variable-sized zone in which the machine has the capabilities to avoid a static object

Note 1 to entry: See Figure 2.

### 3.215 contact zone

boundary in which the machine is assumed to be in contact with the object, and the allowable motion of the machine could be hazardous at that boundary

Note 1 to entry: See Figure 2.

Note 2 to entry: Hazardous exposed moving side brushes are included in the **contact zone**.

### 3.216 open space

area that is not considered to be a **confined space**

### 3.217 confined space

area in which the distance from the nearest continuous wall or obstacle is less than 0,5 m from the **machine transport width** parallel to the direction of motion

Note 1 to entry: See Figure 2.

### 3.218 machine transport width

minimum width the machine can pass through to indicate the maneuverability of the machine during transport

Note 1 to entry: It does not indicate the effective cleaning width of the machine.

[SOURCE: IEC 62885-9:2019, Clause 7, modified – "not the effective cleaning width of the machine" has been deleted and the note to entry has been added]

### 3.219 docking station

unit that may provide one or more of the following functions for the **automatic floor treatment machine**:

- manual or automatic battery charging facilities,
- AC and/or DC power supply,
- filling water with or without detergents,
- filling detergents,
- filling water for wet batteries,
- emptying of wastewater, dust, coarse dirt,
- communication connections,
- navigation information

Note 1 to entry: A **docking station** is also known as a base unit.

## 4 General requirements

The machine shall be constructed as follows:

The machine when in **manual mode** shall fulfil the requirements for commercial floor treatment machines according to IEC 60335-2-72:2021 unless stated otherwise in this standard. Further requirements for the **automatic mode** are given within the main body of this standard. Machines shall be constructed in their **manual** and **automatic mode** so that they function safely 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. For **ride-on machines** in **automatic mode**, **operator** presence on the machine shall be prevented either by sensing which stops the machine from operating, or design features which prevent **operator** presence.

Modified requirements to IEC 60335-2-72:2021 are given in normative Annex FF of this standard for **automatic floor treatment machines** not equipped with a **manual mode**.

For the purposes of this standard, the term 'appliance' as used in IEC 60335-1:2020 is to be read as 'machine'.

Safety of the machine shall not depend on remote operation. Resetting of **stop category 0** or **stop category 1** shall not be possible remotely.

*Compliance is checked by the following:*

*The tests of this standard shall be performed after disabling remote operations.*

## 5 General conditions for the tests

IEC 63327:2021

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**5.1** The following test obstacles, taken from ISO 13856-3, shall be covered in black felt or coarse fabric with a reflectance between 5 % and 10 %:

- a) Obstacle 1 – a cylinder with a diameter of 200 mm and a length of 600 mm, placed horizontally; and
- b) Obstacle 2 – a cylinder with a diameter of 70 mm and a height of 400 mm, placed vertically.

NOTE To perform the test, the obstacle can be attached to a flat plate with a handle or a cord can be used to place the obstacle.

**5.2** Tests shall be conducted at lighting level between 100 lx and 1000 lx.

## 6 Starting of motor operated appliances

It shall only be possible to start the **type 2 machine** in **automatic mode** from initial start-up by intended actuation of an **access control** provided for the purpose. The same requirement applies when restarting the **type 2 machine** in **automatic mode** after a **stop category 0**. 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.*

## 7 Stability and mechanical hazards

**7.1** Machines in **automatic mode**, operating in an **open space** environment, shall not exceed 6 km/h. Machines in **automatic mode** operating in a **confined space** environment shall not exceed 4 km/h.

NOTE 1 As specified in this standard, **manual mode** speed can be higher than **automatic mode** speed.

*Compliance for machine **speed operating in confined space** environment is checked by measurement in accordance with the test procedure as described below.*

*The test area of the **confined space** environment consists of two continuous walls or obstacles, each with a minimum length equal to the machine transport length and a minimum height of 1 m. One wall is located on one side of the machine, and the other wall is located on the opposite side of the machine starting from the location where the first wall ends. The two walls are placed in the direction of travel of the machine so that they are within the **confined space** distance on each side from the **machine transport width**. Sensors are allocated at each end of the test area to measure the start and finish of the machine traversal.*

NOTE 2 An example of test set up is shown in Figure 1.

*The machine, loaded to the **GVW** rating, traverses towards the confined space test set-up area at the maximum **open space** speed and enters the **confined space** test area. The **confined space** speed is measured from the start and end of the machine traversal through the **confined space** test set-up area. The average speed shall be measured over three successful speed measurements.*

*Compliance is checked by measurement in accordance with ISO 18646-1:2016, Clause 5, with the machine loaded to the **GVW** rating.*

**7.2** Machines that can function in **manual mode** as **ride-on machine** or a **walk-behind machine** with **traction drive** shall not be possible to operate with the higher speed of **manual mode** when operating in **automatic mode**.

*Compliance is checked by inspection and measurement.*

**7.3** The maximum allowed **stopping distance**,  $S_a$ , shall be calculated using the following formula:

$$S_a < 1,2 \times V_a$$

where

$S_a$  is **stopping distance in automatic mode** (m);

$V_a$  is maximum **rated automatic speed** of the machine in the direction of test (m/s).

NOTE **Stopping distance** is based on a reaction time below 0,5 s.

*Compliance is checked by functional test.*

**7.4** The detection system shall be capable of avoiding contact with obstacles in the directions in which the machine is capable of motion at distances greater than  $S_a$ , as calculated in 7.3, for the maximum speed the machine can travel in that direction. This requirement is not applicable to **type 1 machines** not exceeding a speed of 1,5 km/h and to **automatic floor treatment machines** during the docking process to the **docking station**.

Obstacles according 5.1 shall be used for testing.

*Compliance is checked by functional test.*

**7.5** A machine shall not fall over abrupt surface elevation changes such as staircases, unprotected drop-offs, and the like.

*Compliance is checked by the following test: The machine shall be tested on a surface  $(11 \pm 1)$  cm above an adjacent surface. The lower surface shall be a minimum 1 m in length from where it meets the upper surface; the lowest surface is concrete. The test shall be conducted under the most unfavourable conditions, based on sensor positions, both starting from rest and in motion towards the abrupt surface elevation change under **normal operation** and at loaded to the **GVW** rating.*

*The machine shall be able to detect and stop in the presence of abrupt surface elevation changes of  $(11 \pm 1)$  cm or greater in all directions of travel.*

**7.6** The **control system** of safety-critical functions in the machine (i.e., electric, hydraulic, pneumatic, and software) shall be designed so that they comply with the PL levels and structures as described in ISO 13849-1. The tests of 7.1 to 7.5 and 7.7 to 7.10 shall be conducted using only the **control system** of the safety-critical functions which meet the requirements of 7.7. Software in programmable **electronic circuits**, necessary to fulfil the safety critical functions and that can interfere with them, shall fulfil the requirements of Annex R of IEC 60335-1:2020. References in R.2.2.5 and R.2.2.9 to Clause 19 shall instead refer to 7.6 of this standard.

Alternative methods for determining the required safety integrity level/performance level, for example IEC 62061, are acceptable in achieving the required risk reduction (see normative Annex JJ). The safety-critical functions are identified in Table 1.

**Table 1 – Minimum required performance levels**

Type and purpose of safety-critical function (SCF)	Minimum required performance level (PL) as described in ISO 13849-1	
	Type 1 machines	Type 2 machines
Prevent traversing over abrupt surface elevation changes such as staircases, unprotected drop-offs, and the like referred to in 7.5	PL = d	PL = d
Prevent intrusions into the stopping or <b>contact zones</b> to prevent crushing of and collision with parts of the body and objects referred in 7.7 to 7.11	PL = b	PL = d
Prevent exceeding the automatic mode speed referred to in 7.1 and 7.2	PL = b	PL = d
Provide <b>locked state</b> of drive wheels referred to in 7.8	PL = b	PL = b
Provide desired switch-off of the machine, or emergency switch-off	PL = b	PL = c
Provide desired <b>stop category 0, 1, or 2</b>	PL = b	PL = d

**7.7** In the initial start-up state, while the machine is at rest, each of the obstacles described in 5.1 is placed in turn in contact with the machine at various locations representative of the **contact zone**. The machine shall not initiate motion unless after selection of automatic mode by an **operator** the machines moves directly away from the obstacle.

The machine shall not initiate motion, unless

- it moves directly away from the obstacle after **automatic mode** is initiated by the **operator**, and
- it can determine that nothing is in the **contact zone**, through **guards** or sensing, in the direction of motion without contacting the obstacle.