

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

Household and similar electrical appliances – Safety –  
Part 2-107: Particular requirements for robotic battery powered electrical  
lawnmowers

Appareils électrodomestiques et analogues – Sécurité –  
Partie 2-107: Exigences particulières relatives aux tondeuses à gazon  
électriques robotisées alimentées par batterie



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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES –  
SAFETY –****Part 2-107: Particular requirements for robotic battery  
powered electrical lawnmowers**

## FOREWORD

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International Standard IEC 60335-2-107 has been prepared by IEC technical committee 116: Safety of motor-operated electric tools.

This second edition cancels and replaces the first edition published in 2012. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Clause 7: Markings and instructions, new requirements for markings, warnings and the instruction manual;
- b) Clause 8: Protection against access to live parts, new requirements for protection against electric shock for hazardous battery voltages;
- c) Clause 20: Stability and mechanical hazards, revised requirements for manual controller, manual stop, cutting means stopping time, traction drive stopping and restart procedures, as well as a new standing child foot probe test;

- d) Clause 22: Construction, revised requirements for disabling devices, working area, perimeter delimiter, sensors and manual controller, as well as new requirements for machine connectors used for charging and contact surfaces used as obstruction sensing devices;
- e) Clause 24: Components, revised requirements for switches;
- f) Clause 29: Clearances, creepage distances and solid insulation, revised requirements for the machine and non-mains-powered peripherals.

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

FDIS	Report on voting
116/350/FDIS	116/354/RVD

Full information on the voting for the approval of this amendment 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 2-107 is to be used in conjunction with the fifth edition (2010) of IEC 60335-1 and its amendments.

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

This Part 2-107 supplements or modifies the corresponding clauses in IEC 60335-1, so as to convert it into the IEC standard: Particular requirements for robotic battery powered electrical lawnmowers.

When a particular subclause of Part 1 is not mentioned in this Part 2-107, that subclause applies as far as is relevant. Where this standard states “addition”, “modification” or “replacement”, the relevant text in Part 1 is to be adapted accordingly.

The following print types are used:

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

The terms defined in Clause 3 are printed in **bold typeface**.

Subclauses, notes and figures which are additional to those in Part 1 are numbered starting from 101. Additional annexes are lettered AA, BB, etc.

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 amendment and the base 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.



## INTRODUCTION

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

This document recognizes the internationally accepted level of protection against hazards such as electrical, mechanical, thermal, fire and radiation of machines 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 machines.

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

If a machine within the scope of this document 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 machine in question over and above the general requirements.

This standard series is a product family standard series 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 documents.

A machine that complies with the text of this document 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.

A machine employing materials or having forms of construction differing from those detailed in the requirements of this document 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 document.

# HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

## Part 2-107: Particular requirements for robotic battery powered electrical lawnmowers

### 1 Scope

#### *Replacement:*

This document specifies safety requirements and their verification for the design and construction of **robotic battery** powered electrical **rotary lawnmowers** and their **peripherals** with the **rated voltage** of the **battery** being not more than 75 V d.c.

EMC and environmental aspects, except noise, have not been considered in this standard.

This document does not apply to the additional risks associated with internal combustion engine(s), hybrid and fuel cell powered machines and associated charging systems.

This document deals with all the significant hazards presented by **battery** powered **robotic lawnmowers** and their **peripherals** when they are used as intended and under conditions of misuse which are reasonably foreseeable.

Throughout this document, the term machine is used to refer to the **robotic lawnmower**, separate from its **charging station**.

This document also provides requirements for the safety of mains powered **charging stations** and signal sources **for perimeter delimiters**.

Additional **battery** operation and charging requirements for **robotic lawnmowers**, including the charging of lithium ion batteries, are specified in Annex KK which replaces Annexes B and S (except for requirements for non-rechargeable **batteries**) of Part 1.

This document is not applicable to machines which are manufactured before the date of publication of this document by IEC.

NOTE Informative Annex FF is provided as a test code for convenience to the users of this document.

### 2 Normative references

This clause of Part 1 is applicable except as follows.

#### *Addition:*

IEC 60320 (all parts), *Appliance couplers for household and similar general purposes*

IEC 60335-2-29:2016, *Household and similar electrical appliances – Safety – Part 2-29: Particular requirements for battery chargers*

IEC 62133 (all parts), *Secondary cells and batteries containing alkaline or other non-acid electrolytes- safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications*

ISO 354:2003, *Acoustics – Measurement of sound absorption in a reverberation room*

ISO 683-4:2014, *Heat-treatable steels, alloy steels and free-cutting steels – Part 4: Free-cutting steels*

ISO 3744:2010, *Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for an essentially free field over a reflecting plane*

ISO 3767-1, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment – Symbols for operator controls and other displays – Part 1: Common symbols*

ISO 3767-3, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment – Symbols for operator controls and other displays – Part 3: Symbols for powered lawn and garden equipment*

ISO 4871:1996, *Acoustics – Declaration and verification of noise emission values of machinery and equipment*

ISO 7000:2014, *Graphical symbols for use on equipment – Index and synopsis*

ISO 7010:2011, *Graphical symbols – Safety colours and safety signs – Registered safety signs*

ISO 11201:2010, *Acoustics – Noise emitted by machinery and equipment – Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections*

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

ISO 11684, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment – Safety signs and hazard pictorials – General principles*

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

ISO 12100:2010, *Safety of machinery – General principles for design – Risk assessment and risk reduction*

ISO 13857:2008, *Safety of machinery – Safety distances to prevent hazard zones being reached by upper and lower limbs*

### 3 Terms and definitions

This clause of Part 1 is applicable except as follows.

#### 3.5.1 Addition:

Note 101 to entry: Machines and **charging stations** are not considered to be **portable appliances**.

#### 3.5.4 Addition:

Note 101 to entry: Machines are not considered to be **fixed appliances**. **Charging stations** are considered to be **fixed appliances**.

#### 3.101

##### **automatic mode**

autonomous operation of the machine without the use of a **manual controller**

#### 3.102

##### **battery**

assembly of one or more **cells** intended to provide electrical current to the machine

#### 3.103

##### **cell**

basic functional electrochemical unit containing an assembly of electrodes, electrolyte, container, terminals, and usually separators, that is a source of electrical energy by direct conversion of chemical energy

**3.104****charging station**

automatic **battery** charging facility located on or within the **working area**

**3.105****control**

means or device which will control the operation of the machine or any specific operating function thereof

**3.106****cutting means**

mechanism used to provide the cutting action

Note 1 to entry: The term “blade” can be used in warnings and instructions to denote “**cutting means**”.

**3.107****cutting means enclosure**

part or assembly which provides the protective means around the **cutting means**

**3.108****cutting means tip circle**

path described by the outermost point of the **cutting means** as it rotates about its shaft axis

**3.109****cutting position**

any height setting of the **cutting means** designated by the manufacturer for cutting grass

**3.110****disabling device**

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**3.110.1****disabling device (removable)**

part, such as for example a key, which prevents operation of the **lawnmower** when it is removed

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**3.110.2****disabling device (code protected)**

device which, when operated, prevents operation of the **lawnmower** and requires a coded input (such as via a keypad) before it can operate

Note 1 to entry: See 22.103.

**3.111****discharge chute**

extension of the **cutting means enclosure** from the **discharge opening**, generally used to control the discharge of material from the **cutting means**

**3.112****discharge opening**

gap or opening in the **cutting means enclosure** through which grass may be discharged

**3.113****fully charged (battery/cell)**

**cell** or **battery** charged to the maximum state of charge permitted by the **battery charging system** intended for use with the machine

**3.114****fully discharged (battery/cell)**

**battery** or **cell** that has been discharged at **C<sub>5</sub> rate** until one of the following conditions occurs: discharge terminates due to protective circuitry or the **battery** (or **cell**) reaches a total voltage with an average voltage per **cell** equal to the end-of-discharge voltage for the **cell** chemistry being used unless a different end-of-discharge voltage is specified by the manufacturer

Note 1 to entry: The end-of-discharge voltages for common **cell** chemistries are provided in KK.5.10.

### 3.115

#### **general purpose (batteries/cells)**

**batteries** and **cells** available from a variety of manufacturers, through a variety of outlets intended for a variety of different manufacturers' products

Note 1 to entry: 12 V automotive **batteries** and AA, C and D alkaline **cells** are examples of **general purpose**.

### 3.116

#### **grass catcher**

part or combination of parts which provides a means for collecting grass clippings or debris

### 3.117

#### **guard**

part of the machine or a component incorporated to provide protection for the operator and/or bystander by means of a physical barrier

### 3.118

#### **hazardous voltage**

voltage between parts having an average value exceeding 60 V d.c. or exceeding 50 V peak when the peak-to-peak ripple exceeds 10 % of the average value

### 3.119

#### **intended use**

any use of the machine which is reasonably foreseeable, as described in the instruction manual, and which is consistent with such activities as cutting grass, starting, stopping, or connecting to (or disconnecting from) a source of power

### 3.120

#### **lawnmower**

grass-cutting machine where the **cutting means** operates in a plane approximately parallel to the ground and which uses the ground to determine the height of cut by means of wheels, air cushion or skids, etc., and which utilises an electric motor for a **power source**

### 3.121

#### **manual controller**

device supplied by the manufacturer either connected by a wire or wireless that allows manual operation of the machine

### 3.122

#### **manual stop**

manually actuated device using software-based or hardware-based components that overrides all other **controls** and removes power to the motor(s) and brings all moving parts to a stop

### 3.123

#### **maximum operating motor speed**

the highest motor speed obtainable when adjusted in accordance with the manufacturers specifications and/or instructions, with the **cutting means** engaged

### 3.124

#### **mulching lawnmower**

**rotary lawnmower** without **discharge openings** in the **cutting means enclosure**

### 3.125

#### **operator control**

any **control** requiring operator actuation to perform specific functions

Note 1 to entry: This includes **controls** on a **manual controller**.

### 3.126

#### **operator presence control**

**control** on a **manual controller** designed so that it will automatically interrupt the **cutting means** when the operator's actuating force is removed

**3.127****perimeter delimiter**

device(s) that defines the perimeter of the **working area** within which the machine can operate automatically

Note 1 to entry: An example of a **perimeter delimiter** is a boundary wire that emits a signal to indicate the limit of the **working area**.

**3.128****peripherals**

equipment additional to the machine itself that is provided by the manufacturer for intended use of the machine, e.g. charging station(s), manual controller

**3.129****power source**

motor which provides mechanical energy for linear or rotational movement

**3.130****remote setting device**

setting device which is not connected by wire to the machine and designed to set the basic functions of the machine

Note 1 to entry: A **remote setting device** is not a **manual controller**.

**3.131****robotic lawnmower**

unattended **lawnmower** that operates automatically

Note 1 to entry: When the term "machine" is used in the text of this standard, it is used to denote a **robotic lawnmower**.

**3.132****rotary lawnmower**

**lawnmower** in which the **cutting means** cutting by impact, rotate about an axis (axes) normal to the cutting plane

**3.133****sensor**

device that responds to physical stimuli (such as, but not limited to, heat, light, sound, pressure, magnetism, motion) and transmits the resulting signal or data providing a measurement, operating a **control**, or both

**3.133.1****lift sensor**

device that senses when all or part of the machine is lifted from the ground

**3.133.2****obstruction sensor**

device that senses when the machine contacts a person or an obstruction

**3.133.3****tilt sensor**

device that senses when the machine is at or above a predetermined angle of incline

**3.133.4****rollover sensor**

device that senses when the machine is inverted

**3.134****stopping time**

time elapsed between the instant when either a **sensor** is activated or the actuator on a **manual controller** is released and the instant at which the machine or component comes to a stop

**3.135****thrown object hazard**

potential for injury caused by object(s) propelled by the moving **cutting means**

**3.136****traction drive**

means (system) used to transmit power from the **power source** to the ground drives means

**3.137****working area**

any defined area in which the machine can function automatically

**4 General requirement**

This clause of Part 1 is applicable.

**5 General conditions for the tests**

This clause of Part 1 is applicable except as follows.

**5.1 Addition:**

Where an electronic speed **control** device can be adjusted, it is set for the highest speed.

**5.2 Modification:**

*A new sample shall be used for each of the tests of Clause 21. However, at the manufacturer's discretion, fewer samples may be used.*

**Addition:**

*The cumulative stress resulting from successive tests on the **battery** is to be avoided.*

*If several tests are conducted on a single sample, then the results shall not be affected by previous tests.*

**5.8.1 Replacement:**

*Unless otherwise specified, a **fully charged battery** shall be used for each test. Where for consecutive tests the same **battery** is specified, there shall be a minimum of 1 min rest time between tests.*

**5.17 Replacement:**

*Machines and **peripherals** powered by rechargeable **batteries** are evaluated to the additional requirements in Annex KK.*

***Peripherals** powered by **batteries** that are non-rechargeable are tested in accordance with Annex S.*

**6 Classification**

This clause of Part 1 is applicable except as follows.

**6.1 Replacement:**

This subclause is not applicable for machines and non-mains-powered **peripherals**.

Note 101 Machines and non-mains-powered **peripherals** covered by this standard are limited to those where the only power source is a **battery** and are therefore considered not to be **class I**, **class II**, or **class III** appliances and are not required to have **basic insulation**, **supplementary insulation** or **reinforced insulation**. Electric shock hazard is considered to exist only between parts of opposite polarity where **hazardous voltage** is present.

Mains-powered **peripherals** shall be of one of the following classes with respect to protection against electric shock: