

INTERNATIONAL STANDARD

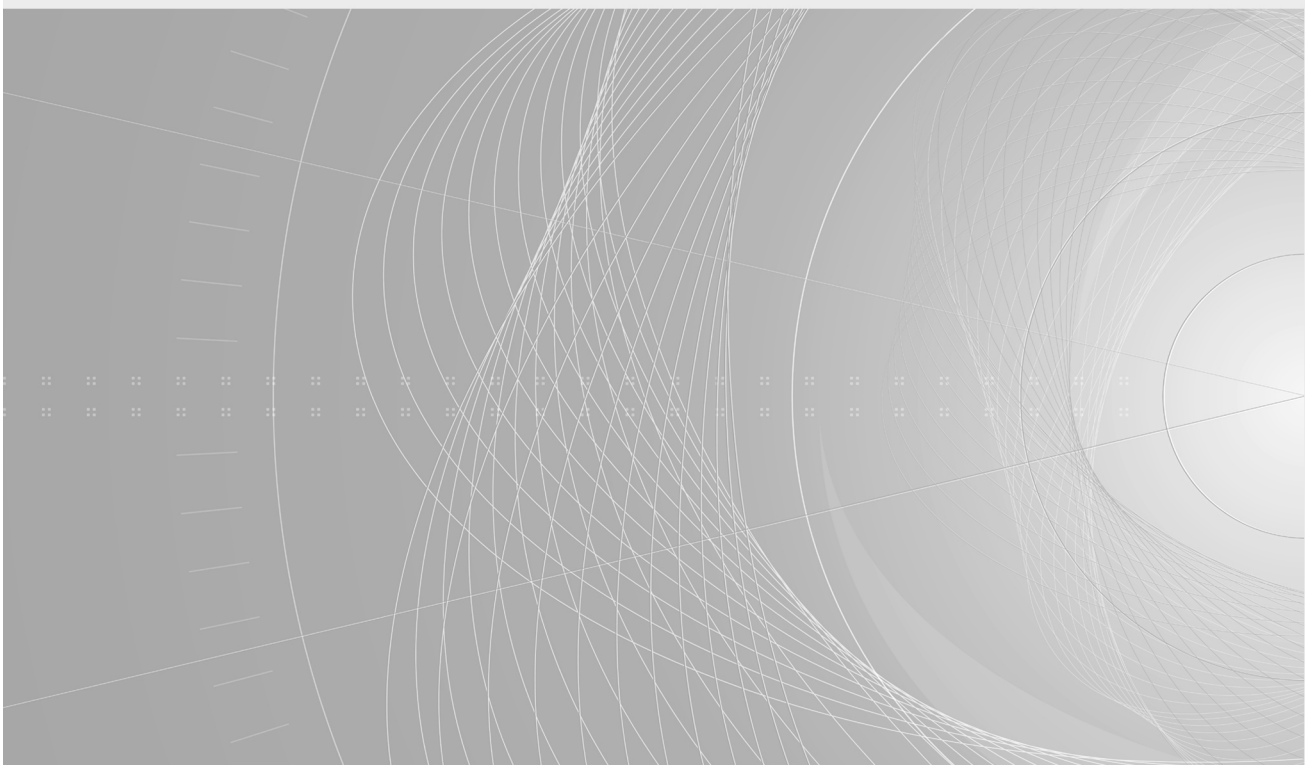
NORME INTERNATIONALE

Household and similar electrical appliances – Safety –
Part 2-29: Particular requirements for battery chargers

Appareils électrodomestiques et analogues – Sécurité –
Partie 2-29: Exigences particulières pour les chargeurs de batterie

ITIH STANDARD PREVIEW
(standards.iteh.ai)

IEC 60335-2-29:2016
https://standards.iteh.ai/catalog/standards/sis/c50cacc0-ab20-4515-b584-406227b4b390/iec-60335-2-29-2016





THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2016 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 15 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

65 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.



IEC 60335-2-29

Edition 5.0 2016-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Household and similar electrical appliances – Safety –
Part 2-29: Particular requirements for battery chargers

Appareils électrodomestiques et analogues – Sécurité –
Partie 2-29: Exigences particulières pour les chargeurs de batterie

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.200; 91.180

ISBN 978-2-8322-3424-2

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	3
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references.....	7
3 Terms and definitions	8
4 General requirement.....	9
5 General conditions for the tests.....	9
6 Classification.....	9
7 Marking and instructions	9
8 Protection against access to live parts	11
9 Starting of motor-operated appliances.....	11
10 Power input and current.....	11
11 Heating	11
12 Void	12
13 Leakage current and electric strength at operating temperature	12
14 Transient overvoltages.....	12
15 Moisture resistance.....	12
16 Leakage current and electric strength.....	12
17 Overload protection of transformers and associated circuits.....	12
18 Endurance.....	12
19 Abnormal operation	12
20 Stability and mechanical hazards	13
21 Mechanical strength.....	13
22 Construction.....	14
23 Internal wiring.....	14
24 Components.....	14
25 Supply connection and external flexible cords	14
26 Terminals for external conductors	15
27 Provision for earthing.....	15
28 Screws and connections	15
29 Clearances, creepage distances and solid insulation	15
30 Resistance to heat and fire	15
31 Resistance to rusting	16
32 Radiation, toxicity and similar hazards	16
Annexes	17
Annex A (informative) Routine tests	17
Annex AA (normative) Battery chargers for use by children.....	18
Bibliography	22
Figure 101 – Circuit for testing battery chargers	16

ITeH STANDARD PREVIEW

(standards.iteh.ai)

IEC 60335-2-29:2016

[https://standards.iteh.ai/catalog/standards/sist/c5c6eac8-a820-4513-b584-](https://standards.iteh.ai/catalog/standards/sist/c5c6eac8-a820-4513-b584-406227b4b390/iec-60335-2-29-2016)

[406227b4b390/iec-60335-2-29-2016](https://standards.iteh.ai/catalog/standards/sist/c5c6eac8-a820-4513-b584-406227b4b390/iec-60335-2-29-2016)

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –**Part 2-29: Particular requirements for battery chargers**

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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 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.

This part of International Standard IEC 60335 has been prepared by IEC technical committee 61: Safety of household and similar electrical appliances.

This fifth edition cancels and replaces the fourth edition published in 2002 including its Amendment 1 (2004) and its Amendment 2 (2009). It constitutes a technical revision.

The principal changes in this edition as compared with the fourth edition of IEC 60335-2-29 are as follows (minor changes are not listed):

- Revised the drop test to refer to IEC 60068-2-31 (21.101);
- Requirements for supply cords on battery chargers used at low temperatures (25.7);
- Requirements for battery chargers having an output voltage exceeding SELV have been added (1, 3.2.2, 3.4.3, 10.101, 24.4, 25.5, 25.7, 25.8, 25.15, 26.5);
- A classification for battery chargers used outdoors has been added (6.2, 29.2);
- Some notes in Clause 1, Subclauses 7.1 and 22.102, Figure 101 and Annex AA 11.8 have been converted to normative text.

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

FDIS	Report on voting
61/5142/FDIS	61/5173/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 battery chargers.

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.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under “<http://webstore.iec.ch>” in the data related to the specific publication. At this date, the publication will be

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

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 standard 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.

- 3.1.9: The artificial load may not be used (USA).
- 11.2: The appliance is not placed in a test corner (USA).

- 21.101: The drop test is carried out differently on outdoor direct plug-in battery chargers (USA).
- 21.102: The test is different (USA).
- 22.26: Basic insulation is allowed between live parts and SELV circuits (USA).
- Annex AA, 11.8: Higher temperature rises are allowed (USA).
- Annex AA, Clause 17: Higher temperature rises are allowed (USA).
- Annex AA, 19.13: Higher temperature rises are allowed (USA).

iTeh STANDARD PREVIEW **(standards.iteh.ai)**

[IEC 60335-2-29:2016](https://standards.iteh.ai/catalog/standards/sist/c3c6eac8-a820-4513-b584-406227b4b390/iec-60335-2-29-2016)

<https://standards.iteh.ai/catalog/standards/sist/c3c6eac8-a820-4513-b584-406227b4b390/iec-60335-2-29-2016>

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.

(standards.iteh.ai)

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.

<https://standards.iteh.ai/catalog/standards/sist/c3c6eac8-a820-4513-b584-40e2194b5914/iec-60335-2-29-2016>

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 2-29: Particular requirements for battery chargers

1 Scope

This clause of Part 1 is replaced by the following.

This part of IEC 60335 deals with the safety of electric battery chargers for household and similar use having an output not exceeding 120 V ripple-free direct current, their **rated voltage** being not more than 250 V.

Battery chargers intended for charging batteries in a household end use application outside the scope of the IEC 60335 series of standards are within the scope of this standard.

Requirements for battery chargers for use by children at least 8 years old without supervision are given in Annex AA.

Battery chargers not intended for normal household use, but which nevertheless may be a source of danger to the public, such as battery chargers intended for use in garages, shops, light industry and on farms, are within the scope of this standard.

As far as is practicable, this standard deals with the common hazards presented by appliances that are encountered by all persons in and around the home. However, in general, it does not take into account

- persons (including children) whose
 - physical, sensory or mental capabilities; or
 - lack of experience and knowledgeprevents them from using the appliance safely without supervision or instruction;
- children playing with the appliance.

NOTE 101 Attention is drawn to the fact that

- for appliances intended to be used in vehicles or on board ships or aircraft, additional requirements may be necessary;
- in many countries additional requirements are specified by the national health authorities, the national authorities responsible for the protection of labour and similar authorities.

NOTE 102 This standard does not apply to

- built-in battery chargers, except those for installing in caravans and similar vehicles;
- battery chargers that are part of an appliance, the battery of which is not accessible to the user;
- battery chargers intended exclusively for industrial purposes;
- battery chargers intended to be used in locations where special conditions prevail, such as the presence of a corrosive or explosive atmosphere (dust, vapour or gas);
- battery chargers for emergency lighting (IEC 60598-2-22);
- supply units for electronic equipment.

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 61558-2-7:2007, *Safety of power transformers, power supplies, reactors and similar products – Part 2-7: Particular requirements and tests for transformers and power supplies for toys*

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1.1 Addition:

The **rated voltage** is the rated input voltage.

3.1.6 Addition:

The **rated current** is the rated input current.

3.1.9 Replacement:

normal operation

operation of the appliance under the following conditions:

Battery chargers for charging lead-acid batteries, and other battery chargers having a **rated DC output current** not exceeding 20 A are connected to the circuit of Figure 101. 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**.

<https://standards.iteh.ai/catalog/standards/sist/c3c6eac8-a820-4513-b584-40227648339/iec-60335-2-29-2016>

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.

Other battery chargers are connected to a discharged battery of the type and having the largest capacity specified in the instructions.

3.2.2 Addition:

Output flexible cords are not considered to be interconnection cords.

3.4.3 Replacement:

safety isolating transformer

transformer, the input winding of which is electrically separated from the output winding by an insulation at least equivalent to **double insulation** or **reinforced insulation**, that is intended to supply a battery charging circuit having an output voltage not exceeding 120 V ripple-free direct current

Note 1 to entry: Ripple-free means an r.m.s. ripple voltage not exceeding 10 % of the DC component.

3.101

rated DC output voltage

output voltage assigned to the battery charger by the manufacturer

3.102

rated DC output current

output current assigned to the battery charger by the manufacturer

3.103

DC distribution board

panel having circuits for distributing DC power to socket-outlets or terminals

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.

5.2 Addition:

If the test of 21.101 is carried out, two additional battery chargers are required.

5.101 *Battery chargers are tested as **motor-operated appliances**.*

6 Classification

This clause of Part 1 is applicable except as follows.

6.2 Addition:

Battery chargers for outdoor use shall be at least IPX4.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 Addition:

Battery chargers shall be marked with

- **rated DC output voltage**, in volts;
- **rated DC output current**, in amperes, however no other output current shall be marked;
- the rated current, in amperes, of **protective devices** incorporated in a **DC distribution board**;
- the polarity of the output terminals unless incorrect polarity connection is prevented. The positive terminal shall be indicated by symbol IEC 60417-5005 (2002-10) and the negative terminal by symbol IEC 60417-5006 (2002-10);
- the time-current characteristic of fuse-links of the time-lag type;
- the substance of the following, if the output is at least 20 VA:
 - before charging, read the instructions;
 - for indoor use, or do not expose to rain (unless the battery charger is at least IPX4);
- the substance of the following, if the output is at least 20 VA and the battery charger is for charging lead-acid batteries:
 - disconnect the supply before making or breaking the connections to the battery;
 - **WARNING:** Explosive gases. Prevent flames and sparks. Provide adequate ventilation during charging.

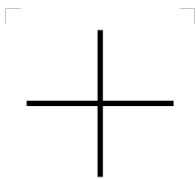
Battery chargers incorporating an engine-cranking switch that allows the battery charger to supply a supplementary starting current for the engine shall be marked with

- the maximum "on" time;
- the minimum "off" time or the maximum ratio between the "on" time and the "off" time.

7.4 Addition:

If the battery charger can be adjusted to different **rated DC output voltages**, the output voltage to which the battery charger is adjusted shall be clearly discernible.

7.6 Addition:



[symbol IEC 60417-5005 (2002-10)] plus; positive polarity



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

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[IEC 60335-2-29:2016](https://standards.iteh.ai/catalog/standards/sist/c3c6eac8-a820-4513-b584-406227b4b390/iec-60335-2-29-2016)

7.12 Addition: <https://standards.iteh.ai/catalog/standards/sist/c3c6eac8-a820-4513-b584-406227b4b390/iec-60335-2-29-2016>

The instructions shall

- specify the types, the number of batteries and the rated capacity of the batteries that can be charged;
- include a warning against recharging non-rechargeable batteries;
- state that during charging, the battery must be placed in a well-ventilated area (for chargers for vented batteries);
- state that the battery charger must only be plugged into an earthed socket-outlet (for **portable class I battery chargers** for outdoor use);
- explain the automatic function, stating any limitation (for automatic battery chargers).

The instructions for battery chargers for charging automobile batteries shall include the substance of the following:

- the battery terminal not connected to the chassis has to be connected first. The other connection is to be made to the chassis, remote from the battery and fuel line. The battery charger is then to be connected to the supply mains;
- after charging, disconnect the battery charger from the supply mains. Then remove the chassis connection and then the battery connection.

7.12.1 Addition:

The instructions for battery chargers for installation in caravans and similar vehicles shall state that the connection to the supply mains is to be in accordance with the national wiring rules.

7.101 DC distribution boards shall be marked with

- the maximum output current, in amperes, for each output circuit;
- the types of any additional power supply that may be connected.

Compliance is checked by inspection.

8 Protection against access to live parts

This clause of Part 1 is applicable except as follows.

8.1 Addition:

*During insertion or removal of batteries having a battery voltage exceeding 42,4 V, protection against contact with **live parts** of the battery or of the battery charger shall be ensured.*

9 Starting of motor-operated appliances

This clause of Part 1 is not applicable.

10 Power input and current

This clause of Part 1 is applicable except as follows.

10.101 The no-load DC output voltage shall not exceed 120 V.

*Compliance is checked by supplying the battery charger at **rated voltage** and measuring the no load DC output voltage.*

10.102 The arithmetic mean value of the output current shall not deviate from the **rated DC output current** by more than 10 %.

*Compliance is checked by connecting the battery charger to the circuit of Figure 101. The battery charger is supplied at **rated voltage** and the variable resistor is adjusted to obtain the **rated DC output voltage**. The output current is then measured.*

11 Heating

This clause of Part 1 is applicable except as follows.

11.2 Modification:

*Battery chargers are placed in the test corner as specified for **heating appliances**.*

11.5 Modification:

*Battery chargers are only supplied at 1,06 times **rated voltage**.*

11.7 Replacement:

Battery chargers are operated until steady conditions are established.

12 Void

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable.

14 Transient overvoltages

This clause of Part 1 is applicable.

15 Moisture resistance

This clause of Part 1 is applicable.

16 Leakage current and electric strength

This clause of Part 1 is applicable.

17 Overload protection of transformers and associated circuits

This clause of Part 1 is applicable except as follows.

Addition:

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

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 Modification:

Instead of the tests specified, battery chargers are subjected to the tests of 19.11, 19.12 and 19.101 to 19.103, as applicable.

19.13 Addition:

During the tests, the values of Table 8 apply.

There shall be no rupture of the battery.

19.101 *Battery chargers are supplied at **rated voltage** and operated under **normal operation**, any control that operates during the test of Clause 11 being short-circuited.*

19.102 *The battery charger is connected to a fully charged battery, the connections being in reverse to normal use. The battery is to have the largest capacity of the types specified in the*

*instructions, the capacity of a lead-acid battery, however, being 70 Ah. The battery charger is operated while supplied at **rated voltage**.*

19.103 *Battery chargers intended to be used with a **DC distribution board** are supplied at **rated voltage** and operated under **normal operation** until steady conditions are established. The load is increased to raise the output current by 10 % until steady conditions are again established. This procedure is repeated until the **protective device** operates or short-circuit conditions are established.*

20 Stability and mechanical hazards

This clause of Part 1 is applicable.

21 Mechanical strength

This clause of Part 1 is applicable except as follows.

21.1 Modification:

The impact energy is increased to 1,0 J ± 0,05 J.

Addition:

Compliance is also checked by the test of 21.101.

21.101 *Battery chargers, other than **built-in battery chargers**, having a mass not exceeding 5 kg are subjected to the test free-fall – procedure 1, of IEC 60068-2-31, which is carried out on three appliances.*

The battery chargers are dropped from a height of 1 m, each appliance being dropped from a different position.

After the test the battery chargers shall show no damage that could impair compliance with 8.1, 15.1.1, 16.3 and Clause 29.

21.102 *Battery chargers for installing in caravans and similar vehicles shall withstand vibrations to which they may be subjected.*

Compliance is checked by carrying out the vibration tests specified in IEC 60068-2-6 under the following conditions:

- *the battery charger is built into an enclosure made from plywood approximately 20 mm thick, the internal dimensions being the minimum stated in the installation instructions;*
- *the enclosure is strapped to the vibration generator with the battery charger in its normal position of use;*
- *the direction of vibration is vertical;*
- *the amplitude of vibration is 0,35 mm;*
- *the sweep frequency range is 10 Hz to 55 Hz;*
- *the duration of the test is 30 min.*

The battery charger shall show no damage that could impair compliance with 8.1, 15.1.1, 16.3 and Clause 29, and connections shall not have worked loose.