

INTERNATIONAL STANDARD

IEC
60335-2-29

Fourth edition
2002-09

Household and similar electrical appliances – Safety –

Part 2-29: Particular requirements for battery chargers

*Appareils électrodomestiques et analogues –
Sécurité –*

*Partie 2-29:
Règles particulières pour les chargeurs de batterie*



Reference number
IEC 60335-2-29:2002(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

Consolidated editions

The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

Further information on IEC publications

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology. Information relating to this publication, including its validity, is available in the IEC Catalogue of publications (see below) in addition to new editions, amendments and corrigenda. Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is also available from the following:

- **IEC Web Site** (www.iec.ch)

- **Catalogue of IEC publications**

The on-line catalogue on the IEC web site (http://www.iec.ch/searchpub/cur_fut.htm) enables you to search by a variety of criteria including text searches, technical committees and date of publication. On-line information is also available on recently issued publications, withdrawn and replaced publications, as well as corrigenda.

- **IEC Just Published**

This summary of recently issued publications (http://www.iec.ch/online_news/justpub/jp_entry.htm) is also available by email. Please contact the Customer Service Centre (see below) for further information.

- **Customer Service Centre**

If you have any questions regarding this publication or need further assistance, please contact the Customer Service Centre:

Email: custserv@iec.ch
Tel: +41 22 919 02 11
Fax: +41 22 919 03 00

INTERNATIONAL STANDARD

IEC 60335-2-29

Fourth edition
2002-09

Household and similar electrical appliances – Safety –

Part 2-29: Particular requirements for battery chargers

*Appareils électrodomestiques et analogues –
Sécurité –*

*Partie 2-29:
Règles particulières pour les chargeurs de batterie*

© IEC 2002 — Copyright - all rights reserved

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 the publisher.

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE

P

For price, see current catalogue

CONTENTS

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

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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 the 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 National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The 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 fourth edition cancels and replaces the third edition published in 1994. It constitutes a technical revision.

The text of this part of IEC 60335 is based on the following documents:

FDIS	Report on voting
61/2169/FDIS	61/2250/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 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 fourth edition (2001) 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 electric 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 2003. At this date, the publication will be

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

The following differences exist in the countries indicated below.

- 3.1.9: The artificial load may not be used (USA).
- 10.101: The d.c. output voltage is not to exceed 30 V (USA).
- 11.2: The appliance is not placed in a test corner (USA).
- 21.101: The drop test is carried out differently on battery chargers with a mass less than 18 kg (USA).
- 21.102: The test is different (USA).
- 22.26: Basic insulation is allowed between live parts and SELV circuits (USA).
- 25.7: Special rubber insulated and sheathed cords are required for some types of battery chargers. (Finland).

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

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.

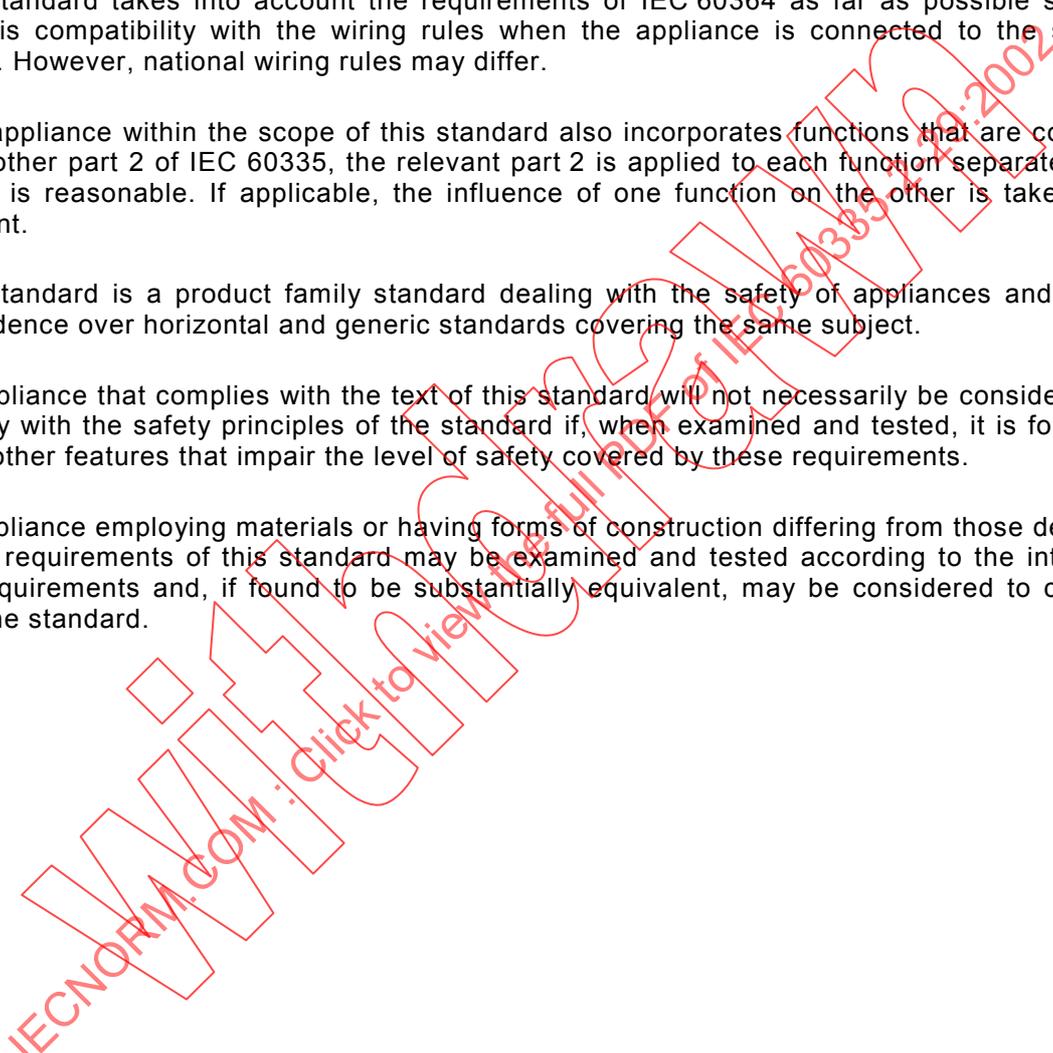
This standard takes into account the requirements of IEC 60364 as far as possible so that there is compatibility with the wiring rules when the appliance is connected to the supply mains. However, national wiring rules may differ.

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.

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.

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 International Standard deals with the safety of electric battery chargers for household and similar use having an output at **safety extra-low voltage**, their **rated voltage** being not more than 250 V.

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

- the use of appliances by young children or infirm persons without supervision;
- playing with the appliance by young children.

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 comprising more than one unit;
- battery chargers for toys;
- supply units for electronic equipment;
- battery chargers and supply units for electronic flash apparatus for photographic purposes (IEC 60491);
- battery chargers intended for use in electric vehicles (IEC 61851).

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

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

3 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 d.c. 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 d.c. output current** when the battery charger is supplied at **rated voltage**.

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

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

NOTE 101 Batteries are considered to be discharged when

- for lead-acid batteries, the specific gravity of the electrolyte is less than 1,16;
- for nickel-cadmium batteries, the voltage per cell is less than 0,9 V.

3.101

rated d.c. output voltage

output voltage assigned to the battery charger by the manufacturer

3.102

rated d.c. output current

output current assigned to the battery charger by the manufacturer

3.103

d.c. distribution board

panel having circuits for distributing d.c. 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.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 Addition:

Battery chargers shall be marked with

- **rated d.c. output voltage**, in volts;
- **rated d.c. output current**, in amperes;

NOTE 101 No other output current is to be marked.

- the rated current, in amperes, of **protective devices** incorporated in a **d.c. distribution board**;
- the polarity of the output terminals. The positive terminal shall be indicated by the colour red or the symbol + and the negative terminal by the colour black or the symbol – ;

NOTE 102 Marking of the polarity is not required for battery chargers if incorrect polarity connection is prevented.

- 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 d.c. output voltages**, the output voltage to which the battery charger is adjusted shall be clearly discernible.

7.12 Addition:

The instructions shall

- specify the types, the number of cells 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 lead-acid 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 D.C. 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.

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 d.c. output voltage shall not exceed 42,4 V.

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

10.102 The arithmetic mean value of the output current shall not deviate from the **rated d.c. 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 d.c. 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 lists 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.

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 **d.c. 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.

Modification:

The impact energy is increased to $1,0 \text{ J} \pm 0,05 \text{ J}$.

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 following test, which is carried out on three appliances.

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

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.

22 Construction

This clause of Part 1 is applicable except as follows.

22.26 Replacement:

The output circuit shall be supplied through a **safety isolating transformer** and shall not be connected to **accessible metal parts** or an earthing terminal. The insulation between parts operating at **safety extra-low voltage** and **live parts** shall comply with the requirements for **double insulation** or **reinforced insulation**.

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

22.101 The conductor for connection to the positive terminal of the battery shall be coloured red and that for connection to the negative terminal shall be coloured black.

This requirement does not apply if

- the output conductors are provided with a polarized connector;
- the polarity of the connection is automatically determined by the battery charger;
- the insulation of the conductor or its terminal for connection to the positive terminal of the battery is permanently identified by marking which is visible when making the connection to the battery.

Compliance is checked by inspection.

22.102 Each circuit supplied from a **d.c. distribution board** shall incorporate an overload **protective device**.

Compliance is checked by inspection.

22.103 Battery chargers for installing in caravans and similar vehicles shall be constructed so that they can be securely fixed to a support.

Compliance is checked by inspection.

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

23 Internal wiring

This clause of Part 1 is applicable.

24 Components

This clause of Part 1 is applicable.

25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows.

25.7 Addition:

Battery chargers for charging automobile batteries shall not be fitted with natural rubber-sheathed **supply cords**.

26 Terminals for external conductors

This clause of Part 1 is applicable except as follows.

26.5 Modification:

This requirement does not apply to the terminals of the output circuit.

27 Provision for earthing

This clause of Part 1 is applicable.

28 Screws and connections

This clause of Part 1 is applicable.

29 Clearances, creepage distances and solid insulation

This clause of Part 1 is applicable.

30 Resistance to heat and fire

This clause of Part 1 is applicable except as follows.

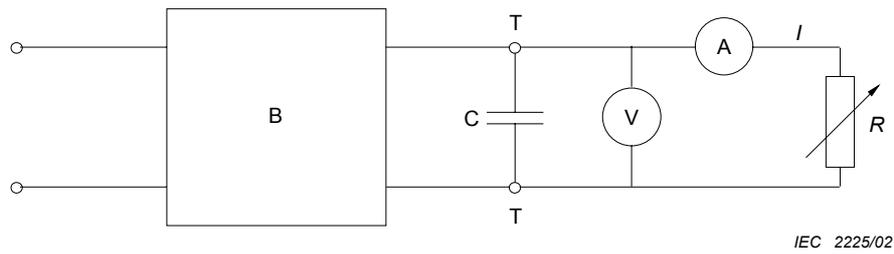
30.2.2 Not applicable.

31 Resistance to rusting

This clause of Part 1 is applicable.

32 Radiation, toxicity and similar hazards

This clause of Part 1 is applicable.



IEC 2225/02

Key

A Mean reading ammeter

B Battery charger

C Capacitor having a capacitance, in farads, given by: $12,5 \frac{I_r}{p \times f \times U_r}$

where

I_r = **rated d.c. output current**, in amperes;

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

f = supply frequency, in hertz;

U_r = **rated d.c. output voltage**, in volts.

I Output current

R Variable resistor

T Output terminals of the battery charger

V Mean reading voltmeter

NOTE 1 The capacitor may have a capacitance deviating from the calculated values of ± 20 %.

NOTE 2 The capacitor may have to be precharged before the battery charger can operate.

Figure 101 – Circuit for testing battery chargers

Annexes

The annexes of Part 1 are applicable except as follows.

Annex A (informative)

Routine tests

A.2 Electric strength test

Addition:

An electric strength test is carried out between the input and output circuits, the test voltage being

- 2 000 V, for battery chargers having a **rated voltage** not exceeding 150 V;
- 2 500 V, for other battery chargers.

Bibliography

The bibliography of Part 1 is applicable except as follows.

Addition:

IEC 60491, *Safety requirements for electronic flash apparatus for photographic purposes*

IEC 61851 (all parts), *Electric vehicle conductive charging system*
