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Wheelchairs —

Part 25: Lead-acid batteries and chargers for powered wheelchairs — Requirements and test methods

Fauteuils roulants —

Partie 25: Batteries au plomb et chargeurs pour fauteuils roulants motorisés — Exigences et méthodes d'essai

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 173, *Assistive products*, Subcommittee SC 1, *Wheelchairs*.

This second edition cancels and replaces the first edition (ISO 7176-25:2013), which has been technically revised.

The main changes are as follows:

— explanations and requirements have been revised;

— requirements for battery chargers have been revised and added in 5.1, 5.2 and 5.3;

— requirements for battery safety and performance have been revised in 6.1 and 6.2;

— the items in test report have been clarified in Clause 7;

— some notes in 4.2, 4.5, and 5.3 have been converted to body text.

A list of all parts in the ISO 7176 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Since the reliability and performance of an electrically-powered wheelchair depends on the operation, performance and reliability of the battery set and the battery charger, it is important to ensure that wheelchair batteries and chargers are suitable for their purpose and that the wheelchair, batteries and charger are compatible. It is also important to ensure that risks arising from the use of wheelchair batteries and their chargers are eliminated or reduced as far as is practicable. Consequently, it is essential that performance requirements and safety requirements for wheelchair batteries and battery chargers be available.

Battery chargers are divided into three types: off-board, carry-on and on-board. Operating, transport and storage situations can differ for these types, so it is appropriate to apply different requirements to them.

Wheelchairs —

Part 25: Lead-acid batteries and chargers for powered wheelchairs — Requirements and test methods

WARNING — This document calls for the use of procedures that might be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve those carrying out or commissioning the tests from legal obligations relating to health and safety. Prior to carrying out tests that could cause batteries or chargers to exhibit dangerous behaviour, it is recommended that the likely outcome is assessed and appropriate arrangements made to minimize risk.

1 Scope

This document specifies requirements and test methods for lead-acid batteries and their chargers intended for use with electrically-powered wheelchairs and scooters. Requirements for chargers are applicable to those with a rated input voltage not greater than 250 V AC and a nominal output voltage not greater than 36 V.

2 Normative references

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.

ISO 7176-8, *Wheelchairs — Part 8: Requirements and test methods for static, impact and fatigue strengths*

ISO 7176-21, *Wheelchairs — Part 21: Requirements and test methods for electromagnetic compatibility of electrically powered wheelchairs and scooters, and battery chargers*

ISO 7176-26, *Wheelchairs — Part 26: Vocabulary*

ISO 14971, *Medical devices — Application of risk management to medical devices*

IEC 60254-1:2005, *Lead-acid traction batteries — Part 1: General requirements and methods of tests*

IEC 60254-2, *Lead-acid traction batteries — Part 2: Dimensions of cells and terminals and marking of polarity on cells*

IEC 60335-2-29:2016+Amd1:2019, *Household and similar electrical appliances — Safety — Part 2-29: Particular requirements for battery chargers*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 61076-2-103, *Connectors for electronic equipment — Part 2-103: Circular connectors — Detail specification for a range of multipole connectors (type 'XLR')*

IEC/TS 61430, *Secondary cells and batteries — Test methods for checking the performance of devices designed for reducing explosion hazards — Lead-acid starter batteries*

SAE J1495, *Test procedure for battery flame retardant venting systems*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7176-26 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
battery
one or more cells fitted with devices necessary for use, for example case, terminals, marking and protective devices

[SOURCE: IEV 482–01–04]

3.2
lead-acid battery
secondary *battery* (3.1) with an aqueous electrolyte based on dilute sulphuric acid, a positive electrode of lead dioxide and a negative electrode of lead

[SOURCE: IEV 482–05–01, modified — Preferred term changed to "lead-acid battery", note to entry deleted.]

3.3
nominal voltage
suitable approximate value of the voltage used to designate or identify a cell, a battery or an electrochemical system

Note 1 to entry: For lead-acid batteries the nominal voltage is usually two volts multiplied by the number of cells.

[SOURCE: IEV 482–03–31, modified — Note to entry added.]

3.4
rated DC output current
output current assigned to the battery charger by its manufacturer

3.5
rated DC output voltage
output voltage assigned to the battery charger by its manufacturer

3.6
rated input voltage
supply mains voltage assigned to the battery charger by its manufacturer

3.7
cyclic endurance of a battery
number of discharge/recharge cycles a *battery* (3.1) can perform under specific conditions

3.8
charge retention
residual discharge capacity after storage while a *battery* (3.1) is on open circuit under specific conditions

4 Test conditions and apparatus

4.1 Test conditions

Carry out the tests in an environment with an ambient temperature of 20 °C ± 5 °C.

4.2 Mean current meter, capable of measuring the arithmetic mean current supplied by a battery charger to an accuracy of 2 % of the measurement, which does not introduce a voltage drop (added to the voltage at the output connector of the battery charger) that exceeds 0,2 % of the nominal battery voltage.

The averaging time of the meter should be matched to any cyclic variations in the charging current.

NOTE The measuring device can be an integral part of an electronic load as specified in 4.5.

4.3 Root-mean-square (r.m.s.) current meter, capable of measuring the r.m.s. current supplied by a battery charger to an accuracy of 2 % of the measurement, which does not introduce a voltage drop that exceeds 0,2 % of the nominal battery voltage.

NOTE The measuring device can be an integral part of an electronic load as specified in 4.5.

4.4 Voltmeter, capable of measuring the voltage supplied by a battery charger, to an accuracy of 0,1 % of the measurement.

NOTE The measuring device can be an integral part of an electronic load as specified in 4.5.

4.5 Electronic load, for simulating a battery to the extent necessary to provide the test loads for battery chargers within the scope of this document.

EXAMPLE Figure 1 shows an outline schematic for an electronic load that can be used in constant-voltage mode or constant-current mode, with terminals for connection to the output terminals of the battery charger.

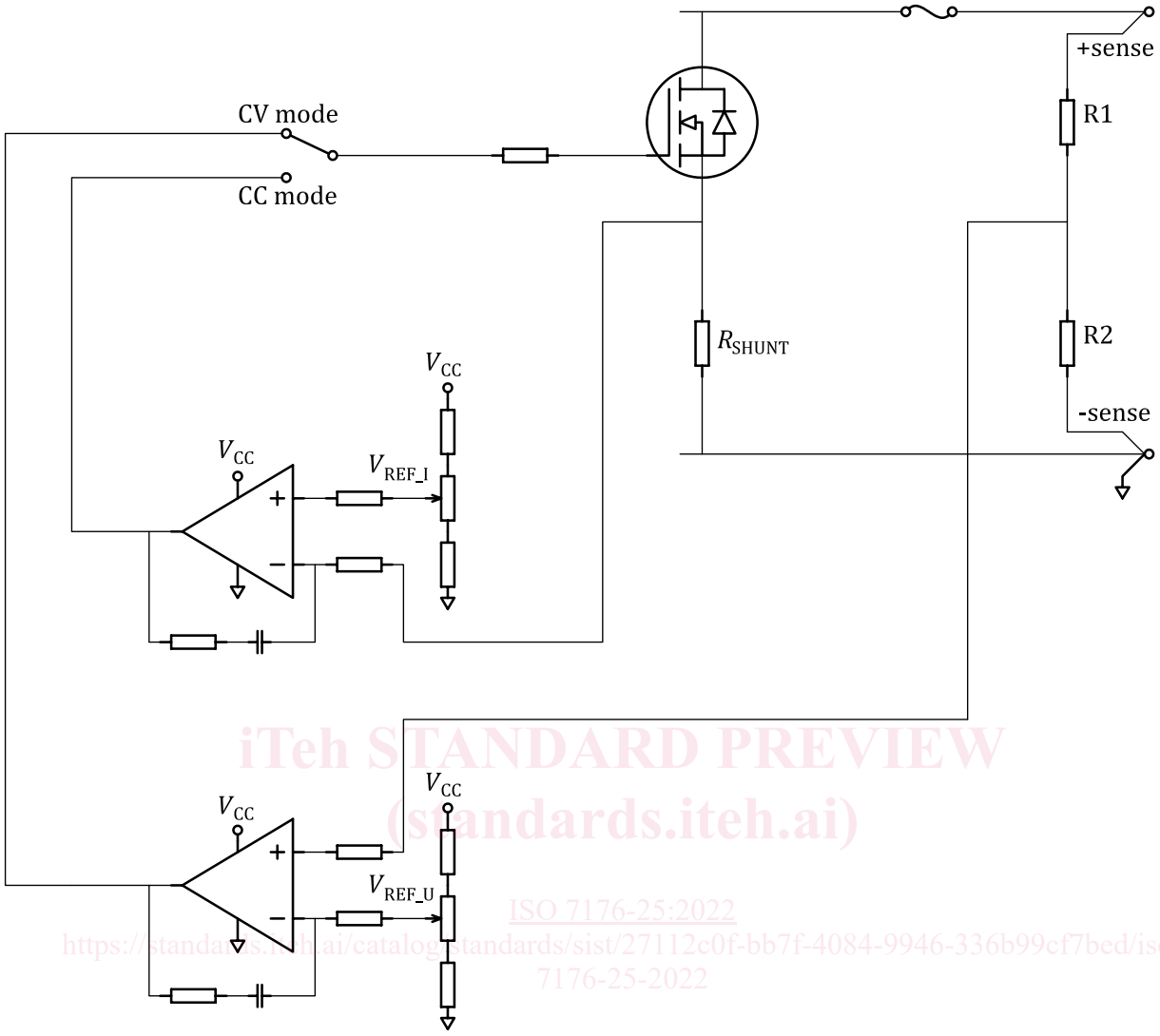
In the constant-voltage mode (switch in CV position), the circuit will keep the voltage between the load terminals substantially constant while sinking the current supplied by the battery charger.

In the constant-voltage mode, the voltage at the load terminals will be given by V_{REF_U}·(R1+R2)/R1. I, where V_{REF_U} is a reference voltage, and R1 and R2 are resistances shown in Figure 1.

In the constant-current mode (switch in CC position), the circuit will sink a substantially constant current with the load terminal voltage being the output voltage of the battery charger.

In constant-current mode the load current will be given by V_{REF_I} / R_{SHUNT}, where V_{REF_I} is an input reference voltage and R_{SHUNT} is a shunt resistance as shown in Figure 1.

Correct operation of the battery charger with the electronic load should be confirmed. For example, some battery chargers might need a capacitive load, in which case an appropriate capacitor should be added to the load terminals and correct operation confirmed.



NOTE 1 R_{SHUNT} can be utilized as a part of a current measuring device (4.2 and 4.3).

NOTE 2 Some battery chargers might need a voltage to be applied to the output terminals to energize or maintain their output. To initialize such chargers, it will be necessary to connect a current-limited voltage source to the load terminals.

Figure 1 — Electronic load outline schematic

4.6 Means to alter the AC supply voltage to a battery charger, normally consisting of a tapped or continuously adjustable variable transformer. The means should not cause the peak supply voltage of the charger when fully loaded to differ by more than 2 % from the peak supply voltage of the charger when not loaded.

5 Battery chargers

5.1 Electrical safety

5.1.1 General

Battery chargers intended for use with electrically-powered wheelchairs should not constitute a safety hazard when utilized in the intended use environment and during foreseeable misuse.

Risk analysis shall be carried out in accordance with ISO 14971.

5.1.2 Requirements

Risk analysis shall take into account storage and operating temperature.

On-board and carry-on battery chargers shall meet the following requirements after being exposed to vibration as specified in 5.1.3.2.

Battery chargers shall meet the requirements of IEC 60335-2-29.

Battery chargers intended for use only in dry indoor areas shall provide a degree of protection not less than IPX1 as specified in IEC 60529.

Battery chargers intended for use in places other than dry indoor areas shall be provided with a degree of protection not less than IPX4 as specified in IEC 60529.

NOTE The wheelchair is expected to provide this protection for installed on-board chargers.

5.1.3 Test methods

5.1.3.1 General

Test battery chargers in accordance with the applicable clauses of IEC 60335-2-29 and IEC 60529. For battery chargers that have cooling fans, include locked or disconnected fans in the abnormal operation testing.

An electronic load in constant-voltage mode as described in 4.5 may be used for loading the battery charger during testing.

NOTE IEC 60335–2-29 specifies tests and inspection criteria for appliances with IP ratings.

5.1.3.2 Exposure to vibration

5.1.3.2.1 On-board battery chargers

On-board battery chargers shall be subjected to the multi-drum fatigue test and the kerb-drop fatigue test specified in ISO 7176-8 while installed in wheelchairs.

After the test, the on-board battery charger shall show no damage that could impair its operation, and connections shall not have worked loose.

5.1.3.2.2 Carry-on battery chargers

Carry-on chargers shall conform to IEC 60335-2-29:2016+AMD1:2019, 21.102.

5.2 Performance-related safety

5.2.1 General

Battery chargers intended for use with electrically-powered wheelchairs shall be safe in normal use and in foreseeable misuse.