Wheelchairs

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

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National foreword

This British Standard is the UK implementation of ISO 7176-25:2022. It supersedes BS ISO 7176-25:2013, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee CH/173, Assistive products for persons with disability.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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ISO 7176-25

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2022-10-06

Wheelchairs —

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

Fauteuils roulants —

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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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 determine 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.

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INTERNATIONAL STANDARD ISO 7176-25:2022

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*

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.

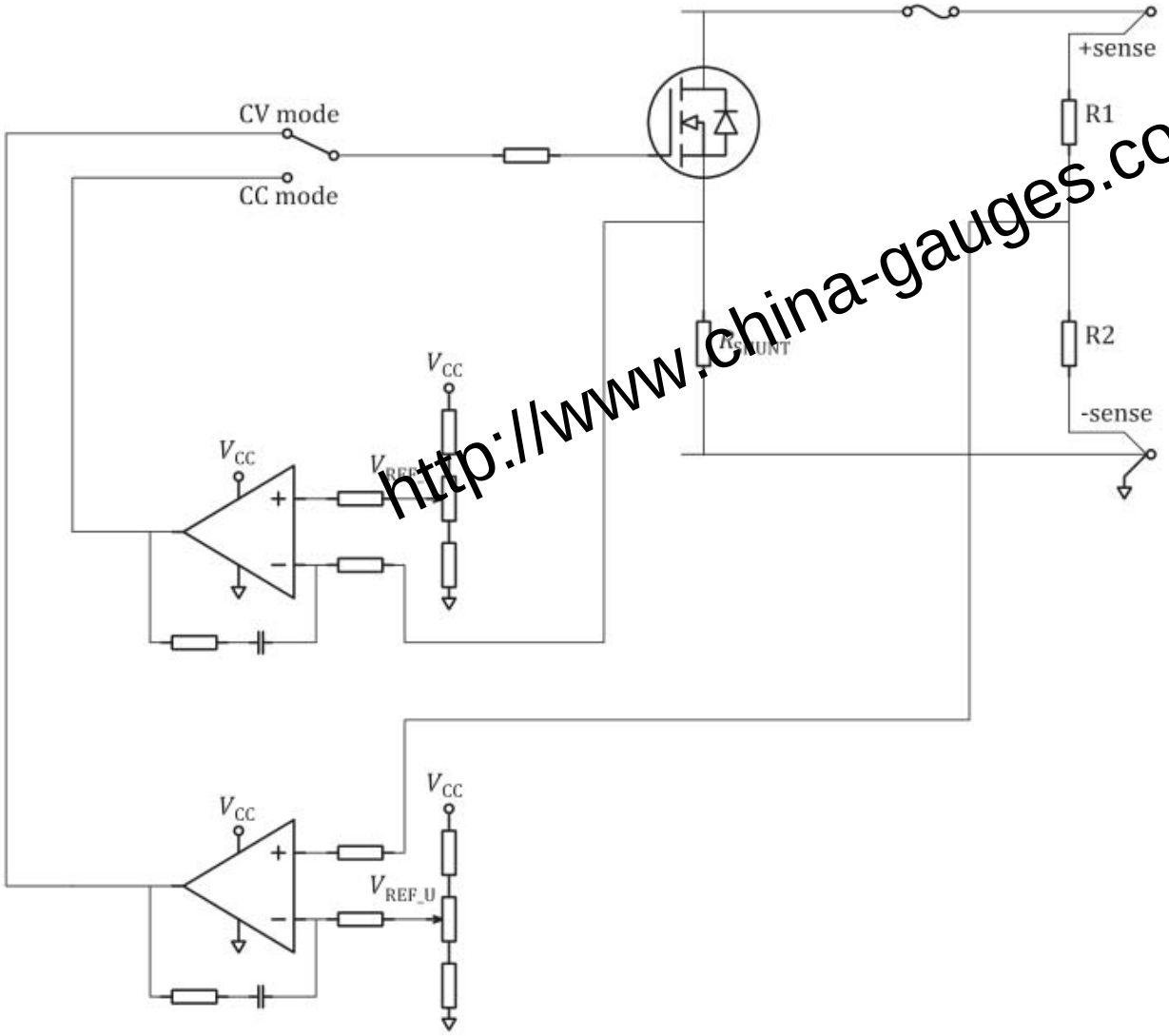
In the constant-voltage mode (switch in CV position), the circuit will keep the voltage between the load terminals substantially constant while sinking the current supplied by the battery charger.

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.

5.2.2 Charging connector

5.2.2.1 General

Output connectors intended to be handled by the end user shall be safe. The connector should also be convenient to use.

NOTE The shape of the charging connector can contribute considerably to ergonomics of use and safety of operation.

5.2.2.2 Requirements

The current rating of the output connector and output cable shall exceed the maximum r.m.s. output current of the battery charger.

If an XLR connector is utilized as a charging connector the following applies:

a) the output connector of the charger shall be male;

b) the XLR connector shall conform to IEC 61076-2-103;

c) where the r.m.s. output current of the battery charger is greater than 5 A, the connector shall conform to the requirements for the power variant specified in IEC 61076-2-103;

d) regardless of whether the connector has more than three pins, the first three pins shall be assigned as follows:

   — pin 1: battery positive;

   — pin 2: battery negative;

   — pin 3: inhibit.

NOTE Inhibit is used to prevent wheelchair movement when the battery charger is connected. Commonly the pin is connected to battery negative.

5.2.2.3 Test methods

Compare the r.m.s. current rating of the charging connector and cable with the r.m.s. output current of the battery charger as measured in 5.3.4.2.

If an XLR connector is utilized as a charging connector, confirm that the requirements of 5.2.2.2 a), b), c) and d) are met by inspection.

5.2.3 Reverse polarity connection

5.2.3.1 General

Reverse polarity connection between the battery and the battery charger could cause a fire or damage to the wheelchair control system, the battery and/or the battery charger if no reverse polarity protection is present.

5.2.3.2 Requirements

There shall be no safety hazard when the battery charger is connected to a battery set with reversed polarity.

When battery chargers are tested in accordance with 5.2.3.3,

— the steady-state current that flows to discharge the battery shall not be greater than 100 mA,

— there shall be no damage to the battery charger, and

— following resetting and/or replacement of any circuit protection devices the battery charger shall operate as specified by the manufacturer.

NOTE This requirement complements the requirement of IEC 60335-2-29 regarding reverse polarity connection.

5.2.3.3 Test method

WARNING — These tests can be hazardous. Appropriate safety precautions should be taken to protect test personnel.

a) Add to the output cable of the battery charger a means to measure the current (4.2).

b) Make provision for connecting the battery charger to the test battery with reversed polarity.

c) With the battery charger disconnected from the supply mains, connect the battery to the battery charger with reversed polarity.

d) Monitor the steady-state current in the output cable of the battery charger for a period of not less than 1 min and record whether any steady state current greater than 100 mA flows in the output cable.

e) Disconnect the battery charger from the battery and examine the battery charger. Record any damage.

f) If the battery charger is undamaged, reset and/or replace any circuit protection devices, if needed.

g) Connect the battery charger to the battery with normal polarity. Connect the battery charger to the supply mains and switch on the battery charger. Check and record whether it operates correctly.

h) With the battery charger connected to the supply mains and switched on, connect the battery to the battery charger with reversed polarity.

i) Repeat d) to g).

j) Switch off the battery charger and disconnect it from the supply mains.

5.2.4 Battery discharge

5.2.4.1 General

A battery charger that is disconnected from the supply mains and left connected to the battery can draw an excessive current from the battery.

5.2.4.2 Requirement

The current drawn from a correctly connected battery by a carry-on or off-board battery charger that is disconnected from the supply mains shall not exceed 10 mA.

5.2.4.3 Test method

Conformity is checked by adding to the output cable of the battery charger a means to measure the mean current (4.2) when the battery charger is connected to a test voltage equal to the nominal voltage of the battery for which the battery charger is intended, ±0,1 V.

NOTE A power supply can be the source of the test voltage.

5.2.5 Battery charger options

5.2.5.1 General

The output voltage of the battery charger, the charging characteristics and any other settings of the battery charger shall be compatible with the battery set to be charged. It shall not be possible to change these settings inadvertently.

5.2.5.2 Requirements

It shall not be possible to change the output voltage, the charging characteristics or other settings of the battery charger without the aid of a tool, key entry combination or similar means for restricting access. If the means for restricting access is other than a tool, it shall not consist of operations which are performed in normal use of the battery charger.

5.2.5.3 Test method

The requirement is confirmed by inspection.

5.2.6 Charging a faulty battery set

5.2.6.1 General

Excessive gassing and heating can occur if a faulty battery set is being recharged.

The battery charger design should reduce the risks related to charging a faulty battery set, including risk of thermal runaway, as far as possible.

5.2.6.2 Requirements

Battery chargers shall cease charging a faulty battery set, i.e. one where the terminal voltage does not increase normally during charging, not more than 12 h after the commencement of charging.

The battery charger shall have a rated output current of not more than $1{,}5 \cdot I_5$ for the smallest capacity battery for which it is specified. Conformity is verified by inspection of battery charger documentation and battery specifications.

5.2.6.3 Test method

Prepare a constant-voltage load (4.5) for connection to the battery charger (as a simulated battery).

Set up the load with a constant voltage not greater than the nominal voltage of the battery set for which the battery charger is intended.

Connect into the output cable of the battery charger a device (4.2) that will detect the flow of current between the battery charger and the constant-voltage load.

Set up a timing device to measure the time for which current flows after charging has commenced.

Connect the battery charger to supply mains.

Switch on the charger.

Connect the charger to the constant-voltage load.

Measure and record time of current flow after charging has commenced.

Measure the output current and record whether or not the current is below the $1{,}5 \cdot I_5$ limit after 12 hours.

5.3 Charging capability

5.3.1 General

It is desirable that the battery set of a wheelchair can be able to be completely recharged overnight.

A typical charging process is made up of the following phases:

— a bulk charging (constant current) phase, where the charging current is controlled by the battery charger;

— an absorption (constant voltage) phase, during which the voltage is controlled by the battery charger and the remaining part of the capacity is recharged while the charging current decreases;

— an optional equalizing phase, during which the charge in the individual cells is balanced.

To provide a predictable charging time and to ensure proper charging of the battery, the output current and the output voltage of the battery charger shall be independent of mains voltage variations.

The duration of the bulk charging phase is influenced by the output voltage of the charger and the voltage drop in the wiring. Consequently, there should be a correct match between the charger, wheelchair charging circuitry and battery set.

To complete the charging process, the absorption phase should come to an end. Repeated incomplete recharging should be avoided as this could cause the battery set to degrade.

5.3.2 Requirements

5.3.2.1 General

When a battery set with a rated 5 h capacity expressed in ampere hours (C_5) has been discharged to the cut off voltage specified by the battery manufacturer at an electric current equal to $C_5/5$, expressed in amperes (I_5), a battery charger shall have a suitable output current, to be able to recharge the battery set to $0{,}8 \cdot C_5$ in a period of 8 h.

5.3.2.2 Charging current - Bulk charge phase

The required minimum nominal DC output current for a battery charger depends on the C_5 of the largest capacity battery for which it is intended.

The battery charger nominal DC output current shall be not less than $0{,}5 \cdot I_5$ when supplied by the nominal mains voltage ±6 %.

NOTE Battery charger DC output current limits based on nominal output current are specified in IEC 60335-2-29.

5.3.2.3 Charging voltage - Absorption charge phase

During the absorption phase, the battery charger shall supply an output voltage equal to $n \cdot (2{,}40 \pm 0{,}05)$ V, where n is the number of cells, when supplied by the nominal mains voltage ±6 %.

5.3.3 Preparation for test

Record the rated DC output voltage, U_{chg}.

Calculate the minimum absorption phase output voltage, $U_{chg,\,min} = n \cdot 2{,}35$ V.

Calculate the maximum absorption phase output voltage, $U_{chg,\,max} = n \cdot 2{,}45$ V.

Record the maximum battery capacity C_5 specified by the charger manufacturer.

Calculate the required output current of the battery charger, $I_{chg,\ min} = 0{,}5 \cdot I_5$.

5.3.4 Test methods

5.3.4.1 Charging current set-up

Prepare a constant-voltage load (4.5) for connection to the battery charger (as a simulated battery).

Set up the load with a constant voltage equal to $U_{chg} \cdot (0{,}97 \pm 0{,}01)$.

Connect into the output cable of the battery charger a device (4.3) to measure the mean current from the battery charger to the constant-voltage load.

Connect into the output cable of the battery charger a device (4.3) to measure the r.m.s. current from the battery charger to the constant-voltage load.

Set up a means to alter the AC supply voltage (4.6) and adjust the supply voltage to be equal to the rated input voltage.

Connect the mains plug of the battery charger to the means to alter the AC supply voltage (4.6).

Switch on the charger.

Connect the charger to the constant-voltage load.

Wait for 5 min.

5.3.4.2 R.M.S. output current

While altering the AC supply voltage between the limits defined as the nominal mains supply voltage ±6 %, measure and record the maximum r.m.s. value of the output current of the battery charger.

The battery charger fails the test if the maximum r.m.s. value of the output current exceeds the specification of the output connector or output cable.

The battery charger fails the test if the maximum r.m.s. value of the output current exceeds 110 % of the rated output current.

5.3.4.3 Mean output current

While altering the AC supply voltage between the limits defined as the nominal mains supply voltage ±6 %, measure the arithmetic mean output current of the battery charger.

The battery charger fails this test if the mean output current drops below $I_{chg,\ min}$ as calculated in 5.3.3.

5.3.4.4 Thermal stability

Adjust the supply voltage to be equal to the nominal mains supply voltage +6 %. Conduct the test at the maximum operating temperature specified by the charger manufacturer, +0 −5 °C.

Measure and record the arithmetic mean output current for four hours (to establish maximum temperature).

The battery charger fails this test if the output current drops below $I_{chg,\ min}$ as defined in 5.3.3 during the test.

5.3.4.5 Charging voltage

Prepare a constant-current load (4.5) for connection to the battery charger (as a simulated battery).

To simulate the absorption charge phase (see 5.3.1), set up the load with a constant current equal to $(0,5 \pm 0,05) \cdot I_{chg, min}$.

Connect into the output cable of the battery charger a resistive load equal to the measured or calculated voltage drop of the wheelchair charging circuitry.

Connect a voltmeter (4.4) as close as possible to the output connector of the battery charger to measure the output voltage of the battery charger.

Set up a means to alter the AC supply voltage (4.6) and adjust the supply voltage to be equal to the nominal supply voltage specified by the charger manufacturer.

Connect the mains plug of the battery charger to the means to alter the AC supply voltage (4.6).

Switch on the charger.

Connect the charger to the constant-current load.

While altering the AC supply voltage between the limits defined as the nominal mains voltage ±6 %, measure the output voltage of the battery charger.

If a capacitor is connected to the terminals of the constant-current load, attention shall be paid to the rate of change of the output voltage.

The battery charger fails this test if the output voltage is less than $U_{chg, min}$ or greater than $U_{chg, max}$ as calculated in 5.3.3.

5.4 Electromagnetic compatibility (EMC)

5.4.1 General

Battery chargers intended for use with electrically-powered wheelchairs should operate without producing excessive electromagnetic disturbances and without unacceptable degradation of performance in the presence of electromagnetic disturbances that can be expected in the anticipated environment.

5.4.2 Requirements

Battery chargers shall meet the applicable requirements of ISO 7176-21.

5.4.3 Test methods

Follow the set-up procedures and test methods specified in ISO 7176-21.

5.5 Indicators

5.5.1 General

Users shall be able to check the status of the battery charger.

5.5.2 Requirements

Indications shall be provided for the following conditions:

— mains on;

— charging commenced;

— charging completed;

— fault present.

The indication for the mains-on condition shall be different from all other indications.

Indicators for other conditions may be provided. The meaning of all indicators shall be explained in detail in the instructions for use.

The indications may be on the battery charger or on a wheelchair user interface.

5.5.3 Test method

The requirements are confirmed by inspection.

6 Batteries

6.1 Performance requirements

6.1.1 General

6.1.1.1 Cyclic endurance

Batteries for home medical equipment applications are rated by the number of charge-discharge cycles they can undergo before their capacity falls below a predetermined percentage of the rated capacity.

The cyclic endurance of batteries, measured as specified in IEC 60254-1:2005, 5.5, is intended to be disclosed and used to compare batteries to determine whether they are suitable for a particular application.

6.1.1.2 Recommendation and requirement

Cyclic endurance of batteries should not be less than 300 cycles when they are tested in accordance with IEC 60254-1:2005, 5.5. The manufacturer shall declare the cyclic endurance.

6.1.1.3 Test methods

Cyclic endurance testing shall follow IEC 60254-1:2005, 5.5.

Battery preparation shall be performed as specified in IEC 60254-1:2005, 4.3 in place of 5.5.1.

Conformity to IEC 60254-1:2005, 5.5 as to the number of cycles accomplished shall be declared.

6.1.2 Charge retention

6.1.2.1 Requirement

A battery will lose charge on an open circuit as a result of self-discharge.

6.1.2.2 Test method

Charge retention testing shall be in accordance with IEC 60254-1:2005, 5.3.

Battery preparation shall be performed as specified in IEC 60254-1:2005, 4.3 in place of 5.3.1.

Conformity to IEC 60254-1:2005, 5.3 as to the residual capacity shall be declared.

6.2 Safety requirements

6.2.1 Requirements

When tested as specified in 6.2.2, batteries shall not explode due to external ignition of gases emitted by the battery.

Batteries shall be non-spillable.

6.2.2 Test methods

Batteries shall be tested for resistance to explosion as specified in IEC/TS 61430 or SAE J1495.

Verification that a battery is non-spillable is checked by inspection to confirm a marking on the battery that reads "NON-SPILLABLE" or "NON-SPILLABLE BATTERY".

6.3 Marking

Batteries shall be marked clearly and durably with

a) the name and/or trade mark of the manufacturer,

b) the type reference,

c) the nominal voltage,

d) the 5 hour rated capacity C_5 and/or the 20 hour rated capacity (C_{20}),

e) the date of manufacture, and

f) polarity markings adjacent to each terminal as specified in IEC 60254-2.

Date of manufacture may be abbreviated; or may be in a nationally accepted conventional code or in a code affirmed by the manufacturer.

The marking is checked by inspection.

7 Test report

7.1 Test reports for battery chargers

Test reports for battery chargers shall contain the following information:

a) the name and address of the testing organization;

b) a unique reference for the battery charger tested (e.g. serial number);

c) the dates of testing;

d) a statement that the tests have been carried out in accordance with this document, i.e. ISO 7176-25:2022;

e) the name and address of the battery charger manufacturer;

f) the type reference of the battery charger;

g) the specification for the battery charger, including

   — the rated input voltage/frequency range,

   — the rated DC output current,

- the rated DC output voltage,
- the operating temperature range,
- the types of the batteries that can be charged, and
- the 5 hour rated capacity C_5 of the batteries that can be charged.

h) if the battery charger is on-board and installed on a wheelchair,
- the name and address of the wheelchair manufacturer, and
- the type reference of the wheelchair.

i) the ambient temperature of test environment during each test;

j) a statement as to which requirements were met by the battery charger;

k) a statement as to which requirements were not met by the battery charger.

7.2 Test reports for batteries

Test reports for batteries shall contain the following information:

a) the name and address of the testing organization;

b) a unique reference for the battery tested (e.g. serial number);

c) the dates of testing;

d) a statement that the tests have been carried out in accordance with this document, i.e. ISO 7176-25:2022;

e) the name and address of the battery manufacturer;

f) the type reference of the battery;

g) the specification for the batteries, including
- the type,
- the 5 hour rated capacity C_5 and/or the 20 hour rated capacity (C_{20}),
- dimensions,
- charging and discharging specifications,
- nominal voltage, and
- claimed cyclic endurance.

h) a statement as to which requirements were met by the batteries;

i) a statement as to which requirements were not met by the batteries.

8 User manual

8.1 User manual for battery chargers

A user manual shall be supplied with each battery charger. It may be incorporated into the wheelchair user manual.

User manuals for battery chargers shall include the following information:

a) if the battery charger is off-board, carry-on or on-board but uninstalled, the type reference of the battery charger;

b) if the battery charger is on-board and installed, the type reference of the wheelchair;

c) a general specification which includes

- the intended use of the battery charger: on-board, carry-on or off-board,
- the rated input voltage range,
- the rated DC output current,
- the rated DC output voltage,
- the operating temperature range,
- the types of the batteries that can be charged, for example, AGM and gel,
- the rated capacity C_5 of the batteries that can be charged,
- the environmental protection rating, for example IPX as specified in IEC 60529, and
- the assignment of charging connector pins.

d) where applicable, the rated current of any user-accessible protective fuses;

e) safety warnings, including warnings that

- users should read the instructions before attempting to use the battery charger,
- if the protection rating of the battery charger is not IPX4 or better, the battery charger is intended for indoor use and is not to be exposed to rain or other sources of moisture,
- explosive gasses can be generated while charging, so the wheelchair and battery charger are to be kept away from sources of ignition, such as flames and sparks,
- charging is carried out with the wheelchair in a space at least twice its volume, with sufficient ventilation that there is no hazard due to build-up of flammable gas,
- only batteries of the specified type and capacity shall be charged,
- off-board battery chargers shall not be carried on wheelchairs.

f) operating instructions, including the following:

- an explanation of the function of indicators,
- an explanation that occasional use of the wheelchair prior to charging complete indication is acceptable if the need is urgent,
- the order of disconnection of the battery charger from the supply mains and wheelchair,
- where applicable, an explanation of the automatic charging function, stating any limitations, and
- basic troubleshooting information.

g) sales and service information, including

- the names, addresses and telephone numbers of service organisations, and
- the name and address of the battery charger manufacturer, if the charger is sold separately.

8.2 User manual for batteries

A user manual shall be supplied with each battery set. It may be incorporated into the wheelchair user manual.

User manuals for wheelchair batteries shall include the following information:

a) the cycle endurance in accordance with IEC 60254-1:2005, 5.5;

b) warranty information;

c) where applicable, instructions for installation and maintenance;

d) where applicable, information concerning performance at low temperatures and any related precautions;

e) precautions regarding the battery as a source of explosive gas (e.g. ventilation, fire risk);

f) sales and service information, including

— the names, addresses and telephone numbers of service organisations, and

— the name and address of the battery manufacturer, if the battery is sold separately;

g) the 5 hour rated capacity C_5 of the batteries that can be charged.

9 Disclosure

The following information shall be disclosed as specified in ISO 7176-15:

— whether the battery charger met the requirements of this document, and

— whether the batteries met the requirements of this document.

Bibliography

[1] IEC 60050-482, *International Electrotechnical Vocabulary — Part 482: Primary and secondary cells and batteries*

[2] IEC 60601-1, *Medical electrical equipment — Part 1: General requirements for basic safety and essential performance*

[3] *IATA Packing Instructions 806*

[4] *IATA Special Provision A67*

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