
Wheelchairs —

Part 31:

**Lithium-ion battery systems and
chargers for powered wheelchairs —
Requirements and test methods**

iTeh STANDARD PREVIEW

Fauteuils roulants —

*Partie 31: Systèmes de batteries lithium-ion 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 document 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).

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

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

This document was developed to standardize requirements for use of lithium-ion batteries in wheelchairs.

Lithium-ion batteries provide performance enhancements relative to batteries with other chemistries, but operation outside specified limits can pose unacceptable risks. It is important not to overlook conditions that occur not only when charging using the wheelchair battery charger, but during operation of the wheelchair, which can charge the battery system when decelerating and/or travelling down a slope. In many cases, the wheelchair controller can be considered part of the battery system and charging system combined.

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Wheelchairs —

Part 31:

Lithium-ion battery systems and chargers for powered wheelchairs — Requirements and test methods

WARNING — The use of this document can involve hazardous materials, operations and equipment. This document does not purport to address all of the safety or environmental problems associated with its use. It is the responsibility of users of this document to take appropriate measures to ensure the safety and health of personnel and the environment prior to application of this document. Particular care should be taken regarding the possible emission of toxic fumes resulting from lithium battery fires.

1 Scope

This document specifies requirements and test methods for lithium-ion batteries and battery systems intended for use in electrically powered wheelchairs, and their charging systems.

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 7176-14, *Wheelchairs — Part 14: Power and control systems for electrically powered wheelchairs and scooters — Requirements and test methods*

ISO 7176-25:2022, *Wheelchairs — Part 25: Lead-acid batteries and chargers for powered wheelchairs — Requirements and test methods*

IEC 60335-2-29:2016+Amd 1:2019, *Household and similar electrical appliances — Safety — Part 2-29: Particular requirements for battery chargers*

IEC 60417, *Graphical symbols for use on equipment — Registered symbols*

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

IEC 62133-2, *Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for portable sealed secondary lithium cells, and for batteries made from them, for use in portable applications - Part 2: Lithium systems*

IEC 61960-3, *Secondary cells and batteries containing alkaline or other non-acid electrolytes - Secondary lithium cells and batteries for portable applications - Part 3: Prismatic and cylindrical lithium secondary cells and batteries made from them*

IEC 62619:2017, *Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries, for use in industrial applications*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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

cell

battery cell

basic manufactured unit providing a source of electrical energy by direct conversion of chemical energy, that consists of electrodes, separators, electrolyte, container and terminals, and that is designed to be charged electrically

[SOURCE: IEC 62133-2:2017, 3.7]

3.2

battery pack

energy storage device, which is comprised of one or more cells or modules electrically connected

Note 1 to entry: Some battery management functions are, by necessity, integrated into the battery; others may need to be integrated into the control and drive system.

Note 2 to entry: It may incorporate a protective housing and be provided with terminals or other interconnection arrangement.

[SOURCE: IEC 62619:2017, 3.10, modified]

3.3

module

battery module

group of cells connected together either in a series and/or parallel configuration with or without protective devices (e.g. fuse or PTC) and monitoring circuitry

[SOURCE: IEC 62133-2:2017, 3.9, modified]

3.4

lithium-ion battery

secondary battery with an organic solvent electrolyte and positive and negative electrodes which utilize an intercalation compound in which lithium is stored

Note 1 to entry: A lithium ion battery does not contain lithium metal.

[SOURCE: IEC 482-05-07, modified]

3.5

battery management system

BMS

electronic system associated with a battery which has functions to maintain safety and prevent damage

3.6

battery system

battery

system which comprises one or more cells, modules or battery packs

Note 1 to entry: The battery system can have cooling or heating units.

[SOURCE: IEC 62619:2017, 3.11, modified]

3.7

cell imbalance

difference between cell conditions that can cause a hazard if allowed to progress

EXAMPLE Significant divergence between cell voltages.

3.8**rated capacity**

capacity value of a cell or battery determined under specified conditions and declared by the manufacturer

3.9**fire**

emission of flames from a cell, module, battery pack, or battery system

[SOURCE: IEC 62619:2017, 3.17]

3.10**battery charging system**

battery charger, battery system and interconnecting components in the charging circuit, including connectors and protective devices

Note 1 to entry: Parts of the battery charging system can be in the wheelchair.

3.11**safety extra-low voltage****SELV**

voltage not exceeding 42 V between conductors and between conductors and earth, the no-load voltage not exceeding 50 V

Note 1 to entry: When safety extra-low voltage is obtained from the supply mains, it is to be through a safety isolating transformer or a convertor with separate windings, the insulation of which complies with double insulation or reinforced insulation requirements.

Note 2 to entry: The voltage limits (specified are based on the assumption that the safety isolating transformer is supplied at its rated voltage.

[SOURCE: IEC 60335-1:2020, 3.4.2, modified]

3.12**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.

[SOURCE: IEC 60335-2-29:2016+Amd 1:2019, 3.4.3]

3.13**thermal runaway**

heat generation caused by uncontrolled exothermic reactions inside the cell

[SOURCE: ISO 6469-1:2019/Amd:2022, 3.38]

4 Lithium-ion batteries**4.1 Battery performance and safety requirements****4.1.1 General**

Lithium-ion batteries shall conform to IEC 62133-2.

4.1.2 Fire

It is important that thermal runaway within a cell does not result in fire of the entire battery system or in fire propagating outside the battery system.

The battery system shall conform to IEC 62619:2017, 7.3.3.

4.1.3 Battery cyclic endurance

The cyclic endurance of a battery is defined by the number of charge/discharge cycles it can perform under specific conditions.

The manufacturer shall declare the number of charge/discharge cycles when tested in accordance with IEC 61960-3.

4.2 Requirements for battery management systems

4.2.1 General

Figure 1 shows examples of possible locations of a BMS, including BMS subsystems.

The BMS can report to the wheelchair controller

- cell voltages and temperatures,
- battery current, and
- estimated state of charge and state of health,

and can balance the voltages or states of charge among individual cells. The controller can use the information reported by the BMS to limit power, such as charging power during regeneration while the wheelchair is decelerating and/or travelling down a slope, in order to prevent cut-off by the BMS.

EXAMPLE Reducing wheelchair speed and/or activating a shunt regulator.

