IEC 62619

Edition 2.0 2022-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for secondary lithium cells and batteries, for use in industrial applications

Accumulateurs alcalins et autres accumulateurs à électrolyte non acide – Exigences de sécurité pour les accumulateurs au lithium pour utilisation dans des applications industrielles

IEC 62619:2022-05(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SECONDARY CELLS AND BATTERIES CONTAINING ALKALINE OR OTHER NON-ACID ELECTROLYTES – SAFETY REQUIREMENTS FOR SECONDARY LITHIUM CELLS AND BATTERIES, FOR USE IN INDUSTRIAL APPLICATIONS

FOREWORD

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IEC 62619 has been prepared by subcommittee 21A: Secondary cells and batteries containing alkaline or other non-acid electrolytes, of IEC technical committee 21: Secondary cells and batteries. It is an International Standard.

This second edition cancels and replaces the first edition published in 2017. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) new requirements for moving parts;
b) addition of requirements for hazardous live parts;
c) addition of requirements for battery system design;
d) new requirements for system lock;
e) new requirements for EMC;

f) addition of procedure of propagation test by laser.

The text of this International Standard is based on the following documents:

Draft	Report on voting
21A/785/FDIS	21A/787/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
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- amended.

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SECONDARY CELLS AND BATTERIES CONTAINING ALKALINE OR OTHER NON-ACID ELECTROLYTES – SAFETY REQUIREMENTS FOR SECONDARY LITHIUM CELLS AND BATTERIES, FOR USE IN INDUSTRIAL APPLICATIONS

1 Scope

This document specifies requirements and tests for the safe operation of secondary lithium cells and batteries used in industrial applications, including stationary applications.

When there exists an IEC International Standard specifying test conditions and requirements for cells used in special applications and which is in conflict with this document, the former takes precedence (e.g., IEC 62660 series on road vehicles).

The following are some examples of applications that utilize cells and batteries under the scope of this document:

- Stationary applications: telecom, uninterruptible power supplies (UPS), electrical energy storage system, utility switching, emergency power, and similar applications.
- Motive applications: forklift truck, golf cart, automated guided vehicle (AGV), railway vehicles, and marine vehicles, with the exception of road vehicles.

Since this document covers batteries for various industrial applications, it includes those requirements which are common and minimum to the various applications.

Electrical safety is included only as a part of the risk analysis of Clause 8. In regard to details for addressing electrical safety, the end use application standard requirements need to be considered.

This document applies to cells and batteries. If the battery is divided into smaller units, the smaller unit can be tested as the representative of the battery. The manufacturer clearly declares the tested unit. The manufacturer can add functions, which are present in the final battery to the tested unit.

This document addresses first life cells and batteries. Reuse, repurpose, second life use or similar are not taken into consideration by this document.

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.

IEC 62133-2:2017, *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 62620:2014, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for use in industrial applications*

ISO/IEC Guide 51, *Safety aspects – Guidelines for their inclusion in standards*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC Guide 51, and the following apply.

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

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
safety
freedom from unacceptable risk

3.2
risk
combination of the probability of occurrence of harm and the severity of that harm

[SOURCE: ISO/IEC Guide 51:2014, 3.9, modified – deletion of Note 1 to entry.]

3.3
harm
physical injury or damage to the health of people, or damage to property or to the environment

[SOURCE: ISO/IEC Guide 51:2014, 3.1]

3.4
hazard
potential source of harm

[SOURCE: ISO/IEC Guide 51:2014, 3.2]

3.5
intended use
use of a product, process or service in accordance with specifications, instructions and information provided by the supplier

3.6
reasonably foreseeable misuse
use of a product, process or service in a way not intended by the supplier, but which can result from readily predictable human behaviour

[SOURCE: ISO/IEC Guide 51:2014, 3.7, modified – "or system" has been replaced with "process or service" and notes to entry deleted.]

3.7
secondary lithium cell
cell
secondary cell where electrical energy is derived from the insertion/extraction reactions of lithium ions or oxidation/reduction reaction of lithium between the negative electrode and the positive electrode

Note 1 to entry: The cell typically has an electrolyte that consists of a lithium salt and organic solvent compound in liquid, gel or solid form and has a metal or a laminate film casing. It is not ready for use in an application because it is not yet fitted with its final housing, terminal arrangement and electronic control device.

3.8
cell block
group of cells connected together in parallel configuration with or without protective devices (e.g. fuse or positive temperature coefficient device (PTC)) and monitoring circuitry

Note 1 to entry: The cell block is not ready for use in an application because it is not yet fitted with its final housing, terminal arrangement and electronic control device.

3.9
module
group of cells connected together either in a series and/or parallel configuration with or without protective devices (e.g. fuse or positive temperature coefficient device (PTC)) and monitoring circuitry

3.10
battery pack
energy storage device, which comprises one or more cells or modules electrically connected and has monitoring circuitry which provides information (e.g. cell voltage) to a battery system to influence the battery's safety, performance and/or service life

Note 1 to entry: The battery pack may incorporate a protective housing and be provided with terminals or other interconnection arrangements.

3.11
battery system
battery
system which comprises one or more cells, modules or battery packs and has a battery management system capable of controlling current in case of overcharge, overcurrent, overdischarge, and overheating

Note 1 to entry: Overdischarge cut-off is not mandatory if there is an agreement between the cell manufacturer and the customer.

Note 2 to entry: The battery system may have cooling or heating units. More than one battery system may constitute a larger battery system. The battery system is sometimes also referred to as a battery.

3.12
battery management system
BMS
electronic system associated with a battery which has functions to control current in case of overcharge, overcurrent, overdischarge, and overheating and which monitors and/or manages the battery's state, calculates secondary data, reports that data and/or controls its environment to influence the battery's safety, performance and/or service life

Note 1 to entry: Overdischarge cut-off is not mandatory if there is an agreement between the cell manufacturer and the customer.

Note 2 to entry: The function of the BMS can be assigned to the battery pack or to equipment that uses the battery. (See Figure 6.)

Note 3 to entry: The BMS can be divided and it can be found partially in the battery pack and partially on the equipment that uses the battery. (See Figure 6.)

Note 4 to entry: The BMS is sometimes also referred to as a BMU (battery management unit).

3.13
leakage
visible escape of liquid electrolyte

3.14
venting
release of excessive internal pressure from a cell, module, battery pack, or battery system in a manner intended by design to preclude rupture or explosion

3.15
rupture
mechanical failure of a cell container or battery case induced by an internal or external cause, resulting in exposure or spillage but not ejection of materials

3.16
explosion
failure that occurs when a cell container or battery case opens violently and solid components are forcibly expelled

Note 1 to entry: Liquid, gas, and smoke are excepted.

3.17
fire
emission of flames from a cell, module, battery pack, or battery system for more than 1 s

Note 1 to entry: Sparks and arcing are not considered as flames.

3.18
rated capacity
capacity value of a cell or battery determined under specified conditions and declared by the manufacturer

Note 1 to entry: The rated capacity is the quantity of electricity C_n Ah (ampere-hours) declared by the manufacturer which a single cell or battery can deliver during an n-hour period when charging, storing and discharging under the conditions specified in IEC 62620:2014, 6.3.1.

[SOURCE: IEC 60050-482:2004, 482-03-15, modified – Addition of the words "cell or" in the definition and of Note 1 to entry.]

3.19
upper limit charging voltage
<of a cell> highest charging voltage in the cell operating region specified by the cell manufacturer

3.20
lower limit discharging voltage
<of a cell> lowest discharging voltage in the cell operating region specified by the cell manufacturer

3.21
maximum charging current
<of a cell> highest charging current in the cell operating region specified by the cell manufacturer

3.22
maximum discharging current
<of a cell> highest discharging current in the cell operating region specified by the cell manufacturer

3.23
thermal runaway
uncontrolled intensive increase in the temperature of a cell driven by exothermic reaction

4 Parameter measurement tolerances

The overall accuracy of controlled or measured values, relative to the specified or actual parameters, shall be within these tolerances:

a) ±0,5 % for voltage;

b) ±1 % for current;

c) ±2 °C for temperature;

d) ±0,1 % for time;

e) ±1 % for mass;

f) ±1 % for dimensions.

These tolerances comprise the combined accuracy of the measuring instruments, the measurement techniques used, and all other sources of error in the test procedure.

The details of the instrumentation used shall be provided in any report of results.

5 General safety considerations

5.1 General

The safety of lithium secondary cells and battery systems requires the consideration of two sets of applied conditions:

1) intended use;

2) reasonably foreseeable misuse.

Cells and battery systems shall be designed and constructed so that they are safe under conditions of intended use and reasonably foreseeable misuse. It may also be expected that cells and battery systems subjected to intended use shall not only be safe but shall continue to be functional in all respects.

It is expected that cells or battery systems subjected to misuse may fail to function. However, even if such a situation occurs, they shall not present any significant hazards.

Potential hazards which are the subject of this document are:

a) fire,

b) burst/explosion,

c) leakage of cell electrolyte,

d) venting with continuous emission of flammable and/or toxic gas and/or smoke,

e) rupture of the casing of cell, module, battery pack, or battery system with exposure of internal components.

Conformity with 5.1 a) and b) is checked by the tests of Clause 6, Clause 7, and 8.2, and in accordance with the appropriate standard (see Clause 2). Conformity with 5.1 c) to e) and with 5.2 to 5.6 is checked by analysis of documents mentioned in 8.1.

Moving parts that have potential to cause human injuries shall be applied using an appropriate design and necessary measures to reduce the risk of injuries, including those injuries that may be incurred during installation, while cells or battery systems are being incorporated into equipment.

5.2 Insulation and wiring

Wiring and its insulation shall be sufficient to withstand the maximum anticipated voltage, current, temperature, altitude and humidity requirements. The design of an internal wiring shall be such that adequate clearances and creepage distances are maintained between conductors and live parts at different voltages or between live parts and non-current-carrying accessible parts. Hazardous live parts of the battery system shall be protected to avoid the risk of electric shocks, including during installation.

The mechanical integrity of the whole battery system (cell/module/BMS) and their connections shall be sufficient to accommodate conditions of reasonably foreseeable misuse.

5.3 Venting

The casing of a cell, module, battery pack, and battery system shall incorporate a pressure relief function that will preclude rupture or explosion. If encapsulation is used to support cells within an outer case, the type of encapsulating material and the method of encapsulation shall neither cause the battery system to overheat during normal operation nor inhibit pressure relief.

5.4 Temperature/voltage/current management

The design of battery systems shall be such that abnormal temperature-rise conditions are prevented. Battery systems shall be designed within voltage, current, and temperature limits specified by the cell manufacturer. Battery systems shall be provided with specifications and charging instructions for equipment manufacturers so that associated chargers are designed to maintain charging within the voltage, current and temperature limits specified.

5.5 Terminal contacts of the battery pack and/or battery system

Terminals shall have clear polarity marking(s) on the external surface of the battery pack or battery system.

Battery packs with keyed external connectors designed for connection to specific end products need not be marked with polarity markings if the design of the external connector prevents reverse polarity connections.

The size and shape of the terminal contacts shall ensure that they can carry the maximum anticipated current. External terminal contact surfaces shall be formed from conductive materials with good mechanical strength and corrosion resistance. Terminal contacts shall be arranged so as to minimize the risk of short-circuits, for example to minimize the risk of short-circuits by metal tools. Compliance is determined through a review of the terminal specifications.

5.6 Assembly of cells, modules, or battery packs into battery systems

5.6.1 General

The assembly of cells, modules or battery packs to constitute the battery system shall respect the following rules to support adequate mitigation of risks as regard to the battery system:

- Each battery system shall have an independent control and protection method(s).

  NOTE For the independent control and protection method(s), see 8.2.

- The cell manufacturer shall provide recommendations about current, voltage, temperature limits and should provide mounting advice, storage conditions, maximum number of cells in series (for cell internal protection such as a current interrupt device (CID)) so that the battery system manufacturer/designer may ensure proper design and assembly.

- Battery systems that are designed for the selective discharging of a portion of their series connected cells shall incorporate separate circuitry to prevent the cell reversal caused by uneven discharging.

- Protective circuit components should be added as appropriate and consideration given to the end-device application.

5.6.2 Battery system design

The voltage control function of the battery system design shall ensure that the voltage of each cell or cell block shall not exceed the upper limit charging voltage specified by the manufacturer of the cells, except in the case where the end-devices provide the voltage control function. In such a case, the end-devices are considered as part of the battery system. Refer to Note 2 and Note 3 in 3.12.

The battery shall be designed so that the maximum charging current or the maximum discharging current of the cell are not exceeded before the maximum allowed charging or discharging current of the battery is reached.

5.7 Operating region of lithium cells and battery systems for safe use

The cell manufacturer shall specify the cell operating region. The battery system manufacturer shall design the battery system to comply with the cell operating region. Determination of the cell operating region is in accordance with Annex A.

5.8 System lock (or system lock function)

The battery system shall have a non-resettable function to stop operation when one or more cells in the battery system deviates from the operating region during operation. This feature shall not be user resettable or allow for automatic reset.

The function of the battery system may be returned after checking that the status of the battery system complies with the battery system manufacturer manual, i.e. the battery system maintenance manual shall clearly set out this procedure.

Depending on the application, a battery system may allow a final discharge, for example to provide emergency functions. In this case, cell limits (e.g. lower limit discharge voltage or upper temperature limit) may deviate once within the range where the cell does not cause dangerous reactions. Therefore, the cell manufacturer shall provide the second set of limits in which the cell in the battery system may accept one discharge without dangerous reactions. The cell should not be further recharged after this last discharge.

5.9 Quality plan

The battery system manufacturer shall prepare and implement a quality plan that defines procedures for the inspection of materials, components, cells, modules, battery packs, and battery systems and which covers the whole process of producing each type of cell, module, battery pack, and battery system (e.g. ISO 9001, etc.). Manufacturers should understand their process capabilities and should institute the necessary process controls in relation to product safety.

6 Type test conditions

6.1 General

A cell in the battery system that is used outside of its operating region may exhibit hazards resulting from the cells or battery systems. Such risks shall be taken into consideration in order to prepare a safe test plan.

The test facility should have sufficient structural integrity and a fire suppression system to sustain the conditions of overpressure and fire that may occur as a result of testing. The facility should have a ventilation system to remove and capture gas which might be produced during the tests. Consideration should be given to high voltage hazards when applicable.

Warning: **THESE TESTS USE PROCEDURES WHICH MAY RESULT IN HARM IF ADEQUATE PRECAUTIONS ARE NOT TAKEN. TESTS SHOULD ONLY BE PERFORMED BY QUALIFIED AND EXPERIENCED TECHNICIANS USING ADEQUATE PROTECTION. TO PREVENT BURNS, CAUTION SHOULD BE TAKEN FOR THOSE CELLS OR BATTERY SYSTEMS WHOSE CASINGS MAY EXCEED 75 °C AS A RESULT OF TESTING.**

6.2 Test items

Tests are made with the number of cells or battery systems specified in Table 1, using cells or battery systems that are stored for not more than six months, under conditions specified by the cell or battery system manufacturer.

Cells or battery systems charged in accordance with the method specified in 7.1 shall deliver the rated capacity or more according to IEC 62620:2014, 6.3.1 when they are discharged at 25 °C ± 5 °C, at a constant current of 0,2 I_t A according to IEC 62620:2014, 6.3.1, down to a specified final voltage. This capacity confirmation may be done during the cell manufacturer shipping inspection. In the case of a battery system, the capacity may be calculated on the basis of the cell capacity as measured during the cell manufacturer shipping inspection.

Unless otherwise specified, tests are carried out in an ambient temperature of 25 °C ± 5 °C.

NOTE Test conditions are for type tests only and do not imply that intended use includes operation under these conditions. Similarly, the limit of six months is introduced for consistency and does not imply that cell and battery system safety is reduced after six months.