IEC 63057

Edition 1.0 2020-01

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for secondary lithium batteries for use in road vehicles not for the propulsion

Accumulateurs alcalins et autres accumulateurs à électrolyte non acide – Exigences de sécurité pour les batteries d'accumulateurs au lithium destinées à être utilisées dans les véhicules routiers, mais non destinées à la propulsion

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CONTENTS

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SECONDARY CELLS AND BATTERIES CONTAINING ALKALINE OR OTHER NON-ACID ELECTROLYTES – SAFETY REQUIREMENTS FOR SECONDARY LITHIUM BATTERIES FOR USE IN ROAD VEHICLES NOT FOR THE PROPULSION

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International Standard IEC 63057 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.

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

FDIS	Report on voting
21A/715/FDIS	21A/719/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

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

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- withdrawn,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

SECONDARY CELLS AND BATTERIES CONTAINING ALKALINE OR OTHER NON-ACID ELECTROLYTES – SAFETY REQUIREMENTS FOR SECONDARY LITHIUM BATTERIES FOR USE IN ROAD VEHICLES NOT FOR THE PROPULSION

1 Scope

This document specifies safety tests and requirements for secondary lithium batteries permanently installed in road vehicles not for the propulsion. Replacement secondary batteries permanently installed in road vehicles not for propulsion are covered by this document.

The following are typical applications that utilize the batteries under the scope of this document: a power source for the starting of internal combustion engines, lighting, on-board auxiliary equipment, and energy absorption for regeneration from braking.

This document applies to batteries with a maximum voltage less than or equal to 60 V DC.

The batteries primarily used for propulsion of electric vehicles (EVs), including battery electric vehicles (BEVs), hybrid electric vehicles (HEVs), and plug-in hybrid electric vehicles (PHEVs) are not covered by this document.

NOTE Testing on cell level is specified in IEC 62619.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-482, *International Electrotechnical Vocabulary (IEV) – Part 482: Primary and secondary cells and batteries* (available at http://www.electropedia.org/)

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*

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 IEC 60050-482, 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
battery
unit comprising one or more cells, modules and a battery management system

3.2
battery management system
BMS
set of protection functions associated with a battery to prevent overcharge, overcurrent, over temperature, under temperature and if applicable overdischarge

Note 1 to entry: The function of the BMS can be assigned to the battery or to the vehicle that uses the battery. See Figure 1.

Note 2 to entry: The BMS can be divided and it can be found partially in the battery and partially on the equipment that uses the battery. See Figure 1.

Note 3 to entry: The BMS is sometimes also referred to as a BMU (battery management unit).

Note 4 to entry: This term applies to the French language only.

3.3
cell
secondary cell where electrical energy is derived from the insertion or 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.

3.4
cell block
group of cells connected together in parallel configuration with or without protective devices (e.g. fuse or positive temperature coefficient device) and monitoring circuitry

Note 1 to entry: 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.

3.5
explosion
failure that occurs when a battery case opens violently, and solid components are forcibly expelled

Note 1 to entry: Liquid, gas, and smoke can be erupted.

3.6
final voltage
specified closed circuit voltage at which the discharge of a battery is terminated

Note 1 to entry: The final voltage should be declared by the battery manufacturer.

3.7
fire
emission of flames from a battery

3.8
harm
physical injury or damage to the health of people or damage to property or to the environment

3.9
hazard
potential source of harm

3.10
intended use
use of a product, process or service in accordance with specifications, instructions and information provided by the battery manufacturer

3.11
leakage
visible escape of liquid electrolyte

3.12
module
group of cells connected together in a series and/or parallel configuration with or without protective devices (e.g. fuse or positive temperature coefficient device) and monitoring circuitry

3.13
rated capacity
capacity value of a battery determined under specified conditions and declared by the battery manufacturer

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

3.14
reasonably foreseeable misuse
use of a product, process or service in a way which is not intended by the battery manufacturer, but which can result from readily predictable human behaviour

3.15
risk
combination of the probability of occurrence of harm and the severity of that harm

3.16
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

3.17
safety
freedom from unacceptable risk

3.18
venting
release of excessive internal pressure from a cell, module, or battery in a manner intended by design to preclude rupture or explosion

4 Parameter measurement tolerances

The overall accuracy of controlled or measured values, relative to the specified or actual values, shall be within the following tolerances unless otherwise noted in the individual test procedure:

a) ±0,5 % for voltage;

b) ±1 % for current;

c) ±2 °C for temperature;

d) ±0,1 % for time;

e) ±1 % for dimensions

f) ±1 % for mass.

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 batteries requires the consideration of two sets of applied conditions:

1) intended use;
2) reasonably foreseeable misuse.

Batteries shall be so designed and constructed that they are safe under conditions of both intended use and reasonably foreseeable misuse.

It is expected that batteries subjected to misuse can 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) explosion.

Conformity with 5.1 to 5.7 is checked by the tests of Clauses 6 and 7, and in accordance with the appropriate standard.

5.2 Insulation and wiring

Wiring and its insulation shall be sufficient to withstand the maximum anticipated voltage, current, and temperature requirements. The design of wiring shall be such that adequate clearances and creepage distances are maintained between conductors. The mechanical integrity of the battery and its connections shall be sufficient to accommodate conditions of reasonably foreseeable misuse.

5.3 Venting

The casing of the battery 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 encapsulant and the method of encapsulation shall neither cause the battery to overheat during normal operation nor inhibit pressure relief.

5.4 Temperature/voltage/current

The design of batteries shall be such that abnormal temperature-rise conditions are prevented. The battery shall be designed within voltage, current, and temperature limitations specified by the cell manufacturer. The battery shall be provided with specifications and charge instructions for vehicle manufacturer or battery-charger manufacturer so that associated chargers are designed to maintain charging within the voltage, current and temperature limits specified.

NOTE Where necessary, means can be provided to limit current or voltage to safe levels during charging and discharging.

5.5 Terminal contacts of the battery

Terminals shall have clear polarity marking(s) on the external surface of the battery, and the polarity marking(s) should be located near the terminal in order to be understood easily.

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 (caused by metal tools, for example).

5.6 Assembly of battery

5.6.1 General

- The battery should have an independent control and protection method.
- The cell manufacturer shall provide recommendations about current, voltage and temperature limits so that the battery manufacturer or designer can ensure proper design and assembly.
- Protective circuit components should be added as appropriate, and consideration given to the vehicle.

5.6.2 Battery design

The voltage control function of the battery design shall ensure that the voltage of each cell or cell block shall not exceed the upper limit of the charging voltage specified by the cell manufacturer, except in the case where the vehicle system provides an equivalent voltage control function.

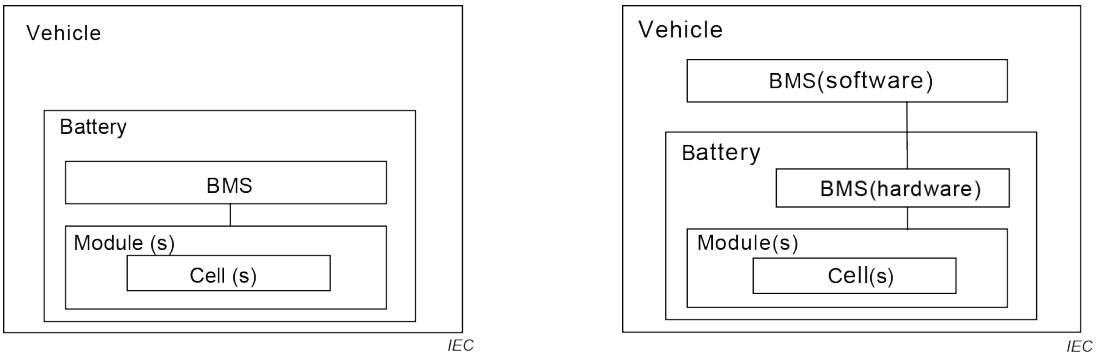
The following should be considered at battery level and by the battery manufacturer:

For a battery that has several series-connected cells or modules, it is recommended that the voltages of any one of the single cells or cell blocks do not exceed the upper limit of the charging voltage, specified by the cell manufacturer, by monitoring the voltage of every single cell or cell block.

5.7 Requirements for the BMS

The BMS evaluates the condition of cells and batteries, and it maintains cells and batteries within the specified cell operating region. Key factors of the cell operating region are voltage, temperature and current for charging and discharging.

The functions of the BMS can be incorporated into the battery or into the vehicle that uses the battery. The BMS can also be divided so that it can be found partially in the battery and partially in the vehicle that uses the battery (see Figure 1).



a) All functions of BMS are in the battery

b) BMS functions are divided between battery and vehicle side

Figure 1 – Examples of BMS locations and battery configurations

A hazard analysis and risk assessment in accordance with Clause 8 of IEC 62619:2017 shall be conducted on the battery and BMS combination.

5.8 Operating region of lithium cells and battery for safe use

Cells shall comply with the cell criteria outlined in IEC 62619:2017. The cell manufacturer shall specify the cell's operating region. The battery manufacturer shall design the battery to comply with the cell's operating region. Determination of the cell's operating region is explained in Annex A of IEC 62619:2017.

5.9 Quality plan

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

6 Type test conditions

6.1 General

A battery that is used outside of its operating region can exhibit hazards resulting from that battery. Such risks have to be taken into consideration in order to prepare a safe test plan.

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

Warning:	**THESE TESTS USE PROCEDURES THAT 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 BATTERIES WHOSE CASINGS MAY EXCEED 75 °C AS A RESULT OF TESTING.**