IEC

IEC 62133-1

Edition 1.0 2017-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications – Part 1: Nickel systems

Accumulateurs alcalins et autres accumulateurs à électrolyte non acide – Exigences de sécurité pour les accumulateurs portables étanches, et pour les batteries qui en sont constituées, destinés à l'utilisation dans des applications portables – Partie 1: Systèmes au nickel

IEC 62133-1:2017-02(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 29.220.30

ISBN 978-2-8322-3909-4

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SECONDARY CELLS AND BATTERIES CONTAINING ALKALINE OR OTHER NON-ACID ELECTROLYTES – SAFETY REQUIREMENTS FOR PORTABLE SEALED SECONDARY CELLS, AND FOR BATTERIES MADE FROM THEM, FOR USE IN PORTABLE APPLICATIONS –

Part 1: Nickel systems

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International Standard IEC 62133-1 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.

This first edition cancels and replaces the second edition of IEC 62133 published in 2012. It constitutes a technical revision.

This edition includes the following significant technical changes with respect to IEC 62133:2012:

– separation of lithium systems into a separate Part 2;

– inclusion of button cell requirements.

The text of this standard is based on the following documents:

FDIS	Report on voting
21A/619/FDIS	21A/627/RVD

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

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

A list of all parts of the IEC 62133 series, published under the general title *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications*, can be found on the IEC website.

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

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

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SECONDARY CELLS AND BATTERIES CONTAINING ALKALINE OR OTHER NON-ACID ELECTROLYTES – SAFETY REQUIREMENTS FOR PORTABLE SEALED SECONDARY CELLS, AND FOR BATTERIES MADE FROM THEM, FOR USE IN PORTABLE APPLICATIONS –

Part 1: Nickel systems

1 Scope

This part of IEC 62133 specifies requirements and tests for the safe operation of portable sealed secondary nickel cells and batteries containing alkaline electrolyte, under intended use and reasonably foreseeable misuse.

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 60050-482:2004, *International Electrotechnical Vocabulary – Part 482: Primary and secondary cells and batteries* (available at http://www.electropedia.org)

IEC 61951-1, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Portable sealed rechargeable single cells – Part 1: Nickel-cadmium*

IEC 61951-2, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Portable sealed rechargeable single cells – Part 2: Nickel-metal hydride*

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
safety
freedom from unacceptable risk

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

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

3.4
hazard
potential source of harm

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 which is not intended by the supplier, but which may result from readily predictable human behaviour

3.7
secondary 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

3.8
secondary battery
assembly of secondary cell(s) ready for use as a source of electrical energy characterized by its voltage, size, terminal arrangement, capacity and rate capability

Note 1 to entry: Includes single cell batteries.

3.9
leakage
unplanned, visible escape of liquid electrolyte

3.10
venting
release of excessive internal pressure from a cell or battery in a manner intended by design to preclude rupture or explosion

3.11
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

3.12
explosion
failure that occurs when a cell container or battery case opens violently and major components are forcibly expelled

3.13
fire
emission of flames from a cell or battery

3.14
portable battery
battery for use in a device or appliance which is conveniently hand-carried

3.15
portable cell
cell intended for assembly in a portable battery

3.16
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_5 Ah (ampere-hours) declared by the manufacturer which a single cell can deliver when discharged at the reference test current of 0,2 I_t A to a specified final voltage, after charging, storing and discharging under specified conditions.

[SOURCE: IEC 60050-482:2004, 482-03-15, modified – In the definition, "battery" has been replaced with "cell or battery". Note 1 to entry has been added.]

3.17
reference test current
I_t
charge or discharge current, expressed as a multiple of I_t A, where I_t A = C_5 Ah/1 h, as defined in IEC 61434, and based on the rated capacity (C_5 Ah) of the cell or battery

3.18
button cell
coin cell
cell with a cylindrical shape in which the overall height is less than the diameter, e.g. in the shape of a button or a coin

Note 1 to entry: In practice, the term coin is used exclusively for non-aqueous lithium cells.

[SOURCE: IEC 60050-482:2004, 482-02-40]

3.19
cylindrical cell
cell with a cylindrical shape in which the overall height is equal to or greater than the diameter

[SOURCE: IEC 60050-482:2004, 482-02-39]

3.20
prismatic cell
cell having the shape of a parallelepiped whose faces are rectangular

[SOURCE: IEC 60050-482:2004, 482-02-38, modified – The source term is "prismatic" (adj.). In the definition, "qualifies a cell or a battery" has been replaced with "cell".]

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) ± 1 % for voltage;

b) ± 1 % for current;

c) ± 2 °C for temperature;

d) ± 0,1 % for time;

e) ± 1 % for dimension;

f) ± 1 % for capacity.

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 secondary cells and batteries requires the consideration of two sets of applied conditions:

1) intended use;
2) reasonably foreseeable misuse.

Cells and 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 cells or batteries subjected to misuse may fail to function following such experience. They shall not however present significant hazards. It may also be expected that cells and batteries subjected to intended use shall not only be safe but shall continue to be functional in all respects.

Potential hazards which are the subject of this document are:

- fire,
- burst/explosion,
- leakage of cell electrolyte,
- venting,
- burns from excessively high external temperatures,
- rupture of battery case with exposure of internal components.

Conformity with 5.2 to 5.7 for cells and batteries other than button cells is checked by inspection, by the tests of Clauses 7, and in accordance with the appropriate standard (see Clause 2 and Table 1).

5.2 Insulation and wiring

The insulation resistance between the positive terminal and externally exposed metal surfaces of the battery excluding electrical contact surfaces shall be not less than 5 MΩ at 500 V DC when measured 60 s after applying the voltage.

Internal wiring and insulation should be sufficient to withstand the maximum anticipated current, voltage and temperature requirements. The orientation of wiring should be such that adequate clearances and creepage distances are maintained between conductors. The mechanical integrity of internal connections should be sufficient to accommodate conditions of reasonably foreseeable misuse (i.e. solder alone is not considered a reliable means of connection).

5.3 Venting

Battery cases and cells shall incorporate a pressure relief mechanism or shall be so constructed that they will relieve excessive internal pressure at a value and rate that will preclude rupture, explosion and self-ignition. 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 and current management

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

Where necessary, applicable means can be provided to limit current to safe levels during charge and discharge.

5.5 Terminal contacts

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.

5.6 Assembly of cells into batteries

If there is more than one battery housed in a single battery case, cells used in the assembly of each battery shall have closely matched capacities, be of the same design, be of the same chemistry and be from the same manufacturer. The battery shall have some type of safety device or feature for charging.

Manufacturers of cells shall specify current, voltage and temperature limits so that the battery manufacturer/designer may ensure proper design and assembly.

Batteries that are designed for the selective discharge of a portion of their series connected cells shall incorporate circuitry to prevent operation of cells outside the limits specified by the cell manufacturer.

Protective circuit components should be added as appropriate and consideration given to the end-device application. When testing a battery, the manufacturer of the battery should provide a test report confirming the compliance according to this document.

5.7 Quality plan

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

6 Type test and sample size

Tests are made with the number of cells or batteries specified in Table 1 using cells or batteries that are not more than six months old. Unless otherwise specified, tests are carried out in an ambient temperature of 20 °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 battery safety is reduced after six months.

Table 1 – Sample size for type tests

Test		Cell [a]	Battery
7.2.1	Low rate charging	5	–
7.2.2	Vibration	5	5
7.2.3	Case stress	–	3
7.2.4	Temperature cycling	5	5
7.3.1	Incorrect installation	5 sets of 4	–
7.3.2	External short circuit	5 per temperature	5 per temperature
7.3.3	Free fall	3	3
7.3.4	Mechanical shock	5	5
7.3.5	Thermal abuse	5	–
7.3.6	Crush	5 (10 for prismatic)	–
7.3.7	Low pressure	3	–
7.3.8	Overcharge	5	5
7.3.9	Forced discharge	5	–
[a] – not applicable to button cells			

7 Specific requirements and tests

7.1 Charging procedure for test purposes

Unless otherwise stated in this document, the charging procedure for test purposes is carried out in an ambient temperature of 20 °C ± 5 °C, using the method declared by the manufacturer.

Prior to charging, the battery shall have been discharged at 20 °C ± 5 °C at a constant current of 0,2 I_t A down to a specified final voltage.

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 BATTERIES WHOSE CASINGS MAY EXCEED 75 °C AS A RESULT OF TESTING.

7.2 Intended use

7.2.1 Continuous low-rate charging (cells)

a) Requirement

A continuous low-rate charge shall not cause fire or explosion.

b) Test

Fully charged cells are subjected for 28 days to a charge as specified by the manufacturer.

c) Acceptance criteria

No fire, no explosion.

7.2.2 Vibration

a) Requirements

Vibration encountered during transportation shall not cause leakage, fire or explosion.