



UL 62133

STANDARD FOR SAFETY

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

UL 62133 2015

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UL Standard for Safety for 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, UL 62133

First Edition, Dated January 9, 2015

Summary of Topics

The adoption of IEC 62133, 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 (second edition, issued by the IEC December 2012) as a new IEC-based UL standard, UL 62133. This standard includes the adoption of Corrigendum 1 issued June 2013.

The new requirements are substantially in accordance with Proposal(s) on this subject dated March 7, 2014.

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1

UL 62133

**Standard For Safety For 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**

First Edition

January 9, 2015

This UL Standard for Safety consists of the First Edition.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at <http://csds.ul.com>.

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CONTENTS

NATIONAL DIFFERENCES	7
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FOREWORD	8
-----------------------	----------

1 Scope	11
2 Normative references	11
3 Terms and definitions	11
4 Parameter measurement tolerances	12
5 General SAFETY considerations	13
5.1 General	13
5.2 Insulation and wiring	14
5.3 VENTING	14
5.4 Temperature/voltage/current management	14
5.5 Terminal contacts	14
5.6 Assembly of cells into batteries	15
5.7 Quality plan	16
6 Type test conditions	16
7 Specific requirements and tests (nickel systems)	17
7.1 Charging procedure for test purposes	17
7.2 INTENDED USE	17
7.3 REASONABLY FORESEEABLE MISUSE	20
8 Specific requirements and tests (lithium systems)	24
8.1 Charging procedures for test purposes	24
8.2 INTENDED USE	25
8.3 REASONABLY FORESEEABLE MISUSE	26
9 Information for SAFETY	32
10 Marking	33
10.1 Cell marking	33
10.2 Battery marking	33
10.3 Other information	33
11 Packaging	33

Annex A (normative) Charging range of secondary lithium ion cells for safe use

A.1 General	35
A.2 SAFETY of lithium-ion SECONDARY BATTERY	35
A.3 Consideration on charging voltage	35
A.3.1 General	35
A.3.2 UPPER LIMIT CHARGING VOLTAGE	35
A.4 Consideration of temperature and charging current	37
A.4.1 General	37
A.4.2 Recommended temperature range	38
A.4.3 High temperature range	39
A.4.4 Low temperature range	40
A.4.5 Scope of the application of charging current	41
A.5 Sample preparation	41
A.5.1 General	41
A.5.2 Insertion procedure for nickel particle to generate internal short	41
A.5.3 Disassembly of charged cell	41

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A.5.4 Shape of nickel particle	41
A.5.5 Insertion of nickel particle to cylindrical cell	42
A.5.6 Insertion of nickel particle to prismatic cell	46

Annex B (informative) Recommendations to equipment manufacturers and battery assemblers

Annex C (informative) Recommendations to the end-users

Bibliography

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Preface (UL)

This UL Standard is based on IEC Publication 62133: second edition 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, as revised by Corrigendum 1 issued June 2013. IEC 62133 is copyrighted by the IEC.

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Note – Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.

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UL Effective Date

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There are five types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences.

DR – These are National Differences based on the **national regulatory requirements**.

D1 – These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for consumers and users of products.

D2 – These are national differences from IEC requirements based on existing **safety practices**. These requirements reflect national safety practices, where empirical substantiation (for the IEC or national requirement) is not available or the text has not been included in the IEC standard.

DC – These are National Differences based on the **component standards** and will not be deleted until a particular component standard is harmonized with the IEC component standard.

DE – These are National Differences based on **editorial comments or corrections**.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base IEC text:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

FOREWORD

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International Standard IEC 62133 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 second edition cancels and replaces the first edition published in 2002. It constitutes a technical revision.

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

- update of assembly of cells into batteries (5.5);
- addition of design recommendations for lithium system only (5.6.2);
- separation of nickel systems and lithium systems (Clause 6);
- addition of specific requirements and tests for lithium systems (Clause 8);
- addition of charging of secondary lithium-ion cells for safe use (Annex A).

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

FDIS	Report on voting
21A/503/FDIS	21A/509/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.

The following difference exists in the countries indicated below:

Subclause 8.3.9: Design evaluation – Forced internal short circuit only applies to Korea, Japan, Switzerland and France.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

DV.1 DE Addition of the following:

- The numbering system in the standard uses a space instead of a comma to indicate thousands and uses a comma instead of a period to indicate a decimal point. For example, 1 000 means 1,000 and 1,01 means 1.01.

DV.2 DE *Addition of the following:*

- Words in SMALL CAPITALS in the text are defined in Clause 3.

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

1 Scope

This International Standard specifies requirements and tests for the safe operation of portable sealed SECONDARY CELLS and batteries (other than button) containing alkaline or other non-acid electrolyte, under INTENDED USE and REASONABLY FORESEEABLE MISUSE.

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 – Part 482: Primary and secondary cells and batteries

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

IEC 61960,
Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for portable 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 and ISO/IEC Guide 51, as well as the following apply.

3.1 SAFETY: freedom from unacceptable RISK

3.2 RISK: a 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

3.9 LEAKAGE: visible escape of liquid electrolyte

3.10 VENTING: release of excessive internal pressure from a cell/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: the emission of flames from a cell or battery

3.14 PORTABLE BATTERY: a battery for use in a device or appliance which is conveniently hand carried

3.15 PORTABLE CELL: a cell intended for assembly in a PORTABLE BATTERY

3.16 POLYMER CELL: cell using gel polymer electrolyte or solid polymer electrolyte, not liquid electrolyte

3.17 RATED CAPACITY: 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

3.18 UPPER LIMIT CHARGING VOLTAGE: the highest charging voltage in the cell operating region specified by the cell manufacturer

3.19 MAXIMUM CHARGING CURRENT: the MAXIMUM CHARGING CURRENT in the cell operating region which is specified by the cell manufacturer

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;

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- b) ± 1 % for current;
- c) ± 2 °C for temperature;
- d) $\pm 0,1$ % 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.

For assistance in selecting instrumentation see IEC 60051 series for analogue instruments and IEC 60485 for digital instruments. 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:

- INTENDED USE;
- 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 standard are:

- a) FIRE,
- b) burst/EXPLOSION,
- c) LEAKAGE of cell electrolyte,
- d) VENTING,
- e) burns from excessively high external temperatures,
- f) RUPTURE of battery case with exposure of internal components.

Conformity with 5.2 to 5.7 is checked by inspection, by the tests of Clauses 7 and 8, and in accordance with the appropriate standard (see Clause 2).

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 M Ω at 500 V d. c. when measured 60 s after applying the voltage.

Internal wiring and its insulation shall be sufficient to withstand the maximum anticipated current, voltage and temperature requirements. The orientation of wiring shall be such that adequate clearances and creepage distances are maintained between connectors. The mechanical integrity of internal connections shall be sufficient to accommodate conditions of REASONABLY FORESEEABLE MISUSE.

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/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.

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

5.5 Terminal contacts

Terminals shall have clear polarity marking on the external surface of the battery. 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.

NOTE Exception: 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.