BRITISH STANDARD

BS EN
62133:2003

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

The European Standard EN 62133:2003 has the status of a British Standard

ICS29.220.30

BSI
British Standards

National foreword

This British Standard is the official English language version of EN 62133:2003. It is identical with IEC 62133:2002. It supersedes BS EN 61809:2001 which will be withdrawn on 2005-12-01. It also partially supersedes BS EN 61960-1:2001 and BS EN 61960-2:2002, both of which will be replaced by BS EN 61960 Ed. 1, which is currently under development and will not contain subjects now covered by this BS EN 62133.

The UK participation in its preparation was entrusted to Technical Committee PEL/21/1, Secondary cells and batteries containing alkaline and other non-acidic electrolytes, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 1 July 2003

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 20, an inside back cover and a back cover.

The BSI copyright date displayed in this document indicates when the document was last issued.

Amendments issued since publication

Amd. No.	Date	Comments

ISBN 0 580 42139 2

EUROPEAN STANDARD **EN 62133**

NORME EUROPÉENNE

EUROPÄISCHE NORM April 2003

ICS 29.220.30

Supersedes EN 61809:2000;
partially supersedes EN 61960-1:2001 and EN 61960-2:2001

English version

Secondary cells and batteries containing alkaline or other non-acid elecrolytes - Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications

(IEC 62133:2002)

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
(CEI 62133:2002)

Akkumulatoren und Batterien mit alkalischem oder anderen nicht säurehaltigen Elektrolyten - Sicherheitsanforderungen für tragbare gasdichte Akkumulatoren und daraus hergestellte Batterien für die Verwendung in tragbaren Geräten
(IEC 62133:2002)

This European Standard was approved by CENELEC on 2002-12-03. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Ref. No. EN 62133:2003 E

Foreword

The text of document 21A/363/FDIS, future edition 1 of IEC 62133, prepared by SC 21A, Secondary cells and batteries containing alkaline or other non-acid electrolytes, of IEC TC 21, Secondary cells and batteries, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 62133 on 2002-12-03.

This European Standard supersedes EN 61809:2000 and partially supersedes EN 61960-1:2001 and EN 61960-2:2001.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2003-11-01

– latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2005-12-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annex ZA is normative and annexes A and B are informative.
Annex ZA has been added by CENELEC.

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Endorsement notice

The text of the International Standard IEC 62133:2002 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60664	NOTE	Harmonized as EN 60664 series (not modified).
IEC 61434	NOTE	Harmonized as EN 61434:1996 (not modified).

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CONTENTS

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 General

1.1 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.

1.2 Normative references

The following referenced documents are indispensable for the application 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 60050-486, *International Electrotechnical Vocabulary – Chapter 486: Secondary cells and batteries*

IEC 60051 (all parts), *Direct acting indicating analogue electrical measuring instruments and their accessories*

IEC 60285, *Alkaline secondary cells and batteries – Sealed nickel-cadmium cylindrical rechargeable single cells*

IEC 60485, *Digital electronic d.c. voltmeters and d.c. electronic analogue-to-digital converters*

IEC 61436, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Sealed nickel-metal hydride rechargeable single cells*

IEC 61438, *Possible safety and health hazards in the use of alkaline secondary cells and batteries – Guide to equipment manufacturers and users*

IEC 61440, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Sealed nickel-cadmium small prismatic rechargeable single cells*

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* [1]

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

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[1] To be published.

1.3 Definitions

For the purpose of this international standard, the definitions contained in IEC 60050-486 and ISO/IEC Guide 51 as well as the following definitions apply.

1.3.1
safety
freedom from unacceptable risk

1.3.2
risk
a combination of the probability of occurrence of harm and the severity of that harm

1.3.3
harm
physical injury or damage to the health of people or damage to property or to the environment

1.3.4
hazard
potential source of harm

1.3.5
intended use
use of a product, process or service in accordance with specifications, instructions and information provided by the supplier

1.3.6
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

1.3.7
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

1.3.8
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

1.3.9
leakage
visible escape of liquid electrolyte

1.3.10
venting
release of excessive internal pressure from a cell/battery in a manner intended by design to preclude rupture or explosion

1.3.11
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

1.3.12
explosion
failure that occurs when a cell container or battery case opens violently and major components are forcibly expelled

1.3.13
fire
the emission of flames from a cell or battery

1.3.14
portable battery
a battery for use in a device or appliance which is conveniently hand carried

1.3.15
portable cell
a cell intended for assembly in a portable battery

1.3.16
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

1.4 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.

For assistance in selecting instrumentation see IEC 60051 for analogue instruments and IEC 60485 for digital instruments. The details of the instrumentation used shall be provided in any report of results.

2 General safety considerations

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

a) intended use;

b) 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 2.1 to 2.6 is checked by inspection, by the tests of clause 4, and in accordance with the appropriate standard (see 1.2).

2.1 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 d.c.

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.

2.2 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.

2.3 Temperature/current management

The design of batteries shall be such that abnormal temperature-rise conditions are prevented.

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

2.4 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.

2.5 Assembly of cells into batteries

Cells used in the assembly of batteries shall have closely matched capacities, be of the same design, be of the same chemistry and be from the same manufacturer. Batteries that are designed for the selective discharge of a portion of their series connected cells shall incorporate separate circuitry to prevent the cell reversal caused by uneven discharges.

2.6 Quality plan

The manufacturer shall prepare 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.

3 Type test conditions

Tests are made with the number of cells or batteries specified in Table 1, using cells or batteries that are not more than three 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 three months is introduced for consistency and does not imply that battery safety is reduced after three months.

Table 1 – Sample size for type tests

Test	Cell	Battery
4.2.1	5	–
4.2.2	5	5
4.2.3	–	3
4.2.4	5	5
4.3.1	5 sets of 4	–
4.3.2	5 sets/Temperature	5 sets/Temperature
4.3.3	3	3
4.3.4	5	5
4.3.5	5	–
4.3.6	5	–
4.3.7	3	–
4.3.8	5	5
4.3.9	5	–
4.3.10	5	–
4.3.11	5	–

4 Specific requirements and tests

4.1 Charging procedure for test purposes

Unless otherwise stated in this standard, 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.

4.2 Intended use

4.2.1 Continuous low-rate charging

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

- Nickel systems: no fire, no explosion.
- Lithium systems: no fire, no explosion, no leakage.

4.2.2 Vibration

a) Requirements

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

b) Test

Fully charged cells or batteries are vibration-tested under the following test conditions and the sequence in Table 2. A simple harmonic motion is applied to the cells or batteries with an amplitude of 0,76 mm, and a total maximum excursion of 1,52 mm. The frequency is varied at the rate of 1 Hz/min between the limits of 10 Hz and 55 Hz. The entire range of frequencies (10 Hz to 55 Hz) and return (55 Hz to 10 Hz), is traversed in 90 min ± 5 min for each mounting position (direction of vibration). The vibration is applied in each of three mutually perpendicular directions, in the sequence specified below.

Step 1: Verify that the measured voltage is typical of the charged product being tested.

Steps 2-4: Apply the vibration as specified in Table 2.

Step 5: Rest cell for 1 h, then make a visual inspection.

c) Acceptance criteria

No fire, no explosion, no leakage.

Table 2 – Conditions for vibration test

Step	Storage time h	Vibration time min	Visual examination
1	–	–	Pre-test
2	–	90 ± 5	–
3	–	90 ± 5	–
4	–	90 ± 5	–
5	1	–	Post-test

4.2.3 Moulded case stress at high ambient temperature

a) Requirement

Internal components of batteries shall not be exposed during use at high temperature.

b) Test

Fully charged batteries are exposed to a moderately high temperature to evaluate case integrity. The battery is placed in an air circulating oven at a temperature of 70 °C ± 2 °C. The batteries remain in the oven for 7 h, after which they are removed and allowed to return to room temperature.

c) Acceptance criteria

No physical distortion of the battery case resulting in exposure of internal components.

4.2.4 Temperature cycling

a) Requirements

Repeated exposure to high and low temperatures shall not cause fire or explosion.

b) Test according to the following procedure and the profile shown in figure 1.

Fully charged cells or batteries are subjected to temperature cycling (–20 °C, +75 °C), in forced draught chambers, according to the following procedure.

Step 1: Place the cells or batteries in an ambient temperature of 75 °C ± 2 °C for 4 h.

Step 2: Change the ambient temperature to 20 °C ± 5 °C within 30 min and maintain at this temperature for a minimum of 2 h.

Step 3: Change the ambient temperature to –20 °C ± 2 °C within 30 min and maintain at this temperature for 4 h.

Step 4: Change the ambient temperature to 20 °C ± 5 °C within 30 min and maintain at this temperature for a minimum of 2 h.

Step 5: Repeat steps 1 to 4 for a further four cycles.

Step 6: After the fifth cycle, store the cells or batteries for seven days prior to examination.

NOTE This test can be performed in a single chamber whose temperature is changed or in three separate chambers at three different test temperatures.

c) Acceptance criteria

No fire, no explosion, no leakage.

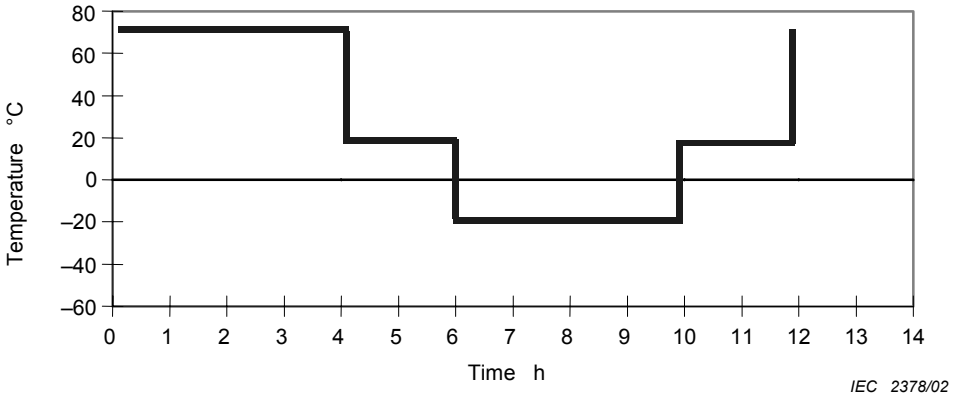

Figure 1 – Temperature profile for 4.2.4 – Temperature cycling test (one cycle)

4.3 Reasonably foreseeable misuse

4.3.1 Incorrect installation of a cell (nickel systems only)

a) Requirements

The incorrect installation of a single cell battery in a multi-cell application shall not cause fire or explosion.

b) Test

Fully charged cells are evaluated under conditions in which one of the cells is incorrectly installed. Four fully charged single cells of the same brand, type, size and age are connected in series with one of the four cells reversed. The resultant assembly is connected across a resistor of 1 Ω until the vent opens or until the temperature of the reversed cell returns to ambient temperature. Alternatively, a stabilized d.c. power supply can be used to simulate the conditions imposed on the reversed cell.

c) Acceptance criteria

No fire, no explosion.

4.3.2 External short circuit

a) Requirements

Short-circuiting of the positive and negative terminals shall not cause fire or explosion.

b) Test

Two sets of fully charged cells or batteries are stored in an ambient temperature of 20 °C ± 5 °C and 55 °C ± 5 °C respectively. Each cell or battery is then short-circuited by connecting the positive and negative terminals with a total external resistance of less than 100 mΩ. The cells or batteries remain on test for 24 h or until the case temperature declines by 20 % of the maximum temperature rise, whichever is the sooner.

c) Acceptance criteria

No fire, no explosion.

4.3.3 Free fall

a) Requirements

Dropping a cell or battery (for example, from a bench top) shall not cause fire or explosion.

b) Test

Each fully charged cell or battery is dropped three times from a height of 1,0 m onto a concrete floor. The cells or batteries are dropped so as to obtain impacts in random orientations.

c) Acceptance criteria

No fire, no explosion.

4.3.4 Mechanical shock (crash hazard)

a) Requirements

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

b) Test

The fully charged cell or battery is secured to the testing machine by means of a rigid mount which will support all mounting surfaces of the cell or battery. The cell or battery is subjected to a total of three shocks of equal magnitude. The shocks are applied in each of three mutually perpendicular directions. At least one of them shall be perpendicular to a flat face.

For each shock the cell or battery is accelerated in such a manner that during the initial 3 milliseconds the minimum average acceleration is 75 g_n. The peak acceleration shall be between 125 g_n and 175 g_n. Cells or batteries are tested in an ambient temperature of 20 °C ± 5 °C.

c) Acceptance criteria

No fire, no explosion, no leakage.

4.3.5 Thermal abuse

a) Requirements

An extremely high temperature shall not cause fire or explosion.

b) Test

Each fully charged cell, stabilized at room temperature, is placed in a gravity or circulating air-convection oven. The oven temperature is raised at a rate of 5 °C/min ± 2 °C/min to a temperature of 130 °C ± 2 °C. The cell remains at this temperature for 10 min before the test is discontinued.

c) Acceptance criteria

No fire, no explosion.

4.3.6 Crushing of cells

a) Requirements

Severe crushing of a cell (for example, during disposal in a waste compactor) shall not cause fire or explosion.

b) Test

Each fully charged cell is crushed between two flat surfaces. The force for the crushing is applied by a hydraulic ram exerting a force of 13 kN ± 1 kN. The crushing is performed in a manner that will cause the most adverse result. Once the maximum force has been applied, or an abrupt voltage drop of one-third of the original voltage has been obtained, the force is released.

A cylindrical or prismatic cell is crushed with its longitudinal axis parallel to the flat surfaces of the crushing apparatus. To test both wide and narrow sides of prismatic cells, a second set of cells is tested, rotated 90° around their longitudinal axes compared to the first set.

c) Acceptance criteria

No fire, no explosion.

4.3.7 Low pressure

a) Requirements

Low pressure (for example, during transportation in an aircraft cargo hold) shall not cause fire or explosion.

b) Test

Each fully charged cell is placed in a vacuum chamber, in an ambient temperature of 20 °C ± 5 °C. Once the chamber has been sealed, its internal pressure is gradually reduced to a pressure equal to or less than 11,6 kPa (this simulates an altitude of 15 240 m) held at that value for 6 h.

c) Acceptance criteria

No fire, no explosion, no leakage.

4.3.8 Overcharge for nickel systems

a) Requirements

Charging for longer periods and at a higher rate than specified by the manufacturer shall not cause fire or explosion.

b) Test

A discharged cell or battery is subjected to a high-rate charge of 2,5 times the recommended charging current for a time that produces a 250 % charge input (250 % of rated capacity).

c) Acceptance criteria

No fire, no explosion.

4.3.9 Overcharge for lithium systems

a) Requirements

Charging for longer periods than specified by the manufacturer shall not cause fire or explosion.

b) Test

The cell is discharged as described in IEC 61960, then charged from a power supply of ≥10 V, at the charging current I_{rec}, recommended by the manufacturer, for 2,5 C_5/I_{rec} h.

c) Acceptance criteria

No fire, no explosion.

4.3.10 Forced discharge

a) Requirements

A cell in a multicell application shall withstand polarity reversal without causing fire or explosion.

b) Test

A discharged cell is subjected to a reverse charge at 1 I_t A for 90 min.

c) Acceptance criteria

No fire, no explosion.

4.3.11 Cell protection against a high charging rate (lithium systems only)

a) Requirements

A cell shall not cause fire or explosion if a charger malfunctions or if excess current flows in a parallel battery pack.

b) Test

The cell is discharged as described in IEC 61960, then charged at three times the charging current recommended by the manufacturer, until the cell is fully charged or an internal safety device cuts off the charge current before the cell is fully charged.

c) Acceptance criteria

No fire, no explosion.

5 Information for safety

The use, and particularly abuse, of portable sealed secondary cells and batteries containing alkaline or other non-acid electrolyte may result in the creation of hazards and may cause harm. Manufacturers of secondary cells and batteries shall ensure that equipment manufacturers and, in the case of direct sales, end-users are provided with information to minimize and mitigate these hazards. It is the equipment manufacturer’s responsibility to inform end-users of the potential hazards arising from the use of equipment containing secondary cells and batteries.

Guidance on the possible hazards is provided in IEC 61438, and non-exhaustive lists of good advice are provided for information in Annexes A and B.

Conformity is checked by examination of manufacturer's documentation.

6 Marking

6.1 Cell marking

Cells shall be marked as specified in the following applicable cell standards: IEC 60285, IEC 61436, IEC 61440, IEC 61951-1, IEC 61951-2 or IEC 61960.

NOTE By agreement between the manufacturer and user, cells used in the manufacture of a battery need not be marked.

Conformity is checked by inspection.

6.2 Battery marking

Batteries shall be marked as for the cells from which they are assembled, as specified in 6.1. They shall bear in addition an appropriate caution statement.

Conformity is checked by inspection.

6.3 Other information

The following information shall be marked on or supplied with the battery:

- disposal instructions;
- recommended charging instructions.

Conformity is checked by examination of markings and manufacturer's documentation.

7 Packaging

The packaging shall be adequate to avoid mechanical damage during transport, handling and stacking. The materials and pack design shall be chosen so as to prevent the development of unintentional electrical conduction, corrosion of the terminals and ingress of moisture.

Annex A
(informative)

Recommendations to equipment manufacturers and battery assemblers

The following represents a typical, but non-exhaustive, list of good advice to be provided by the manufacturer of secondary cells and batteries to equipment manufacturers and battery assemblers.

a) Do not dismantle, open or shred cells. Batteries should be dismantled only by trained personnel. Multicell battery cases should be designed so that they can be opened only with the aid of a tool.

b) Do not short-circuit a cell or battery. Do not store cells or batteries haphazardly in a box or drawer where they may short-circuit each other or be short-circuited by conductive materials.

c) Do not remove a cell or battery from its original packaging until required for use.

d) Do not expose cells or batteries to heat or fire. Avoid storage in direct sunlight.

e) Do not subject cells or batteries to mechanical shock.

f) In the event of a cell leaking, do not allow the liquid to come into contact with the skin or eyes. If contact has been made, wash the affected area with copious amounts of water and seek medical advice.

g) Equipment should be designed to prohibit the incorrect insertion of cells or batteries and should have clear polarity marks. Always observe the polarity marks on the cell, battery and equipment and ensure correct use.

h) Do not mix cells of different manufacture, capacity, size or type within a battery.

i) Seek medical advice immediately if a cell or battery has been swallowed.

j) Consult the cell/battery manufacturer on the maximum number of cells, which may be assembled in a battery and on the safest way in which cells may be connected.

k) A dedicated charger should be provided for each equipment. Complete charging instructions should be provided for all secondary cells and batteries offered for sale.

l) Keep cells and batteries clean and dry.

m) Wipe the cell or battery terminals with a clean dry cloth if they become dirty.

n) Secondary cells and batteries need to be charged before use. Always refer to the cell or battery manufacturer’s instructions and use the correct charging procedure.

o) Do not maintain secondary cells and batteries on charge when not in use.

p) After extended periods of storage, it may be necessary to charge and discharge the cells or batteries several times to obtain maximum performance.

q) Secondary cells and batteries give their best performance when they are operated at normal room temperature.

r) Retain the original cell and battery literature for future reference.

s) When disposing of secondary cells or batteries, keep cells or batteries of different electrochemical systems separate from each other.

Annex B
(informative)

Recommendations to the end-users

The following represents a typical, but not exhaustive list of good advice to be provided by the equipment manufacturer to the end-user.

a) Do not dismantle, open or shred secondary cells or batteries.

b) Do not expose cells or batteries to heat or fire. Avoid storage in direct sunlight.

c) Do not short-circuit a cell or a battery. Do not store cells or batteries haphazardly in a box or drawer where they may short-circuit each other or be short-circuited by other metal objects.

d) Do not remove a cell or battery from its original packaging until required for use.

e) Do not subject cells or batteries to mechanical shock.

f) In the event of a cell leaking, do not allow the liquid to come in contact with the skin or eyes. If contact has been made, wash the affected area with copious amounts of water and seek medical advice.

g) Do not use any charger other than that specifically provided for use with the equipment.

h) Observe the plus (+) and minus (–) marks on the cell, battery and equipment and ensure correct use.

i) Do not use any cell or battery which is not designed for use with the equipment.

j) Do not mix cells of different manufacture, capacity, size or type within a device.

k) Keep cells and batteries out of the reach of children.

l) Seek medical advice immediately if a cell or a battery has been swallowed.

m) Always purchase the correct cell or battery for the equipment.

n) Keep cells and batteries clean and dry.

o) Wipe the cell or battery terminals with a clean dry cloth if they become dirty.

p) Secondary cells and batteries need to be charged before use. Always use the correct charger and refer to the manufacturer’s instructions or equipment manual for proper charging instructions.

q) Do not leave a battery on prolonged charge when not in use.

r) After extended periods of storage, it may be necessary to charge and discharge the cells or batteries several times to obtain maximum performance.

s) Secondary cells and batteries give their best performance when they are operated at normal room temperature (20 °C ± 5 °C).

t) Retain the original product literature for future reference.

u) Use only the cell or battery in the application for which it was intended.

v) When possible, remove the battery from the equipment when not in use.

w) Dispose of properly.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60050-486	- [1)]	International Electrotechnical Vocabulary (IEV) Chapter 486: Secondary cells and batteries	-	-
IEC 60051	Series	Direct acting indicating analogue electrical measuring instruments and their accessories	EN 60051	Series
IEC 60285	- [1)]	Alkaline secondary cells and batteries - Sealed nickel-cadmium cylindrical rechargeable single cells	EN 60285	1994 [2)]
IEC 60485	- [1)]	Digital electronic d.c. voltmeters and d.c. electronic analogue-to-digital converters	-	-
IEC 61436	- [1)]	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Sealed nickel-metal hydride rechargeable single cells	EN 61436	1998 [2)]
IEC 61438	- [1)]	Possible safety and health hazards in the use of alkaline secondary cells and batteries - Guide to equipment manufacturers and users	-	-
IEC 61440	- [1)]	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Sealed nickel-cadmium small prismatic rechargeable single cells	EN 61440	1997 [2)]

1) Undated reference.

2) Valid edition at date of issue.

Publication	Year	Title	EN/HD	Year
IEC 61951-1	- [1)]	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Portable sealed rechargeable single cells Part 1: Nickel-cadmium	EN 61951-1	2001 [2)]
IEC 61951-2	- [1)]	Part 2: Nickel-metal hydride	EN 61951-2	2001 [2)]
IEC 61960	- [3)]	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Secondary lithium cells and batteries for portable applications	-	-
ISO/IEC Guide 51	- [1)]	Safety aspects - Guidelines for their inclusion in standards	-	-

3) At draft stage.

Bibliography

IEC 60664 (all parts), *Insulation co-ordination for equipment within low-voltage systems*

IEC 61434, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Guide to the designation of current in alkaline secondary cell and battery standards*

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