

INTERNATIONAL STANDARD

IEC 61951-1

Edition 2.1
2006-01

Edition 2:2003 consolidated with amendment 1:2005

Secondary cells and batteries containing alkaline or other non-acid electrolytes – Portable sealed rechargeable single cells –

Part 1: Nickel-cadmium

(<https://standards.iteh.ai>)
Document Preview

IEC 61951-1:2003

<https://standards.iteh.ai/iec/standards/iec/5b65f0e0-2d07-47be-be58-a1dfd1d19503/iec-61951-1-2003>

*This **English-language** version is derived from the original **bilingual** publication by leaving out all French-language pages. Missing page numbers correspond to the French-language pages.*



Reference number
IEC 61951-1:2003+A1:2005(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

Consolidated editions

The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

Further information on IEC publications

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology. Information relating to this publication, including its validity, is available in the IEC Catalogue of publications (see below) in addition to new editions, amendments and corrigenda. Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is also available from the following:

- **IEC Web Site** (www.iec.ch)

- **Catalogue of IEC publications**

The on-line catalogue on the IEC web site (www.iec.ch/searchpub) enables you to search by a variety of criteria including text searches, technical committees and date of publication. On-line information is also available on recently issued publications, withdrawn and replaced publications, as well as corrigenda.

- **IEC Just Published**

This summary of recently issued publications (www.iec.ch/online_news/justpub) is also available by email. Please contact the Customer Service Centre (see below) for further information.

- **Customer Service Centre**

If you have any questions regarding this publication or need further assistance, please contact the Customer Service Centre:

Email: custserv@iec.ch
Tel: +41 22 919 02 11
Fax: +41 22 919 03 00

<https://standards.iteh.ai/catalog/standards/iec/3569f0e0-2d07-47be-be58-a1dfd1d19503/iec-61951-1-2003>

INTERNATIONAL STANDARD

IEC 61951-1

Edition 2.1
2006-01

Edition 2:2003 consolidated with amendment 1:2005

Secondary cells and batteries containing alkaline or other non-acid electrolytes – Portable sealed rechargeable single cells –

Part 1: Nickel-cadmium

(<https://standards.iteh.ai>)
Document Preview

IEC 61951-1:2003

<https://standards.iteh.ai/catalog/standards/iec/5b65f0e0-2d07-47be-be58-a1dfd1d19503/iec-61951-1-2003>

© IEC 2006 Copyright - all rights reserved

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Electrotechnical Commission, 3, rue de Varembe, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE **CL**

For price, see current catalogue

CONTENTS

FOREWORD.....	7
1 Scope.....	11
2 Normative references.....	11
3 Definitions.....	11
4 Parameter measurement tolerances.....	13
5 Cell designation and marking.....	13
5.1 Cell designation.....	13
5.1.1 Small prismatic cells.....	13
5.1.2 Cylindrical cells.....	15
5.1.3 Button cells.....	17
5.2 Cell termination.....	17
5.3 Marking.....	17
5.3.1 Small prismatic cells and cylindrical cells.....	17
5.3.2 Button cells.....	17
6 Dimensions.....	19
6.1 Small prismatic cells and cylindrical cells.....	19
6.1.1 Small prismatic cells.....	21
6.1.2 Cylindrical cells.....	21
6.2 Button cells.....	23
7 Electrical tests.....	25
7.1 Charging procedure for test purposes.....	25
7.2 Discharge performance.....	25
7.2.1 Discharge performance at 20 °C.....	25
7.2.2 Discharge performance at -18 °C.....	29
7.2.3 Discharge performance for rapid charge cells (R cells).....	29
7.3 Charge (capacity) retention.....	31
7.4 Endurance.....	31
7.4.1 Endurance in cycles.....	31
7.4.2 Permanent charge endurance.....	37
7.5 Charge acceptance at constant voltage.....	45
7.6 Overcharge.....	45
7.6.1 Small prismatic cells.....	45
7.6.2 L, M, H or X cylindrical and button cells.....	45
7.6.3 LT/LU, MT/MU or HT/HU cylindrical cells.....	45
7.6.4 R cylindrical cells.....	47
7.7 Safety device operation.....	47
7.8 Storage.....	49
7.9 Charge acceptance at +55 °C for LT, MT or HT cylindrical cells.....	49
7.10 Internal resistance.....	51
7.10.1 Measurement of the internal a.c. resistance.....	51
7.10.2 Measurement of the internal d.c. resistance.....	53
8 Mechanical tests.....	53

9	Type approval and batch acceptance	53
9.1	Type approval.....	53
9.1.1	Type approval for small prismatic cells	53
9.1.2	Type approval for cylindrical and button cells	55
9.2	Batch acceptance	59
	Bibliography.....	61
	Figure 1 – Jacketed cylindrical cells	19
	Figure 2 – Jacketed small prismatic cells.....	19
	Figure 3 – Button cells	23
	Table 1 – Dimensions of jacketed small prismatic cells.....	21
	Table 2 – Cylindrical cells dimensionally interchangeable with primary batteries.....	21
	Table 3 – Dimensions of jacketed cylindrical cells not dimensionally interchangeable with primary batteries	23
	Table 4 – Dimensions of button cells	25
	Table 5 – Discharge performance at 20 °C for small prismatic cells	27
	Table 6 – Discharge performance at 20 °C for cylindrical cells.....	27
	Table 7 – Discharge performance at 20 °C for button cells.....	27
	Table 8 – Discharge performance at –18 °C for small prismatic cells	29
	Table 9 – Discharge performance at –18 °C for cylindrical cells	29
	Table 10 – Discharge performance at –18 °C for button cells.....	29
	Table 11 – Endurance in cycles for small prismatic and cylindrical cells	31
	Table 12 – Endurance in cycles for H or X cells	33
	Table 13 – Endurance in cycles for cylindrical X cells	33
	Table 14 – Endurance in cycles for HR or XR cells	35
	Table 15 – Endurance in cycles for button cells	35
	Table 16 – Permanent charge endurance for L, M, H or X cylindrical cells.....	37
	Table 17 – Permanent charge endurance for button cells.....	37
	Table 18 – Permanent charge endurance for LT, MT, or HT cylindrical cells.....	41
	Table 19 – Overcharge at 0 °C.....	47
	Table 20 – Charge and discharge at +55 °C	51
	Table 21 – Constant discharge currents used for measurement of d.c. resistance.....	53
	Table 22 – Sequence of tests for type approval for small prismatic cells	55
	Table 23 – Sequence of tests for type approval for cylindrical cells	57
	Table 24 – Sequence of tests for type approval for button cells.....	57
	Table 25 – Recommended test sequence for batch acceptance	59
	Table 26 – Permanent charge endurance for LU, MU, or HU cylindrical cells.....	43

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SECONDARY CELLS AND BATTERIES CONTAINING ALKALINE
OR OTHER NON-ACID ELECTROLYTES –
PORTABLE SEALED RECHARGEABLE SINGLE CELLS –****Part 1: Nickel-cadmium**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61951-1 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 consolidated version of IEC 61951-1 consists of the second edition (2003) [documents 21A/373/FDIS and 21A/379/RVD] and its amendment 1 (2005) [documents 21A/421/FDIS and 21A/422/RVD].

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience.

It bears the edition number 2.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

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

IEC 61951 series, published under the general title *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Portable sealed rechargeable single cells*, consists of the following parts:

- Part 1: Nickel-cadmium
- Part 2: Nickel-metal hydride.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the maintenance result 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.

Withdrawing

iTech Standards
(<https://standards.itih.ai>)
Document Preview

[IEC 61951-1:2003](https://standards.itih.ai/standards/iec/5b65f0e0-2d07-47be-be58-a1dfd1d19503/iec-61951-1-2003)

<https://standards.itih.ai/standards/iec/5b65f0e0-2d07-47be-be58-a1dfd1d19503/iec-61951-1-2003>

SECONDARY CELLS AND BATTERIES CONTAINING ALKALINE OR OTHER NON-ACID ELECTROLYTES – PORTABLE SEALED RECHARGEABLE SINGLE CELLS –

Part 1: Nickel-cadmium

1 Scope

This part of IEC 61951 specifies marking, designation, dimensions, tests and requirements for portable sealed nickel-cadmium small prismatic, cylindrical and button rechargeable single cells, suitable for use in any orientation.

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 60086 (all parts), *Primary batteries*

IEC 60410, *Sampling plans and procedures for inspection by attributes*

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

IEC 61959, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Mechanical tests for sealed portable secondary cells and batteries*¹

3 Definitions

For the purposes of this document, the definitions contained in IEC 60050-486 and the following apply.

3.3.1

small prismatic cell

cell in the form of a rectangular parallelepiped whose width and thickness dimensions are not more than 25 mm

3.3.2

cylindrical cell

cell of circular cross-section in which the overall height is equal to, or greater than, the overall diameter

¹ To be published.

3.3.3

button cell

cell of a circular cross-section in which the overall height is less than the overall diameter

3.3.4

sealed cell

cell which remains closed and does not release either gas or liquid when operated within the limits of charge and temperature specified by the manufacturer. The cell is equipped with a safety device to prevent dangerously high internal pressure. The cell does not require addition to the electrolyte and is designed to operate during its life in its original sealed state

3.3.5

nominal cell voltage

nominal voltage of a sealed nickel-cadmium rechargeable single cell: 1,2 V

3.3.6

portable cell

cell designed mainly for use in an easily hand-carried battery

3.3.7

rated capacity

quantity of electricity C_5 Ah (ampere-hours) declared by the manufacturer which a single cell can deliver during a 5 h period when charging, storing and discharging under the conditions specified in 7.2.1

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:

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

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 the IEC 60051 series for analogue instruments and IEC 60485 for digital instruments. The details of the instrumentation used shall be provided in each report of results.

5 Cell designation and marking

5.1 Cell designation

5.1.1 Small prismatic cells

Sealed nickel-cadmium small prismatic rechargeable single cells shall be designated by the letters "KF" followed by three groups of figures each one separated by a solidus.

- a) The two figures to the left of the first solidus shall indicate the maximum width specified for the cell, expressed in millimetres, rounded up to the next whole number.

- b) The two figures in the middle shall indicate the maximum thickness specified for the cell, expressed in millimetres, rounded up to the next whole number.
- c) The two figures to the right of the second solidus shall indicate the maximum height specified for the cell, expressed in millimetres, rounded up to the next whole number.

EXAMPLE KF 18/07/49 designation identifies a small prismatic cell, with a maximum width of 18 mm, a maximum thickness of 7 mm and a maximum height of 49 mm.

5.1.2 Cylindrical cells

Sealed nickel-cadmium cylindrical rechargeable single cells shall be designated by the letters "KR" followed by a third letter L, M, H or X which signifies :

- low rate of discharge (L);
- medium rate of discharge (M);
- high rate of discharge (H);
- very high rate of discharge (X).

NOTE These cells are typically but not exclusively used for the following discharge rates:

- L up to $0,5 I_t$ A;
- M up to $3,5 I_t$ A;
- H up to $7,0 I_t$ A;
- X up to and above $15 I_t$ A.

When a cell is intended for permanent charge at elevated temperatures, typically up to $40\text{ }^{\circ}\text{C}$, a letter "T" is placed after the letter L, M, H or X.

When a cell is intended for permanent charge at elevated temperatures, typically up to $50\text{ }^{\circ}\text{C}$, a letter "U" is placed after the letter L, M, H or X.

When a cell is intended for rapid charge, typically at $1,0 I_t$ A, a letter "R" is placed after the letter L, M, H or X.

The group of three (or four) letters shall then be followed by two groups of figures separated by a solidus.

- a) The two figures to the left of the solidus shall indicate the maximum diameter specified for the cell, expressed in millimetres, rounded up to the next whole number.
- b) The two figures to the right of the solidus shall indicate the maximum height specified for the cell, expressed in millimetres, rounded up to the next whole number.

When a manufacturer designs a cell with dimensions and tolerances which make it interchangeable with a primary battery, the designation of Table 2 shall also be marked on the cell.

EXAMPLE 1 KRL 33/62 designation identifies a cylindrical cell of low discharge rate capability, with a maximum diameter of 33 mm and a maximum height of 61,5 mm.

EXAMPLE 2 KRLT 33/62 designation identifies a cylindrical cell of low discharge rate capability, intended for permanent charge at elevated temperatures, with a maximum diameter of 33 mm and a maximum height of 61,5 mm.

EXAMPLE 3 KRHR 23/43 designation identifies a cylindrical cell of high discharge rate capability, intended for rapid charge, with a maximum diameter of 23 mm and a maximum height of 43 mm.

5.1.3 Button cells

Sealed nickel-cadmium button rechargeable single cells shall be designated by the letters “KB” followed by a letter L, M or H which signifies:

- low rate of discharge (L);
- medium rate of discharge (M);
- high rate of discharge (H).

The group of three letters shall then be followed by two groups of figures separated by a solidus.

- a) The three figures to the left of the solidus shall indicate the maximum diameter specified for the cell, expressed in tenths of millimetres, rounded up to the next whole number.
- b) The three figures to the right of the solidus shall indicate the maximum height specified for the cell, expressed in tenths of millimetres, rounded up to the next whole number.

EXAMPLE KBL 116/055 designation identifies a button cell of low discharge rate capability, with a maximum diameter of 11,6 mm and a maximum height of 5,5 mm.

5.2 Cell termination

This standard does not specify cell termination.

5.3 Marking

5.3.1 Small prismatic cells and cylindrical cells

Each jacketed cell supplied without connections shall carry durable markings giving the following minimum information:

- sealed, rechargeable nickel-cadmium or Ni-Cd;
- cell designation as specified in 5.1 (in addition, it is permissible for a manufacturer to use his own type designation);
- rated capacity;
- nominal voltage;
- recommended charge rate and time or permanent charge current for “T” cells;
- polarity;
- date of manufacture (which may be in code);
- name or identification of manufacturer or supplier.

NOTE In general, sealed nickel-cadmium rechargeable single cells with connection tabs need no labels if they form an integral part of a battery, in which case, the battery itself is marked with the above information.

5.3.2 Button cells

Each button cell supplied without connection shall carry durable markings giving the following minimum information:

- cell designation as specified in 5.1;
- polarity;