



BSI Standards Publication

Secondary cells and batteries containing alkaline or other non-acid electrolytes — Secondary sealed cells and batteries for portable applications

Part 1: Nickel-cadmium

National foreword

This British Standard is the UK implementation of EN 61951-1:2017+A1:2023. It is identical to IEC 61951-1:2017, incorporating amendment 1:2023. It supersedes BS EN 61951-1:2014 and [BS EN 61951-1:2017](#), which are withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment 1 is indicated by **A1** ^{A1}.

The UK participation in its preparation was entrusted to Technical Committee PEL/21, Secondary cells and batteries.

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

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

© The British Standards Institution 2023
Published by BSI Standards Limited 2023

ISBN 978 0 539 16247 9

ICS 29.220.30

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on .

Amendments/corrigenda issued since publication

Date	Text affected
31 March 2023	Implementation of IEC amendment 1:2023 with CENELEC endorsement A1:2023

English Version

**Secondary cells and batteries containing alkaline or other non-acid electrolytes - Secondary sealed cells and batteries for portable applications - Part 1: Nickel-cadmium
(IEC 61951-1:2017)**

Accumulateurs alcalins et autres accumulateurs à électrolyte non acide - Accumulateurs étanches pour applications portables - Partie 1: Nickel-cadmium
(IEC 61951-1:2017)

Akkumulatoren und Batterien mit alkalischen oder anderen nichtsäurehaltigen Elektrolyten - Tragbare wiederaufladbare gasdichte Einzelzellen - Teil 1: Nickel-Cadmium
(IEC 61951-1:2017)

This European Standard was approved by CENELEC on 2017-04-11. 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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

European foreword

The text of document 21A/622/FDIS, future edition 4 of IEC 61951-1, 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 approved by CENELEC as EN 61951-1:2017.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2018-01-11
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2020-04-11

This document supersedes EN 61951-1:2014.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 61951-1:2017 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 60051 Series	NOTE	Harmonized as EN 60051 Series.
IEC 60086 Series	NOTE	Harmonized as EN 60086 Series.
IEC 61434	NOTE	Harmonized as EN 61434.

European foreword to Amendment 1

The text of document 21A/821/FDIS, future IEC 61951-1/AMD1, 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 approved by CENELEC as EN 61951-1:2017/A1:2023.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2023-12-13
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2026-03-13

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice Amendment 1

The text of the International Standard IEC 61951-1:2017/AMD1:2023 was approved by CENELEC as a European Standard without any modification.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-482	2004	International Electrotechnical Vocabulary (IEV) - Part 482: Primary and secondary cells and batteries	-	-
IEC 60086-1	-	Primary batteries - Part 1: General	EN 60086-1	-
IEC 60086-2	-	Primary batteries - Part 2: Physical and electrical specifications	EN 60086-2	-
IEC 61959	-	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Mechanical tests for sealed portable secondary cells and batteries	EN 61959	-
IEC 62133-1	-	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	EN 62133-1	-
IEC 62902	-	Secondary cells and batteries - Marking symbols for identification of their chemistry	EN IEC 62902	-

CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	7
4 Parameter measurement tolerances	9
5 Cell and battery designation and marking	9
5.1 Cell and battery designation.....	9
5.1.1 Small prismatic cells and cylindrical cells.....	9
5.1.2 Button cells.....	11
5.1.3 Batteries	11
5.2 Cell or battery termination.....	11
5.3 Marking.....	11
5.3.1 Small prismatic cells and cylindrical cells.....	11
5.3.2 Button cells.....	12
5.3.3 Batteries	12
5.4 Exemption of wording.....	12
6 Dimensions.....	12
6.1 Small prismatic cells and cylindrical cells	12
6.1.1 General	12
6.1.2 Small prismatic cells	13
6.1.3 Cylindrical cells	13
6.2 Button cells.....	15
7 Electrical tests.....	16
7.1 General.....	16
7.2 Charging procedure for test purposes	16
7.2.1 Charging procedure for cell.....	16
7.2.2 Charging procedure for battery	16
7.3 Discharge performance	17
7.3.1 General	17
7.3.2 Discharge performance at 20 °C	17
7.3.3 Discharge performance at –18 °C	19
7.3.4 Discharge performance for rapid charge cells (R cells)	20
7.4 Charge (capacity) retention.....	20
7.5 Endurance	20
7.5.1 Endurance in cycles.....	20
7.5.2 Permanent charge endurance	24
7.6 Charge acceptance at constant voltage.....	28
7.7 Overcharge	28
7.7.1 Small prismatic cells	28
7.7.2 L, M, H or X cylindrical and button cells	29
7.7.3 LT/LU, MT/MU or HT/HU cylindrical cells	29
7.7.4 J cylindrical cells	29
7.7.5 JT cylindrical cells	30
7.7.6 R cylindrical cells.....	30
7.8 Safety device operation	31

7.9	Button cells or batteries storage, small prismatic cells or batteries storage, cylindrical cells or batteries storage	31
7.10	Charge acceptance at +55 °C for LT, MT or HT cylindrical cells	32
7.11	Trickle charge acceptance for JT cylindrical cells	32
7.12	Internal resistance	33
7.12.1	General	33
7.12.2	Measurement of the internal AC resistance	33
7.12.3	Measurement of the internal DC resistance	34
8	Mechanical tests	34
9	Safety requirements	34
10	Type approval and batch acceptance	34
10.1	General	34
10.2	Type approval	35
10.2.1	Type approval for small prismatic cells	35
10.2.2	Type approval for cylindrical and button cells	35
10.2.3	Type approval for batteries	37
10.3	Batch acceptance	38
	Bibliography	40
	Figure 1 – Jacketed cylindrical cells	13
	Figure 2 – Jacketed small prismatic cells	13
	Figure 3 – Jacketed cells dimensionally interchangeable with primary cells	14
	Figure 4 – Button cells	15
	Table 1 – Dimensions of jacketed small prismatic cells	13
	Table 2 – Dimensions of jacketed cylindrical cells dimensionally interchangeable with primary cells	14
	Table 3 – Dimensions of jacketed cylindrical cells not dimensionally interchangeable with primary cells	15
	Table 4 – Dimensions of button cells	16
	Table 5 – Discharge performance at 20 °C for small prismatic cells and cylindrical cells	17
	Table 6 – Discharge performance at 20 °C for button cells	18
	Table 7 – Discharge performance at 20 °C for batteries	18
	Table 8 – Rated capacity (mAh) compliance test (example)	19
	Table 9 – Discharge performance at –18 °C for small prismatic cells	19
	Table 10 – Discharge performance at –18 °C for cylindrical cells	19
	Table 11 – Discharge performance at –18 °C for button cells	20
	Table 12 – Endurance in cycles for small prismatic cells and cylindrical cells not dimensionally interchangeable with primary cells	21
	Table 13 – Endurance in cycles for cylindrical cells dimensionally interchangeable with primary cells	21
	Table 14 – Endurance in cycles for H or X cells	22
	Table 15 – Endurance in cycles for cylindrical X cells	22
	Table 16 – Endurance in cycles for HR or XR cells	23
	Table 17 – Endurance in cycles for button cells	23
	Table 18 – Permanent charge endurance for L, M, J, H or X cylindrical cells	24

Table 19 – Permanent charge endurance for button cells	24
Table 20 – Permanent charge endurance for LT, MT, or HT cylindrical cells	26
Table 21 – Permanent charge endurance for LU, MU, or HU cylindrical cells	28
Table 22 – Overcharge at 0 °C.....	29
Table 23 – Capacity deterioration due to storage period for cells or batteries.....	32
Table 24 – Charge and discharge at +55 °C.....	32
Table 25 – Trickle charge acceptance for JT cylindrical cells	33
Table 26 – Constant discharge currents used for measurement of DC resistance	34
Table 27 – Sequence of tests for type approval for small prismatic cells	35
Table 28 – Sequence of tests for type approval for cylindrical cells.....	36
Table 29 – Sequence of tests for type approval for button cells.....	37
Table 30 – Sequence of tests for type approval for batteries	38
Table 31 – Recommended test sequence for batch acceptance	39

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SECONDARY CELLS AND BATTERIES CONTAINING
ALKALINE OR OTHER NON-ACID ELECTROLYTES –
SECONDARY SEALED CELLS AND BATTERIES
FOR PORTABLE APPLICATIONS –****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 itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 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 fourth edition cancels and replaces the third edition published in 2013 of which it constitutes a technical revision.

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

- addition of battery type;
- revision of Figure 3 (6.1.3.1);

- addition of “Optional pip” note to positive contact;
- changed leader line position from pip to flats of positive contact (B and G).

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

FDIS	Report on voting
21A/622/FDIS	21A/630/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 61951 series can be found, under the general title *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary sealed cells and batteries for portable applications*, 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.

SECONDARY CELLS AND BATTERIES CONTAINING ALKALINE OR OTHER NON-ACID ELECTROLYTES – SECONDARY SEALED CELLS AND BATTERIES FOR PORTABLE APPLICATIONS –

Part 1: Nickel-cadmium

1 Scope

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

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 (IEV) – Part 482: Primary and secondary cells and batteries*

IEC 60086-1, *Primary batteries – Part 1: General*

IEC 60086-2, *Primary batteries – Part 2: Physical and electrical specifications*

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

IEC 62133-1, *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*

 IEC 62902, *Secondary cells and batteries – Marking symbols for identification of their chemistry* 

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-482 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

nominal voltage

suitable approximate value of voltage used to designate or identify a cell or a battery

Note 1 to entry: The nominal voltage of a sealed nickel-cadmium rechargeable single cell: 1,2 V.

Note 2 to entry: The nominal voltage of a battery of n series connected cells is equal to n times the nominal voltage of a single cell.

[SOURCE: IEC 60050-482:2004, 482-03-31, modified – Addition of Notes 1 and 2 to entry.]

3.2

rated capacity

capacity value of a cell or a 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 during a 5 h period when charging, storing and discharging under the conditions specified in 7.3.2.

Note 2 to entry: The capacity of a battery is the quantity of electricity C_5 Ah (ampere-hours) declared by the manufacturer which a battery can deliver during a 5 h period, when charged, stored and discharged under the conditions specified in 7.3.2.

[SOURCE: IEC 60050-482:2004, 482-03-15, modified – Addition of Notes 1 and 2 to entry.]

3.3

small prismatic cell

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

3.4

cylindrical cell

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

3.5

button cell

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

3.6

nickel-cadmium cell

cell containing a nickel hydroxide compound for the positive electrode, a cadmium compound for the negative electrode, and potassium hydroxide or other alkaline solution as electrolyte

Note 1 to entry: Positive electrodes are isolated from negative electrodes by a separator.

3.7

nickel- cadmium battery

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

3.8

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

Note 1 to entry: The cell is equipped with a safety device to prevent dangerously high internal pressure.

Note 2 to entry: The cell does not require addition to the electrolyte and is designed to operate during its life in its original sealed state.

[SOURCE: IEC 60050-482:2004, 482-05-17, modified – The existing note has been developed into Notes 1 and 2 to entry.]

3.9

portable cell

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

3.10**battery for portable applications**

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

**3.11****trickle charge**

method of charge applied to a battery wherein the state of charge is maintained by a continuous, long term, regulated small electric current

Note 1 to entry: The trickle charge compensates self-discharge effects and maintains the battery in an approximately fully charged state.

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;
- f) $\pm 0,1$ mm for dimensions;
- g) ± 5 % for humidity.

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 each report of results.

5 Cell and battery designation and marking**5.1 Cell and battery designation****5.1.1 Small prismatic cells and cylindrical cells****5.1.1.1 General**

Sealed nickel-cadmium small prismatic rechargeable single cells and cylindrical rechargeable single cells shall be designated by a letter L, M, J, H or X which signifies:

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

NOTE 1 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;
- J up to $5,0 I_t$ A;
- H up to $7,0 I_t$ A;
- X up to and above $15 I_t$ A.

NOTE 2 These currents are expressed as multiples of I_t A, where I_t A = C_5 Ah/1 h (see IEC 61434).

When a cell is intended for permanent charge at elevated temperatures, typically higher than 40 °C, a letter "T" is placed after the letter L, M, J, H or X.

When a cell is intended for permanent charge at elevated temperatures, typically higher than 50 °C, a letter "U" is placed after the letter L, M, J, 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, J, H or X.

5.1.1.2 Small prismatic cells

Sealed nickel-cadmium small prismatic rechargeable single cells shall be designated by the letters "KF" followed by a letter L, M, J, H or X 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 KFL 18/07/49 designation identifies a small prismatic cell of low discharge rate capability, with a maximum width of 18 mm, a maximum thickness of 7 mm and a maximum height of 49 mm.

5.1.1.3 Cylindrical cells

Sealed nickel-cadmium cylindrical rechargeable single cells shall be designated by the letters "KR" followed by a letter L, M, J, H or X followed by two groups of figures, each one 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 cell, 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.

For cells dimensionally interchangeable with primary cells, the following single or double figures following the letter L, M or R may indicate:

- 20- size D;
- 14- size C;
- 6- size AA;
- 03- size AAA.

EXAMPLE 4 KRMR03 designation identifies a sealed nickel-cadmium cylindrical rechargeable single cell, of medium discharge rate capability, also intended for rapid charge, dimensionally interchangeable with primary cell and whose type designation is AAA.