IEC 61960-3

Edition 1.0 2017-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for portable applications – Part 3: Prismatic and cylindrical lithium secondary cells, and batteries made from them

SIST Preview
(https://ecommerce.sist.si)

Accumulateurs alcalins et autres accumulateurs à électrolyte non acide – Accumulateurs au lithium pour applications portables – Partie 3: Eléments et batteries d'accumulateurs au lithium, parallélépipédiques et cylindriques

https://standards.iteh.ai/catalog/standards/sist/...-21626f8acd2d/iec-61960-3-2017

IEC 61960-3:2017-02(en-fr)

THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2017 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, 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 either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue
The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org
The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

STOP PRESS
(https://compass.iec.ch)
IEC 61960-3:2017
https://standards.iteh.ai/catalog/standards/iec/9a9189f-bc91-45e5-ab49-21626f8acd2d/iec-61960-3-2017

A propos de l'IEC
La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC
Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue
Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub
La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,…). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished
Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org
Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary
65 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc
Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

IEC 61960-3

Edition1.0 2017-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for portable applications – Part 3: Prismatic and cylindrical lithium secondary cells, and batteries made from them

SIST Preview
(https://ecommerce.sist.si)

Accumulateurs alcalins et autres accumulateurs à électrolyte non acide – Accumulateurs au lithium pour applications portables – Partie 3: Eléments et batteries d'accumulateurs au lithium, parallélépipédiques et cylindriques

https://standards.iteh.ai/catalog/standards/sist/21626f8acd2d/iec-61960-3-2017

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.220.99

ISBN 978-2-8322-3908-7

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

® Registered trademark of the International Electrotechnical Commission
Marque déposée de la Commission Electrotechnique Internationale

CONTENTS

FOREWORD 4
1 Scope 6
2 Normative references 7
3 Terms and definitions 7
4 Parameter measurement tolerances 8
5 Cell designation and marking 8
5.1 Cell and battery designation 8
5.2 Marking 10
5.3 Providing the design and produce requirement of batteries 10
6 Examples of cells 10
7 Electrical tests 11
7.1 General 11
7.2 Charging procedure for test purposes 12
7.3 Discharge performance 12
7.3.1 Discharge performance at 20 °C (rated capacity) 12
7.3.2 Discharge performance at –20 °C 12
7.3.3 High rate discharge performance at 20 °C 12
7.4 Charge (capacity) retention and recovery 13
7.5 Charge (capacity) recovery after long term storage 13
7.6 Endurance in cycles 14
7.6.1 General 14
7.6.2 Endurance in cycles at a rate of 0,2 I_t A 14
7.6.3 Endurance in cycles at a rate of 0,5 I_t A (accelerated test procedure) 14
7.7 Battery internal resistance 14
7.7.1 General 14
7.7.2 Measurement of the internal AC resistance 15
7.7.3 Measurement of the internal DC resistance 15
7.8 Electrostatic discharge (ESD) 16
7.8.1 General 16
7.8.2 Test procedure 16
7.8.3 Acceptance criterion 16
8 Test protocol and conditions for type approval 16
8.1 Test protocol 16
8.2 Conditions for type approval 16
8.2.1 Dimensions 16
8.2.2 Electrical tests 16
8.2.3 Conditional type approval 16
Annex A (informative) Dimensions of the cell with a laminate film case 19
A.1 General 19
A.2 Measuring method of cell thickness 19
A.3 Measuring method of cell width 19
Annex B (informative) Capacity after storage 21
Bibliography 22

Figure 1 – Sample sizes and sequence of tests 17

SIST Preview
(https://ecommerce.sist.si)
IEC 61960-3:2017
https://ecommerce.sist.si/catalog/standards/sist/89a91891-6c91-45e5-ab49-21626f8acd2d/iec-61960-3-2017

Figure A.1 – Thickness measuring method 20
Figure A.2 – Width measuring method 20

Table 1 – Specification examples of secondary lithium cells for portable applications 11
Table 2 – Examples of secondary lithium cells for portable applications 11
Table 3 – Endurance in cycles at a rate of 0,2 I_t A 14
Table 4 – Endurance in cycles at a rate of 0,5 I_t A 14
Table 5 – Minimum requirements for each type of secondary lithium cells and batteries 18
Table B.1 – Capacity after storage 21

SIST Preview
(https://ecommerce.sist.si)

IEC 61960-3:2017
https://ecommerce.sist.si/catalog/standards/sist/89a9189f-bc91-45e5-ab49-21626f8acd2d/iec-61960-3-2017

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 3: Prismatic and cylindrical lithium secondary cells, and batteries made from them

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.

SIST Preview
(standards.iteh.ai)
https://standards.iteh.ai/catalog/standards/sist/89a9189f-bc91-45e5-ab49-21626f8acd2d/iec-61960-3-2017

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 61960-3 has been prepared by subcommittee 21A: Secondary cells and batteries containing alkaline or other non-acid electrolytes, of IEC technical committee 21: Secondary cells and batteries.

This first edition cancels and replaces the second edition of IEC 61960 published in 2011. It is a technical revision.

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

- adding definition of portable applications (Scope),
- update of examples of cells (Table 1 and 2),

- adding “Dimensions of the cell with a laminate film case” (Annex A),
- adding “Capacity after storage” (from the date of manufacture) (Annex B).

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

FDIS	Report on voting
21A/618/FDIS	21A/625/RVD

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

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

A list of all parts in the IEC 61960 series, published under the general title *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for portable applications*, can be found on the IEC website.

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

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

SIST Preview
(https://ecommerce.sist.si)

IEC 61960-3:2017
https://ecommerce.sist.si/catalog/standards/sist/89a9189f-bc91-45e5-ab49-21626f8acd2d/iec-61960-3-2017

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

Part 3: Prismatic and cylindrical lithium secondary cells, and batteries made from them

1 Scope

This part of IEC 61960 specifies performance tests, designations, markings, dimensions and other requirements for secondary lithium single cells and batteries for portable applications.

The objective of this document is to provide the purchasers and users of secondary lithium cells and batteries with a set of criteria with which they can judge the performance of secondary lithium cells and batteries offered by various manufacturers.

Portable applications comprise hand-held equipment, transportable equipment and movable equipment.

Examples of the main uses are shown below:

a) hand-held equipment: smartphone, tablet PCs, audio/video players, and similar equipment;

b) transportable equipment: notebook computers, CD players, and similar equipment;

c) movable equipment

- 18 kg or less in mass and not fixed in place, or
- provided with wheels, castors, or other means to facilitate movement by an ordinary person as required to perform its intended use,
- power tools, power assisted cycles, business-use video cameras, and similar equipment.

SIST Preview
(https://ecommerce.sist.si)
IEC 61960-3:2017
https://ecommerce.sist.si/catalog/standards/sist/89a9189f-be91-45e5-ab49-21626f8acd2d/iec-61960-3-2017

NOTE 1 All applications using batteries whose nominal voltages are equal to or over the hazardous voltage of 60 V DC are excluded.

NOTE 2 EESS (Electrical Energy Storage Systems) and UPS, which use batteries over 500 Wh of electric energy are excluded.

NOTE 3 Self-propelled vehicles are excluded.

This document defines a minimum required level of performance and a standardized methodology by which testing is performed and the results of this testing reported to the user. Hence, users will be able to establish the viability of commercially available cells and batteries via the declared specification and thus be able to select the cell or battery best suited for their intended application. The end user can handle only batteries which have completely fulfilled all the requirements of this document and others concerning safety such as IEC 62133-2.

This document covers secondary lithium cells and batteries with a range of chemistries. Each electrochemical couple has a characteristic voltage range over which it releases its electrical capacity, a characteristic nominal voltage and a characteristic final voltage during discharge. Users of secondary lithium cells and batteries are requested to consult the manufacturer for advice.

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 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 62133-2:2017, *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 2: Lithium systems*

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:

SIST Preview
(https://ecommerce.sist.si)

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

IEC 61960-3:2017
https://standards.iteh.ai/catalog/standards/sist/89a9189f-bc91-45e5-ab49-21626f8acd2d/iec-61960-3-2017

3.1
charge recovery
capacity recovery
capacity that a cell or battery can deliver with subsequent recharge after storage, at a specific temperature, for a specific time, as a percentage of the rated capacity

3.2
charge retention
capacity retention
capacity that a cell or battery can deliver after storage, at a specific temperature, for a specific time without subsequent recharge as a percentage of the rated capacity

3.3
final voltage
end-of-discharge voltage
specified closed circuit voltage at which a discharge of a cell or battery is terminated

3.4
nominal voltage
suitable approximate value of the voltage used to designate or identify a cell, a battery or an electrochemical system

Note 1 to entry: The nominal voltages of secondary lithium cells are shown in Table 1 and 2.

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 Notes 1 and 2 to entry.]

3.5
rated capacity
capacity value of a cell or battery determined under specified conditions and declared by the manufacturer

Note 1 to entry: The rated capacity is the quantity of electricity C_5 Ah (ampere-hours) declared by the manufacturer which a single cell can deliver during a 5-h period, when charged, stored and discharged under the conditions specified in 7.3.1

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

3.6
secondary lithium battery
unit which incorporates one or more secondary lithium cells and which is ready for use

Note 1 to entry: It may incorporate adequate housing and a terminal arrangement and may have electronic control devices.

3.7
secondary lithium cell
secondary cell where electrical energy is derived from the insertion/extraction reactions of lithium ions or oxidation/reduction reaction of lithium between the negative electrode and the positive electrode

Note 1 to entry: The cell typically has an electrolyte that consists of a lithium salt and organic solvent compound in liquid, gel or solid form and has a metal or a laminate film casing. It is not ready for use in an application because it is not yet fitted with its final housing, terminal arrangement and electronic control device.

SIST Preview
(https://ecommerce.sist.si)

3.8
lithium ion polymer cell
cell using gel polymer electrolyte or solid polymer electrolyte, not liquid electrolyte

4 Parameter measurement tolerances

IEC 61960-3:2017
https://ecommerce.sist.si/catalog/standards/sist/89a9189f-bc91-45e5-ab49-21626f8acd2d/iec-61960-3-2017

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) ± 0,1 % for time;

f) ± 0,1 mm for dimensions.

These tolerances comprise the combined accuracy of the measuring instruments, the measurement techniques used, and all other sources of error in the test procedure.

The details of the instrumentation used shall be provided in any report of results.

5 Cell designation and marking

5.1 Cell and battery designation

Batteries shall be designated with following form:

$$N_1\ A_1\ A_2\ A_3\ N_2\ /\ N_3\ /\ N_4 - N_5$$

Cells shall be designated with following form:

$$A_1\ A_2\ A_3\ N_2\ /\ N_3\ /\ N_4$$

where

N_1 is the number of series connected cells in the battery;

A_1 designates the negative electrode basis in which

- I is carbon;
- L is lithium metal or lithium alloy;
- T is titanium;
- X is others;

A_2 designates the positive electrode basis in which

- C is cobalt;
- F is iron;
- Fp is iron phosphate;
- N is nickel;
- M is manganese;
- Mp is manganese phosphate;
- T is titanium;
- V is vanadium;
- X is others;

A_3 designates the shape of the cell in which

- R is cylindrical;
- P is prismatic;

SIST Preview
(https://ecommerce.sist.si)
IEC 61960-3:2017
https://ecommerce.sist.si/catalog/standard/sist/89a91b91-0e91-4f3e-9dd9-21b20dded2d/iec-61960-3-2017

N_2 is the maximum diameter (if R) or the maximum thickness (if P) in millimetres rounded up to the next whole number;

N_3 is the maximum width (if P) in millimetres rounded up to the next whole number (N_3 not shown if R);

N_4 is the maximum overall height in millimetres rounded up to the next whole number;

NOTE 1 If any dimension is less than 1 mm, the units used are tenths of millimetres and the single number is written tN.

N_5 is the number of parallel connected cells if two or more (not shown if value is 1).

EXAMPLE 1 ICR19/66 designates a cylindrical Li-ion secondary cell, with a cobalt-based positive electrode, a maximum diameter which is greater than 18 mm and less than or equal to 19 mm, a maximum overall height which is greater than 65 mm and less than or equal to 66 mm.

EXAMPLE 2 ICP9/35/150 designates a prismatic Li-ion secondary lithium cell, with a cobalt-based positive electrode, a maximum thickness which is greater than 8 mm and less than or equal to 9 mm, a maximum width which is greater than 34 mm and less than or equal to 35 mm, and a maximum overall height which is greater than 149 mm and less than or equal to 150 mm.

EXAMPLE 3 ICPt9/35/48 designates a prismatic Li-ion secondary lithium cell, with a cobalt-based positive electrode, a maximum thickness which is greater than 0,8 mm and less than or equal to 0,9 mm, a maximum width which is greater than 34 mm and less than or equal to 35 mm, and a maximum overall height which is greater than 47 mm and less than or equal to 48 mm.

EXAMPLE 4 1ICR20/70 designates a cylindrical Li-ion secondary battery with one single cell, a cobalt-based positive electrode, a maximum diameter which is greater than 19 mm and less than or equal to 20 mm, and a maximum overall height which is greater than 69 mm and less than or equal to 70 mm.

EXAMPLE 5 2ICP20/34/70 designates a prismatic Li-ion secondary battery with two series connected cells, a cobalt-based positive electrode, a maximum thickness which is greater than 19 mm and less than or equal to 20 mm, a maximum width which is greater than 33 mm and less than or equal to 34 mm, and a maximum overall height which is greater than 69 mm and less than or equal to 70 mm.

EXAMPLE 6 1ICP20/68/70-2 designates a prismatic Li-ion secondary battery with two parallel connected cells, a cobalt-based positive electrode, a maximum thickness which is greater than 19 mm and less than or equal to 20 mm, a maximum width which is greater than 67 mm and less than or equal to 68 mm, and a maximum overall height which is greater than 69 mm and less than or equal to 70 mm.

EXAMPLE 7 When the batteries which have different designation such as ICR19/66 and ICP9/35/150 are parallel connected into single case, the marking to the case is taken as (ICR19/66)(ICP9/35/150).

NOTE 2 Notwithstanding the above specification, other designations can be used according to agreement between manufacturer and user.

5.2 Marking

Each cell or battery shall carry clear and durable markings giving the following information:

Manufacturer shall provide the following information in document form such as specification sheet or instruction manual or similar documents. When the battery is handled by end-users, the following information shall be marked on it.

- secondary (rechargeable) Li or Li-ion;
- battery or cell designation as specified in 5.1;
- polarity;
- date of manufacture (which may be in code);
- name or identification of manufacturer or supplier;
- rated capacity;
- nominal voltage.

SIST Preview
(standardsinmerce.sist.si)

When a cell or battery is considered swallowable the following additional information shall be marked on it or on the immediate package:

- caution for batteries which are considered swallowable (see IEC 60086-4).

IEC 61960-3:2017

When the battery surface is too small to accommodate all markings, information shall be given in specification sheet or in instruction manual or on the immediate package instead of on the battery.

Polarity need not be marked when the battery has been exclusively designed not to be connected wrongly.

Instead of designation as specified in 5.1, product code or name of battery can be used when the battery is designed for use in particular end product.

By agreement between the cell manufacturer and battery and/or end product manufacturer, cells used in the assembly of a battery need not be marked. The battery designed not to be replaced by the end user also need not be marked.

5.3 Providing the design and produce requirement of batteries

In order to ensure the safe use of lithium-ion secondary batteries, cell manufacturers shall provide equipment manufacturers who design and produce lithium-ion secondary batteries with the requirements specified in IEC 62133-2:2017, Annex A.

6 Examples of cells

Table 1 shows the specifications of some secondary lithium cell(s), and Table 2 shows the chemistries of the secondary lithium cell(s) that are suitable for standardization and used in assembling batteries.

Table 1 – Specification examples of secondary lithium cells for portable applications

	Cylindrical	Prismatic (metal case)	Prismatic (laminate film case)
Secondary lithium cell	ICR19/66	ICP5/34/50	ICP7/34/50
Height (mm)	64,0/65,2	49,0/49,6	49,2/50,0
Diameter (mm)	17,8/18,5	NA	NA
Width (mm)	NA	33,6/34,0	33,2/34,0
Thickness (mm)	NA	4,1/4,6	6,2/7,0
Nominal voltage (V)	3,7	3,7	3,7
Final voltage (V)	2,50	2,50	2,50
Final voltage (V) for endurance (cycle life)	2,75	2,75	2,75

Table 2 – Examples of secondary lithium cells for portable applications

Cell type	Positive electrode	Electrolyte	Negative electrode	Cell case	Nominal Voltage (V)
Lithium ion	Lithium transition metal (Nickel, Cobalt, Manganese) oxide	Non-aqueous solution with lithium salt	Carbon	Metal	3,6~3,9
				Laminate film	
			Tin based Compound	Metal	3,3~3,6
			Titanium oxide	Metal	2,2~2,5
				Laminate film	
	Lithium iron phosphate		Carbon	Metal	3,2
				Laminate film	
Lithium ion polymer	Lithium transition metal (Nickel, Cobalt, Manganese) oxide	Gel polymer with lithium salt	Carbon	Laminate film	3,6~3,8
NOTE A lithium ion cell is a secondary cell. The electrode materials are selected so that lithium metal is not involved in the charge and the discharge directly. Typical examples of lithium ion cells are listed in this table.					

SIST Preview (https://ecommerce.sist.si) IEC 61960-3:2017 https://ecommerce.sist.si/catalog/standards/sist/89a9189f-bc91-45e5-ab49-[illegible]cd2d/iec-61960-3-2017

7 Electrical tests

7.1 General

Only cell or battery samples which are less than two months (60 days) old, from the date of manufacture, shall be used for the tests specified in this document.

NOTE Generally capacity of lithium ion cells or batteries gradually decreases (see Table B.1).

Charge and discharge currents for the tests shall be based on the value of the rated capacity (C_5 Ah). These currents are expressed as a multiple of I_t A, where: I_t A = C_5 Ah/1 h.

The minimum values required for each electrical test are stated in Table 5. Sample sizes and sequence of tests are described in Figure 1.

7.2 Charging procedure for test purposes

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

Unless otherwise stated in this document, cells or batteries shall be charged, in an ambient temperature of 20 °C ± 5 °C, using the method declared by the manufacturer.

7.3 Discharge performance

7.3.1 Discharge performance at 20 °C (rated capacity)

This test verifies the rated capacity of a cell or battery.

Step 1 – The cell or battery shall be charged in accordance with 7.2.

Step 2 – The cell or battery shall be stored, in an ambient temperature of 20 °C ± 5 °C, for not less than 1 h and not more than 4 h.

Step 3 – The cell or battery shall be discharged, in an ambient temperature of 20 °C ± 5 °C, at a constant current of 0,2 I_t A, until its voltage is equal to the specified final voltage.

Step 4 – The capacity (Ah) delivered during step 3 shall be not less than 100 % of the rated capacity declared by the manufacturer. Steps 1 to 4 may be repeated up to four additional times, as necessary to satisfy this requirement.

SIST Preview
(https://ecommerce.sist.si)

7.3.2 Discharge performance at –20 °C

This test determines the capacity of the cell or battery at low temperature.

IEC 61960-3:2017
https://ecommerce.sist.si/catalog/standards/sist/89a9189f-bc91-45e5-ab49-21626f8acd2d/iec-61960-3-2017

Step 1 – The cell or battery shall be charged in accordance with 7.2.

Step 2 – The cell or battery shall be stored, in an ambient temperature of −20 °C ± 2 °C, for not less than 16 h and not more than 24 h.

Step 3 – The cell or battery shall be discharged, in an ambient temperature of −20 °C ± 2 °C, at a constant current of 0,2 I_t A, until its voltage is equal to the specified final voltage.

Step 4 – The capacity (Ah), delivered during step 3, shall be not less than that specified for this characteristic in Table 5.

7.3.3 High rate discharge performance at 20 °C

This test determines the capacity of a cell or battery when discharged at a high rate. This test is not required if the cell or battery is not designed to be used at this rate.

Step 1 – The cell or battery shall be charged in accordance with 7.2.

Step 2 – The cell or battery shall be stored, in an ambient temperature of 20 °C ± 5 °C, for not less than 1 h and not more than 4 h.

Step 3 – The cell or battery shall be discharged, in an ambient temperature of 20 °C ± 5 °C, at a constant current of 1,0 I_t A, until its voltage is equal to the specified final voltage.

Step 4 – The capacity (Ah) delivered during step 3 shall be not less than that specified for this characteristic in Table 5.

7.4 Charge (capacity) retention and recovery

This test determines firstly the capacity which a cell or battery retains after storage for an extended period of time, and secondly the capacity that can be recovered by a subsequent recharge.

Step 1 – The cell or battery shall be charged in accordance with 7.2.

Step 2 – The cell or battery shall be stored in an ambient temperature of 20 °C ± 5 °C, for 28 days.

Step 3 – The cell or battery shall be discharged, in an ambient temperature of 20 °C ± 5 °C, at a constant current of 0,2 I_t A, until its voltage is equal to the specified final voltage.

Step 4 – The 28-day retained capacity (Ah) delivered, during step 3, shall be not less than that specified for this characteristic in Table 5.

Step 5 – The cell or battery shall then be charged in accordance with 7.2, within 24 h following the discharge of step 3.

Step 6 – The cell or battery shall be stored, in an ambient temperature of 20 °C ± 5 °C, for not less than 1 h and not more than 4 h.

Step 7 – The cell or battery shall be discharged, in an ambient temperature of 20 °C ± 5 °C, at a constant current of 0,2 I_t A, until its voltage is equal to the specified final voltage.

Step 8 – The recovery capacity (Ah) delivered, during step 7, shall be not less than that specified for this characteristic in Table 5.

7.5 Charge (capacity) recovery after long term storage

https://ecommerce.sist.si/catalog/standards/sist/89e9189f-bc91-45e5-ab49-21626f8acd2d/iec-61960-3-2017

This test determines the capacity of a cell or battery after extended storage at 50 % state of charge, followed by a subsequent charge.

Step 1 – The cell or battery shall be charged in accordance with 7.2.

Step 2 – The cell or battery shall be discharged, in an ambient temperature of 20 °C ± 5 °C, at a constant current of 0,2 I_t A, for 2,5 h.

Step 3 – The cell or battery shall be stored in an ambient temperature of 40 °C ± 2 °C, for 90 days.

Step 4 – The cell or battery shall be charged, in an ambient temperature of 20 °C ± 5 °C, using the method declared by the manufacturer.

Step 5 – The cell or battery shall be stored, in an ambient temperature of 20 °C ± 5 °C, for not less than 1 h and not more than 4 h.

Step 6 – The cell or battery shall be discharged, in an ambient temperature of 20 °C ± 5 °C, at a constant current of 0,2 I_t A, until its voltage is equal to the specified final voltage.

Step 7 – The capacity (Ah) delivered during step 6 shall be not less than that specified for this characteristic in Table 5. Steps 4, 5 and 6 may be repeated up to four additional times, as necessary to satisfy this requirement.