



# INTERNATIONAL STANDARD



**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**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

ICS 29.220.30

ISBN 978-2-8322-0505-1

**Warning! Make sure that you obtained this publication from an authorized distributor.**

This is a preview - click here to buy the full publication

Withdrawn

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE



**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**

**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**

## CONTENTS

|   |    |
|---|----|
| FOREWORD.....   | 4  |
| 1 Scope.....  | 6  |
| 2 Normative references .....  | 6  |
| 3 Terms and definitions .....   | 6  |
| 4 Parameter measurement tolerances .....                                | 8  |
| 5 General safety considerations .....                                   | 8  |
| 5.1 General.....  | 8  |
| 5.2 Insulation and wiring .....   | 9  |
| 5.3 Venting.....  | 9  |
| 5.4 Temperature/voltage/current management .....                        | 9  |
| 5.5 Terminal contacts.....  | 9  |
| 5.6 Assembly of cells into batteries .....                              | 9  |
| 5.6.1 General .....   | 9  |
| 5.6.2 Design recommendation for lithium systems only.....               | 10 |
| 5.7 Quality plan .....  | 10 |
| 6 Type test conditions .....  | 10 |
| 7 Specific requirements and tests (nickel systems).....                 | 11 |
| 7.1 Charging procedure for test purposes.....                           | 11 |
| 7.2 Intended use .....  | 12 |
| 7.2.1 Continuous low-rate charging (cells).....                         | 12 |
| 7.2.2 Vibration.....  | 12 |
| 7.2.3 Moulded case stress at high ambient temperature (batteries) ..... | 12 |
| 7.2.4 Temperature cycling.....  | 13 |
| 7.3 Reasonably foreseeable misuse.....                                  | 13 |
| 7.3.1 Incorrect installation (cells).....                               | 13 |
| 7.3.2 External short circuit.....                                       | 14 |
| 7.3.3 Free fall.....  | 14 |
| 7.3.4 Mechanical shock (crash hazard).....                              | 14 |
| 7.3.5 Thermal abuse (cells) .....                                       | 15 |
| 7.3.6 Crushing of cells.....  | 15 |
| 7.3.7 Low pressure (cells) .....  | 15 |
| 7.3.8 Overcharge.....   | 15 |
| 7.3.9 Forced discharge (cells) .....                                    | 16 |
| 8 Specific requirements and tests (lithium systems).....                | 16 |
| 8.1 Charging procedures for test purposes .....                         | 16 |
| 8.1.1 First procedure .....   | 16 |
| 8.1.2 Second procedure .....  | 16 |
| 8.2 Intended use .....  | 17 |
| 8.2.1 Continuous charging at constant voltage (cells).....              | 17 |
| 8.2.2 Moulded case stress at high ambient temperature (battery) .....   | 17 |
| 8.3 Reasonably foreseeable misuse .....                                 | 17 |
| 8.3.1 External short circuit (cell).....                                | 17 |
| 8.3.2 External short circuit (battery).....                             | 17 |
| 8.3.3 Free fall.....  | 18 |
| 8.3.4 Thermal abuse (cells).....  | 18 |

|       |  |    |
|-------|--|----|
| 8.3.5 | Crush (cells).....   | 18 |
| 8.3.6 | Over-charging of battery.....  | 18 |
| 8.3.7 | Forced discharge (cells).....  | 19 |
| 8.3.8 | Transport tests.....   | 19 |
| 8.3.9 | Design evaluation – Forced internal short circuit (cells).....   | 19 |
| 9     | Information for safety.....  | 21 |
| 10    | Marking.....   | 21 |
| 10.1  | Cell marking.....  | 21 |
| 10.2  | Battery marking.....   | 22 |
| 10.3  | Other information.....   | 22 |
| 11    | Packaging.....   | 22 |
|       | Annex A (normative) Charging range of secondary lithium ion cells for safe use.....  | 23 |
|       | Annex B (informative) Recommendations to equipment manufacturers and battery assemblers.....   | 34 |
|       | Annex C (informative) Recommendations to the end-users.....  | 35 |
|       | Bibliography.....  | 36 |
|       | Figure 1 – Temperature profile for 7.2.4 – Temperature cycling test.....   | 13 |
|       | Figure 2 – Jig for pressing.....   | 21 |
|       | Figure A.1 – Typical of operating region of Li-ion cells with cobalt oxide cathode and carbon anode.....   | 24 |
|       | Figure A.2 – Shape of nickel particle.....   | 28 |
|       | Figure A.3 – Nickel particle insertion position between positive and negative active material coated area of cylindrical cell.....               | 29 |
|       | Figure A.4 – Nickel particle insertion position between positive aluminum foil and negative active material coated area of cylindrical cell..... | 29 |
|       | Figure A.5 – Disassembly of cylindrical cell.....  | 30 |
|       | Figure A.6 – Nickel particle insertion position between positive and negative (active material) coated area of prismatic cell.....               | 31 |
|       | Figure A.7 – Nickel particle insertion position between positive aluminum foil and negative (active material) coated area of prismatic cell..... | 32 |
|       | Figure A.8 – Disassembly of prismatic cells.....   | 33 |
|       | Table 1 – Sample size for type tests (nickel systems).....   | 11 |
|       | Table 2 – Sample size for type tests (lithium systems).....  | 11 |
|       | Table 3 – Conditions for vibration test.....   | 12 |
|       | Table 4 – Condition of charging procedure.....   | 16 |
|       | Table 5 – Ambient temperature for cell test <sup>a</sup> .....   | 20 |

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

### SECONDARY CELLS AND BATTERIES CONTAINING ALKALINE OR OTHER NON-ACID ELECTROLYTES –

### SAFETY REQUIREMENTS FOR PORTABLE SEALED SECONDARY CELLS, AND FOR BATTERIES MADE FROM THEM, FOR USE IN PORTABLE APPLICATIONS

#### FOREWORD

- 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 62133 has been prepared by subcommittee 21A: Secondary cells and batteries containing alkaline or other non-acid electrolytes, of IEC technical committee 21: Secondary cells and batteries.

This second edition cancels and replaces the first edition published in 2002. It constitutes a technical revision.

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

- update of assembly of cells into batteries (5.5);
- addition of design recommendations for lithium system only (5.6.2);
- separation of nickel systems and lithium systems (Clause 6);

- addition of specific requirements and tests for lithium systems (Clause 8);
- addition of charging of secondary lithium-ion cells for safe use (Annex A).

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

| FDIS         | Report on voting |
|--------------|------------------|
| 21A/503/FDIS | 21A/509/RVD      |

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

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

The following difference exists in the countries indicated below:

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

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

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

The contents of the corrigendum of June 2013 have been included in this copy.

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

**SECONDARY CELLS AND BATTERIES CONTAINING ALKALINE  
OR OTHER NON-ACID ELECTROLYTES –  
SAFETY REQUIREMENTS FOR PORTABLE SEALED  
SECONDARY CELLS, AND FOR BATTERIES MADE FROM THEM,  
FOR USE IN PORTABLE APPLICATIONS**

## **1 Scope**

This International Standard specifies requirements and tests for the safe operation of portable sealed secondary cells and batteries (other than button) containing alkaline or other non-acid electrolyte, under intended use and reasonably foreseeable misuse.

## **2 Normative references**

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-482, *International Electrotechnical Vocabulary – Part 482: Primary and secondary cells and batteries*

IEC 61951-1, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Portable sealed rechargeable single cells – Part 1: Nickel-cadmium*

IEC 61951-2, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Portable sealed rechargeable single cells – Part 2: Nickel-metal hydride*

IEC 61960, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for portable applications*

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

## SOMMAIRE

|  |    |
|--|----|
| AVANT-PROPOS.....  | 40 |
| 1 Domaine d'application .....  | 42 |
| 2 Références normatives.....   | 42 |
| 3 Termes et définitions .....  | 42 |
| 4 Tolérances de mesure des paramètres .....  | 44 |
| 5 Considérations générales de sécurité .....   | 44 |
| 5.1 Généralités.....   | 44 |
| 5.2 Isolement et câblage .....   | 45 |
| 5.3 Échappement de gaz.....  | 45 |
| 5.4 Gestion de la température, de la tension et du courant.....                          | 45 |
| 5.5 Bornes de contacts.....  | 46 |
| 5.6 Assemblage des éléments dans les batteries .....                                     | 46 |
| 5.6.1 Généralités.....   | 46 |
| 5.6.2 Recommandations de conception pour les systèmes au lithium<br>seulement.....       | 46 |
| 5.7 Plan qualité .....   | 46 |
| 6 Conditions des essais d'homologation .....   | 47 |
| 7 Exigences spécifiques et essais (systèmes au nickel) .....                             | 48 |
| 7.1 Procédure de charge pour les besoins des essais .....                                | 48 |
| 7.2 Utilisation normale.....   | 48 |
| 7.2.1 Charge continue à faible régime (éléments).....                                    | 48 |
| 7.2.2 Vibration.....   | 48 |
| 7.2.3 Contrainte de moulage du boîtier à température ambiante élevée<br>(batteries)..... | 49 |
| 7.2.4 Cycles de températures.....  | 49 |
| 7.3 Utilisation abusive raisonnablement prévisible.....                                  | 50 |
| 7.3.1 Installation incorrecte (éléments).....  | 50 |
| 7.3.2 Court-circuit externe .....  | 50 |
| 7.3.3 Chute libre.....   | 50 |
| 7.3.4 Choc mécanique (danger de collision) .....   | 51 |
| 7.3.5 Utilisation à température abusive (éléments) .....                                 | 51 |
| 7.3.6 Écrasement d'éléments .....  | 51 |
| 7.3.7 Basse pression (éléments) .....  | 52 |
| 7.3.8 Surcharge.....   | 52 |
| 7.3.9 Décharge forcée (éléments) .....   | 52 |
| 8 Exigences spécifiques et essais (systèmes au lithium) .....                            | 52 |
| 8.1 Procédures de charge pour les besoins des essais .....                               | 52 |
| 8.1.1 Première procédure .....   | 52 |
| 8.1.2 Deuxième procédure .....   | 53 |
| 8.2 Utilisation normale.....   | 53 |
| 8.2.1 Charge continue à tension constante (éléments) .....                               | 53 |
| 8.2.2 Contrainte de moulage du boîtier à température ambiante élevée<br>(batterie) ..... | 53 |
| 8.3 Utilisation abusive raisonnablement prévisible.....                                  | 54 |
| 8.3.1 Court-circuit externe (élément) .....  | 54 |
| 8.3.2 Court-circuit externe (batterie).....  | 54 |

|       |   |    |
|-------|---|----|
| 8.3.3 | Chute libre.....  | 54 |
| 8.3.4 | Utilisation à température abusive (éléments) .....  | 55 |
| 8.3.5 | Écrasement (éléments).....  | 55 |
| 8.3.6 | Surcharge d'une batterie .....  | 55 |
| 8.3.7 | Décharge forcée (éléments) .....  | 56 |
| 8.3.8 | Essais de transport.....  | 56 |
| 8.3.9 | Évaluation de la conception – Court-circuit interne forcé (éléments) .....  | 56 |
| 9     | Information relative à la sécurité.....   | 58 |
| 10    | Marquage .....  | 59 |
| 10.1  | Marquage des éléments .....   | 59 |
| 10.2  | Marquage des batteries .....  | 59 |
| 10.3  | Autres informations .....   | 59 |
| 11    | Emballage .....   | 59 |
|       | Annexe A (normative) Gamme de charge des accumulateurs lithium-ion pour un usage sûr.....   | 60 |
|       | Annexe B (informative) Recommandations aux fabricants de matériel et aux assembleurs de batteries .....   | 72 |
|       | Annexe C (informative) Recommandations pour les utilisateurs finals.....  | 73 |
|       | Bibliographie.....  | 74 |
|       | Figure 1 – Profil de température pour 7.2.4 – Essai de cycle de température .....   | 50 |
|       | Figure 2 – Gabarit de serrage sous pression.....  | 58 |
|       | Figure A.1 – Région de fonctionnement type des éléments Li-ion avec cathode en oxyde de cobalt et anode en carbone.....   | 61 |
|       | Figure A.2 – Forme de la particule de nickel.....   | 66 |
|       | Figure A.3 – Position d'insertion de la particule de nickel entre les zones enduites de matière active positive et négative dans un élément cylindrique.....                            | 66 |
|       | Figure A.4 – Position d'insertion de la particule de nickel entre la feuille d'aluminium positive et la zone imprégnée de matière active négative de l'élément cylindrique .....        | 67 |
|       | Figure A.5 – Démontage d'un élément cylindrique.....  | 68 |
|       | Figure A.6 – Position d'insertion de la particule de nickel entre les zones positive et négative enduites (de matière active) de l'élément parallélépipédique .....                     | 69 |
|       | Figure A.7 – Position d'insertion de la particule de nickel entre la feuille d'aluminium positive et la zone enduite (de matière active) négative de l'élément parallélépipédique ..... | 70 |
|       | Figure A.8 – Démontage d'un élément parallélépipédique.....   | 71 |
|       | Tableau 1 – Taille des échantillons pour essais d'homologation (systèmes au nickel).....  | 47 |
|       | Tableau 2 – Taille des échantillons pour essais d'homologation (systèmes au lithium).....   | 47 |
|       | Tableau 3 – Conditions des essais de vibrations.....  | 49 |
|       | Tableau 4 – Condition de la procédure de charge .....   | 53 |
|       | Tableau 5 – Température ambiante pour l'essai d'un élément <sup>a</sup> .....   | 57 |

## COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

### 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

#### AVANT-PROPOS

- 1) La Commission Electrotechnique Internationale (CEI) est une organisation mondiale de normalisation composée de l'ensemble des comités électrotechniques nationaux (Comités nationaux de la CEI). La CEI a pour objet de favoriser la coopération internationale pour toutes les questions de normalisation dans les domaines de l'électricité et de l'électronique. A cet effet, la CEI – entre autres activités – publie des Normes internationales, des Spécifications techniques, des Rapports techniques, des Spécifications accessibles au public (PAS) et des Guides (ci-après dénommés "Publication(s) de la CEI"). Leur élaboration est confiée à des comités d'études, aux travaux desquels tout Comité national intéressé par le sujet traité peut participer. Les organisations internationales, gouvernementales et non gouvernementales, en liaison avec la CEI, participent également aux travaux. La CEI collabore étroitement avec l'Organisation Internationale de Normalisation (ISO), selon des conditions fixées par accord entre les deux organisations.
- 2) Les décisions ou accords officiels de la CEI concernant les questions techniques représentent, dans la mesure du possible, un accord international sur les sujets étudiés, étant donné que les Comités nationaux de la CEI intéressés sont représentés dans chaque comité d'études.
- 3) Les Publications de la CEI se présentent sous la forme de recommandations internationales et sont agréées comme telles par les Comités nationaux de la CEI. Tous les efforts raisonnables sont entrepris afin que la CEI s'assure de l'exactitude du contenu technique de ses publications; la CEI ne peut pas être tenue responsable de l'éventuelle mauvaise utilisation ou interprétation qui en est faite par un quelconque utilisateur final.
- 4) Dans le but d'encourager l'uniformité internationale, les Comités nationaux de la CEI s'engagent, dans toute la mesure possible, à appliquer de façon transparente les Publications de la CEI dans leurs publications nationales et régionales. Toutes divergences entre toutes Publications de la CEI et toutes publications nationales ou régionales correspondantes doivent être indiquées en termes clairs dans ces dernières.
- 5) La CEI elle-même ne fournit aucune attestation de conformité. Des organismes de certification indépendants fournissent des services d'évaluation de conformité et, dans certains secteurs, accèdent aux marques de conformité de la CEI. La CEI n'est responsable d'aucun des services effectués par les organismes de certification indépendants.
- 6) Tous les utilisateurs doivent s'assurer qu'ils sont en possession de la dernière édition de cette publication.
- 7) Aucune responsabilité ne doit être imputée à la CEI, à ses administrateurs, employés, auxiliaires ou mandataires, y compris ses experts particuliers et les membres de ses comités d'études et des Comités nationaux de la CEI, pour tout préjudice causé en cas de dommages corporels et matériels, ou de tout autre dommage de quelque nature que ce soit, directe ou indirecte, ou pour supporter les coûts (y compris les frais de justice) et les dépenses découlant de la publication ou de l'utilisation de cette Publication de la CEI ou de toute autre Publication de la CEI, ou au crédit qui lui est accordé.
- 8) L'attention est attirée sur les références normatives citées dans cette publication. L'utilisation de publications référencées est obligatoire pour une application correcte de la présente publication.
- 9) L'attention est attirée sur le fait que certains des éléments de la présente Publication de la CEI peuvent faire l'objet de droits de brevet. La CEI ne saurait être tenue pour responsable de ne pas avoir identifié de tels droits de brevets et de ne pas avoir signalé leur existence.

La Norme internationale CEI 62133 a été préparée par le sous-comité 21A: Accumulateurs alcalins et autres accumulateurs à électrolyte non acide, du comité d'étude 21 de la CEI: Accumulateurs.

Cette deuxième édition annule et remplace la première édition parue en 2002, dont elle constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

- mise à jour du montage des éléments en batteries (5.5);

- recommandations complémentaires de conception uniquement pour les systèmes au lithium (5.6.2);
- séparation des systèmes au nickel et des systèmes au lithium (Article 6);
- addition d'exigences et d'essais spécifiques pour les systèmes au lithium (Article 8);
- addition des éléments d'accumulateurs lithium-ion pour un usage sûr (Annexe A).

Le texte de cette norme est basé sur les documents suivants:

| FDIS         | Rapport de vote |
|--------------|-----------------|
| 21A/503/FDIS | 21A/509/RVD     |

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette norme.

Cette publication a été rédigée selon les Directives ISO/CEI, Partie 2.

Les différences suivantes existent dans les pays indiqués ci-dessous:

Paragraphe 8.3.9: Évaluation de la conception – Court-circuit interne forcé, s'applique uniquement à la Corée, à la France, au Japon et à la Suisse.

Le comité a décidé que le contenu de cette publication ne sera pas modifié avant la date de stabilité indiquée sur le site web de la CEI sous "<http://webstore.iec.ch>" dans les données relatives à la publication recherchée. A cette date, la publication sera

- reconduite,
- supprimée,
- remplacée par une édition révisée, ou
- amendée.

Le contenu du corrigendum de juin 2013 a été pris en considération dans cet exemplaire.

**IMPORTANT – Le logo "colour inside" qui se trouve sur la page de couverture de cette publication indique qu'elle contient des couleurs qui sont considérées comme utiles à une bonne compréhension de son contenu. Les utilisateurs devraient, par conséquent, imprimer cette publication en utilisant une imprimante couleur.**

## 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

#### 1 Domaine d'application

La présente Norme internationale spécifie les exigences et les essais pour le fonctionnement en sécurité des accumulateurs portables étanches, et accumulateurs (autre que boutons) contenant un électrolyte alcalin ou un autre électrolyte non acide dans des utilisations prévues et dans des utilisations abusives raisonnablement prévisibles.

#### 2 Références normatives

Les documents suivants sont cités en référence de manière normative, en intégralité ou en partie, dans le présent document et sont indispensables pour son application. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

CEI 60050-482, *Vocabulaire Électrotechnique International – Partie 482: Piles et accumulateurs électriques*

CEI 61951-1, *Accumulateurs alcalins et autres accumulateurs à électrolyte non acide – Accumulateurs individuels portables étanches – Partie 1: Nickel-cadmium*

CEI 61951-2, *Accumulateurs alcalins et autres accumulateurs à électrolyte non acide – Accumulateurs individuels portables étanches – Partie 2: Nickel-métal hydrure*

CEI 61960, *Accumulateurs alcalins et autres accumulateurs à électrolyte non acide – Éléments et batteries d'accumulateurs au lithium pour applications portables*

Guide ISO/CEI 51, *Aspects liés à la sécurité – Principes directeurs pour les inclure dans les normes*

## REDLINE VERSION



**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**

Withstand

## CONTENTS

|   |    |
|---|----|
| FOREWORD.....   | 4  |
| 1 Scope.....  | 6  |
| 2 Normative references .....  | 6  |
| 3 Terms and definitions .....   | 7  |
| 4 Parameter measurement tolerances .....                                | 8  |
| 5 General safety considerations .....                                   | 9  |
| 5.1 General .....   | 9  |
| 5.2 Insulation and wiring .....   | 9  |
| 5.3 Venting.....  | 9  |
| 5.4 Temperature/voltage/current management .....                        | 10 |
| 5.5 Terminal contacts .....   | 10 |
| 5.6 Assembly of cells into batteries .....                              | 10 |
| 5.6.1 General .....   | 10 |
| 5.6.2 Design recommendation for lithium systems only.....               | 10 |
| 5.7 Quality plan.....   | 11 |
| 6 Type test conditions .....  | 11 |
| 7 Specific requirements and tests (nickel systems).....                 | 12 |
| 7.1 Charging procedure for test purposes.....                           | 12 |
| 7.2 Intended use .....  | 13 |
| 7.2.1 Continuous low-rate charging (cells).....                         | 13 |
| 7.2.2 Vibration.....  | 13 |
| 7.2.3 Moulded case stress at high ambient temperature (batteries) ..... | 14 |
| 7.2.4 Temperature cycling .....   | 14 |
| 7.3 Reasonably foreseeable misuse.....                                  | 15 |
| 7.3.1 Incorrect installation (cells).....                               | 15 |
| 7.3.2 External short circuit.....                                       | 15 |
| 7.3.3 Free fall.....  | 16 |
| 7.3.4 Mechanical shock (crash hazard).....                              | 16 |
| 7.3.5 Thermal abuse (cells) .....                                       | 16 |
| 7.3.6 Crushing of cells.....  | 16 |
| 7.3.7 Low pressure (cells) .....  | 17 |
| 7.3.8 Overcharge .....  | 17 |
| 7.3.9 Forced discharge (cells) .....                                    | 18 |
| 8 Specific requirements and tests (lithium systems).....                | 18 |
| 8.1 Charging procedures for test purposes .....                         | 18 |
| 8.1.1 First procedure .....   | 18 |
| 8.1.2 Second procedure .....  | 18 |
| 8.2 Intended use .....  | 19 |
| 8.2.1 Continuous charging at constant voltage (cells).....              | 19 |
| 8.2.2 Moulded case stress at high ambient temperature (battery) .....   | 19 |
| 8.3 Reasonably foreseeable misuse .....                                 | 19 |
| 8.3.1 External short circuit (cell).....                                | 19 |
| 8.3.2 External short circuit (battery).....                             | 20 |
| 8.3.3 Free fall.....  | 20 |

|                       |  |    |
|-----------------------|--|----|
| 8.3.4                 | Thermal abuse (cells) .....  | 20 |
| 8.3.5                 | Crush (cells) .....  | 20 |
| 8.3.6                 | Over-charging of battery .....   | 21 |
| 8.3.7                 | Forced discharge (cells) .....   | 21 |
| 8.3.8                 | Transport tests .....  | 21 |
| 8.3.9                 | Design evaluation – Forced internal short circuit (cells) .....  | 21 |
| 9                     | Information for safety .....   | 23 |
| 10                    | Marking .....  | 24 |
| 10.1                  | Cell marking .....   | 24 |
| 10.2                  | Battery marking .....  | 24 |
| 10.3                  | Other information .....  | 24 |
| 11                    | Packaging .....  | 24 |
|                       |  |    |
| Annex A (normative)   | Charging range of secondary lithium ion cells for safe use .....   | 25 |
| Annex B (informative) | Recommendations to equipment manufacturers and battery assemblers .....  | 36 |
| Annex C (informative) | Recommendations to the end-users .....   | 37 |
|                       |  |    |
| Bibliography          | .....  | 38 |
|                       |  |    |
| Figure 1              | – Temperature profile for 7.2.4 – Temperature cycling test .....   | 15 |
| Figure 2              | – Jig for pressing .....   | 23 |
| Figure A.1            | – Typical of operating region of Li-ion cells with cobalt oxide cathode and carbon anode .....   | 26 |
| Figure A.2            | – Shape of nickel particle .....   | 30 |
| Figure A.3            | – Nickel particle insertion position between positive and negative active material coated area of cylindrical cell .....               | 31 |
| Figure A.4            | – Nickel particle insertion position between positive aluminum foil and negative active material coated area of cylindrical cell ..... | 31 |
| Figure A.5            | – Disassembly of cylindrical cell .....  | 32 |
| Figure A.6            | – Nickel particle insertion position between positive and negative (active material) coated area of prismatic cell .....               | 33 |
| Figure A.7            | – Nickel particle insertion position between positive aluminum foil and negative (active material) coated area of prismatic cell ..... | 34 |
| Figure A.8            | – Disassembly of prismatic cells .....   | 35 |
|                       |  |    |
| Table 1               | – Sample size for type tests (nickel systems) .....  | 11 |
| Table 2               | – Sample size for type tests (lithium systems) .....   | 11 |
| Table 3               | – Conditions for vibration test .....  | 13 |
| Table 4               | – Condition of charging procedure .....  | 18 |
| Table 5               | – Ambient temperature for cell test .....  | 22 |

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

### SECONDARY CELLS AND BATTERIES CONTAINING ALKALINE OR OTHER NON-ACID ELECTROLYTES –

### SAFETY REQUIREMENTS FOR PORTABLE SEALED SECONDARY CELLS, AND FOR BATTERIES MADE FROM THEM, FOR USE IN PORTABLE APPLICATIONS

#### FOREWORD

- 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.

**This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.**

International Standard IEC 62133 has been prepared by subcommittee 21A: Secondary cells and batteries containing alkaline or other non-acid electrolytes, of IEC technical committee 21: Secondary cells and batteries.

This second edition cancels and replaces the first edition published in 2002. It constitutes a technical revision.

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

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

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

| FDIS         | Report on voting |
|--------------|------------------|
| 21A/503/FDIS | 21A/509/RVD      |

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

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

The following difference exists in the countries indicated below:

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

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

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

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

# 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

## 4 General

### 4.11 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.

### 4.22 Normative references

The following ~~referenced~~ documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

~~IEC 60050-482, International Electrotechnical Vocabulary – Part 482: Primary and secondary cells and batteries~~

~~IEC 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-<sup>4</sup>

<sup>4</sup> ~~To be published.~~

Withdrawn