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Safety of primary and secondary lithium cells and batteries during transport

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SAFETY OF PRIMARY AND SECONDARY LITHIUM CELLS AND BATTERIES DURING TRANSPORT

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.
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This Redline version is not an official Standard and is intended to provide the user with an indication of what changes have been made to the previous version. Only the IEC International Standard provided in this package is to be considered the official Standard.

This Redline version provides you with a quick and easy way to compare all the changes between this standard and its 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 62281 has been prepared jointly by IEC technical committee 35: Primary cells and batteries and 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 2016. This edition constitutes a technical revision.

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

- a) button cell definition revised, moved to coin (cell or battery);
- b) addition of provisions for batteries forming an integral part of equipment (5.4);
- c) all tests for secondary cells and batteries now also contain a requirement for 25 charge and recharge cycles prior to the test;
- d) addition of alternative tables for Table 1 and Table 2 in Annex B;
- e) addition of "forcible" to the rupture criteria;
- f) test report 6.8 merged with test certificate 6.9 and replaced with the items listed in [12];
- g) addition of an informative Annex B with important deviations from the UN Manual of Tests and Criteria, Chapter 38.3.

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

FDIS	Report on voting
35/1416/FDIS	35/1422/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.

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,
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INTRODUCTION

Primary lithium cells and batteries were first introduced in military applications in the 1970s. At that time, little commercial interest and no industrial standards existed. Consequently, the United Nations (UN) Committee of Experts on the Transport of Dangerous Goods, although usually referring to industrial standards for testing and criteria, introduced a sub-section in the Manual of tests and criteria concerning safety tests relevant to transport of primary lithium cells and batteries. Meanwhile, commercial interest in primary and secondary (rechargeable) lithium cells and batteries has grown and several industrial standards exist. However, the existing IEC standards are manifold, not completely harmonized, and not necessarily relevant to transport. They are not suitable to be used as a source of reference in the UN Model Regulations. Therefore this group safety standard has been prepared to harmonize the tests and requirements relevant to transport.

This document applies to primary and secondary (rechargeable) lithium cells and batteries containing lithium in any chemical form: lithium metal, lithium alloy or lithium-ion. Lithium-metal and lithium alloy primary electrochemical systems use metallic lithium and lithium alloy, respectively, as the negative electrode. Lithium-ion secondary electrochemical systems use intercalation compounds (intercalated lithium exists in an ionic or quasi-atomic form within the lattice of the electrode material) in the positive and in the negative electrodes.

This document also applies to lithium polymer cells and batteries, which are considered either as primary lithium-metal cells and batteries or as secondary lithium-ion cells and batteries, depending on the nature of the material used in the negative electrode.

The history of transporting primary and secondary lithium cells and batteries is worth noting. Since the 1970s, over ten billion primary lithium cells and batteries have been transported, and since the early 1990s, over one billion secondary (rechargeable) lithium cells and batteries utilizing a lithium-ion system have been transported. As the number of primary and secondary lithium cells and batteries to be transported is increasing, it is appropriate to also include in this document the safety testing of packaging used for the transportation of these products.

This document specifically addresses the safety of primary and secondary lithium cells and batteries during transport and also the safety of the packaging used.

The UN Manual of Tests and Criteria [12]¹ distinguishes between lithium metal and lithium alloy cells and batteries on the one hand, and lithium ion and lithium polymer cells and batteries on the other hand. While it defines that lithium metal and lithium alloy cells and batteries can be either primary (non-rechargeable) or rechargeable, it always considers lithium ion cells and batteries as rechargeable. However, test methods in the UN Manual of Tests and Criteria are the same for both secondary lithium metal and lithium alloy cells and batteries and lithium ion and lithium polymer cells and batteries. The concept is only needed to distinguish between small and large battery assemblies. Battery assemblies assembled from (primary or secondary) lithium metal and lithium alloy batteries are distinguished by the aggregate lithium content of all anodes (measured in grams), while battery assemblies assembled from lithium ion or lithium polymer batteries are distinguished by their "nominal" energy (measured in Watt-hours).

¹ Numbers in square brackets refer to the Bibliography.

SAFETY OF PRIMARY AND SECONDARY LITHIUM CELLS AND BATTERIES DURING TRANSPORT

1 Scope

This International Standard specifies test methods and requirements for primary and secondary (rechargeable) lithium cells and batteries to ensure their safety during transport other than for recycling or disposal. Requirements specified in this document do not apply in those cases where special provisions given in the relevant regulations, listed in 7.3, provide exemptions.

NOTE Different standards may apply for lithium-ion traction battery systems used for electrically propelled road vehicles.

2 Normative references

There are no normative references in this document.

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Safety of primary and secondary lithium cells and batteries during transport

Sécurité des piles et des accumulateurs au lithium pendant le transport



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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

SÉCURITÉ DES PILES ET DES ACCUMULATEURS AU LITHIUM PENDANT LE TRANSPORT

AVANT-PROPOS

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La Norme internationale IEC 62281 a été établie conjointement par le comité d'études 35 de l'IEC: Piles, et le sous-comité 21A: Accumulateurs alcalins et autres accumulateurs à électrolyte non acide, du comité d'études 21 de l'IEC: Accumulateurs.

Cette quatrième édition annule et remplace la troisième édition parue en 2016. Cette édition constitue une révision technique.

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

- a) la définition de l'élément bouton révisée, a été intégrée à celle de (élément ou batterie) bouton;
- b) ajout de dispositions pour les batteries faisant partie intégrante du matériel (5.4);
- c) tous les essais pour accumulateurs intègrent désormais une exigence de 25 cycles de charge et de recharge avant l'essai.

- d) ajout dans l'Annexe B de tableaux alternatifs au Tableau 1 et au Tableau 2;
- e) ajout de "violent" aux critères de rupture;
- f) le rapport d'essai en 6.8 a été fusionné avec le certificat d'essai en 6.9 et remplacé par les éléments énumérés dans [12];
- g) ajout d'une Annexe B informative indiquant d'importants écarts par rapport au Manuel d'épreuves et de critères et de l'Organisation des Nations unies, Chapitre 38.3.

Le texte de cette norme est issu des documents suivants:

FDIS	Rapport de vote
35/1416/FDIS	35/1422/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 internationale.

Ce document a été rédigé selon les directives ISO/IEC, Partie 2.

Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous "<http://webstore.iec.ch>" dans les données relatives au document recherché. À cette date, le document sera

- reconduit,
- supprimé,
- remplacé par une édition révisée, ou
- amendé.

INTRODUCTION

Les piles au lithium ont d'abord été introduites dans les applications militaires dans les années 1970. À cette époque, elles présentaient peu d'intérêt commercial et il n'existait aucune norme industrielle. En conséquence, le Comité d'experts sur le Transport des marchandises dangereuses de l'Organisation des Nations unies, bien que se référant habituellement aux normes industrielles pour les essais et les critères d'acceptation, a introduit un sous-paragraphe dans le Manuel d'épreuves et de critères, traitant des essais de sécurité relatifs aux transports des piles au lithium. Pendant ce temps, l'intérêt commercial des piles et des accumulateurs au lithium s'est développé et plusieurs normes industrielles ont vu le jour. Bien que les normes IEC existantes soient nombreuses, elles ne sont pas complètement harmonisées et ne traitent pas nécessairement du transport. Elles ne sont pas appropriées pour être utilisées comme source de référence dans le règlement type des Nations Unies. En conséquence, la présente norme générique de sécurité a été établie afin d'harmoniser les essais et les exigences concernant le transport.

La présente Norme internationale s'applique aux piles et aux accumulateurs contenant du lithium sous quelque forme que ce soit: lithium-métal, alliage de lithium ou ion-lithium. Les piles utilisent des systèmes électrochimiques à base de lithium-métal et d'alliage de lithium comme électrode négative. Les accumulateurs utilisent les systèmes électrochimiques ion-lithium mettant en œuvre des composés d'intercalation (le lithium intercalé existant sous forme ionique ou quasi atomique dans la trame du matériau de l'électrode) dans les électrodes positives et négatives.

Le présent document s'applique également aux éléments et aux batteries de piles et d'accumulateurs au lithium polymère, qui sont définis soit comme des piles au lithium-métal, soit comme des accumulateurs ion-lithium selon la nature du matériau utilisé dans l'électrode négative.

L'histoire du transport des éléments et des batteries de piles et d'accumulateurs au lithium mérite d'être notée. Depuis les années 1970, plus de 10 milliards de piles au lithium ont été transportées, et depuis le début des années 1990 plus de 1 milliard d'accumulateurs au lithium utilisant le système ion-lithium ont été transportés. Le nombre de piles et d'accumulateurs à transporter étant en augmentation, il est également souhaitable d'inclure, dans le présent document, les essais de sécurité des emballages utilisés pour le transport de ces produits.

Le présent document concerne spécifiquement la sécurité des piles et des accumulateurs au lithium pendant le transport ainsi que la sécurité des emballages utilisés.

Le Manuel d'épreuves et de critères [12]¹ de l'Organisation des Nations unies fait la distinction entre les éléments et les batteries au lithium-métal et à l'alliage de lithium d'une part, et les éléments et les batteries ion-lithium et au lithium polymère, d'autre part. Tout en définissant que les éléments et les batteries au lithium-métal et à l'alliage de lithium peuvent constituer des piles ou des accumulateurs, il définit toujours les éléments et les batteries ion-lithium comme des accumulateurs. Cependant, les méthodes d'essai spécifiées dans le Manuel d'épreuves et de critères de l'ONU sont identiques tant pour les éléments et les batteries d'accumulateurs au lithium-métal et à l'alliage de lithium que pour les éléments et les batteries d'accumulateurs ion-lithium et au lithium polymère. Ce concept n'est nécessaire que pour différencier les assemblages de petites batteries des assemblages de grandes batteries. Les assemblages de batteries constitués à partir de batteries (piles ou accumulateurs) au lithium-métal et à l'alliage de lithium sont différenciés par le contenu total de lithium de toutes les anodes (mesuré en grammes). Les assemblages de batteries constitués à partir de batteries ion-lithium ou au lithium polymère sont différenciés par leur énergie "nominale" (mesurée en wattheures).

¹ Les chiffres entre crochets se réfèrent à la Bibliographie.

SÉCURITÉ DES PILES ET DES ACCUMULATEURS AU LITHIUM PENDANT LE TRANSPORT

1 Domaine d'application

La présente Norme internationale spécifie les méthodes d'essai et les exigences pour les éléments et les batteries de piles et d'accumulateurs au lithium afin de garantir leur sécurité pendant les opérations de transport autres que celles relatives à leur recyclage ou leur mise au rebut. Les exigences spécifiées dans le présent document ne s'appliquent pas aux cas bénéficiant d'exemptions accordées par des dispositions spéciales prévues dans les réglementations applicables énumérées en 7.3.

NOTE Différentes normes peuvent s'appliquer aux systèmes de batteries de traction ion-lithium utilisés pour les véhicules routiers électriques.

2 Références normatives

Le présent document ne contient aucune référence normative.