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BS ISO 17546:2016



BSI Standards Publication

Space systems — Lithium ion battery for space vehicles — Design and verification requirements

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Space systems — Lithium ion battery for space vehicles — Design and verification requirements

*Systèmes spatiaux — Batteries à ions lithium pour véhicules spatiaux
— Exigences de vérification et de conception*



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

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Introduction

This International Standard has been developed for the purpose of addressing the standard to obtain sustainable development and to prevent incident of lithium ion battery for space vehicle.

For battery developer and spacecraft system architects, this International Standard leads the way to assess the whole life cycle “from electrolyte filling to the end of the mission in space” and to clarify what is considered in the battery design phase and the processes to reach the appropriate verification.

It is important for lithium ion battery (LIB) for space vehicle to prevent performance defect in orbit and incident through the life cycle.

The three objectives in the life cycle, which are “performance”, “safety”, and comfortable “logistics”, aim to realize more reliable, more safe, and high efficient means at the same time for development of space vehicle batteries.

We address each objective as follows.

Performance

“How to estimate the life degradation at end of life”

Since LIB starts to degrade from activation, the consideration to meet the power requirement through the mission life is needed, that is, unaffected from handling conditions (temperature) and usage conditions in orbit (temperature, cycle, current or power and depth of discharge). Also, the risk in orbit could be mitigated based on the life estimation and unexpected degradation could be carefully avoided throughout the whole life cycle.

Safety

Here, we establish a complex risk assessment process that is easy to understand. The method was agreed internationally at ISO/IEC and is a traditional method for space use.

LIB needs to keep some amount of the SOC to avoid significant capacity degradation, so that the specific consideration and care for handling are required because of potential hazard source.

It is well known that LIB has specific risks with higher voltage when compared to other power sources and no saturation characteristic for overcharge.

The important thing is that the process, which can result to a hazardous situation, does not always immediately result to an incident. Because of these risks, LIB is considered hazardous at all times. The risk assessment needs to become very important to cover a variety of environment during the handling or use and history of stress.

Logistics

“How to bring the demand close to the general requirements to guarantee the safety and space quality”

From a wide-ranging point of view, the most important thing is to conduct life cycle assessment against performance and safety. For example, temperature history (especially high temperature history when cell is kept outdoors, where temperature is not controlled) and shocks/vibrations that cell receives during transport and electrical short when handling. Also, to reflect the results of handling or usage, measurement is needed.

All the personnel who owed responsibility of development, design, and handling are desired to survey and estimate the influence of their assessment spontaneously to improve for sustainable development of space component. As a result, a third party can evaluate the validity of the design and verification.

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Space systems — Lithium ion battery for space vehicles — Design and verification requirements

1 Scope

This International Standard specifies design and minimum verification requirements for lithium ion rechargeable (including lithium ion polymer) batteries for space vehicles.

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.

The focus of this International Standard is on “battery assembly” and cell is described as “component cells” to be harmonized with other industrial standards and regulations.

“Performance”, “safety”, and “logistics” are the main points of view to specify.

This International Standard does not address “disposal” or “recycle”; however, some recommendations regarding disposal are suggested.

1.1 Life cycle

The service life of a battery starts at cell activation and continues through all subsequent fabrication, acceptance testing, handling, storage, transportation, testing preceding launch, launch and mission operation.

The scope of this International Standard addresses the shelf life, from cell activation to launch, although the life design and evaluations of the battery on the ground need to accommodate to the whole mission life in space.

Each article in this International Standard addresses “performance”, “safety”, and “logistics”, according to the each stage of lifecycle.

NOTE Stages 3 and 5 include storage period which induce some performances verifications.