AUSTRALIAN RAIL INDUSTRY STANDARDS ORGANISATION

AS 7486

Rolling Stock Onboard Electrical Energy Storage

STANDARDS

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Advancing safety and productivity

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Development of this Standard was prepared by an Australian Rail Industry Standards Organisation (ARISO) Development Group consisting of representatives from the following organisations:

Metro Trains Melbourne, ESR Consulting, Freightquip Pty Ltd, SYSTRA, Mage Consulting, Innovation Industries Pty Ltd, Jacobs, 3ME Technology and Aurizon.

The Rolling Stock Standing Committee verified that ARISO's accredited process was followed in developing the product, before the ARISO Board approved the document for publication.

ARISO wishes to acknowledge the positive contribution of subject matter experts in the development of this Standard. Their efforts ranged from membership of the Development Group through to individuals providing comments on a draft of the Standard during the open review.

I commend this Standard to the Australasian rail industry as it represents industry good practice and has been developed through a rigorous process.

Alan Fedda
Chief Executive Officer
Australian Rail Industry Standards Organisation

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Document history

Publication Version	Effective Date	Reason for and Extent of Change(s)
2026	18 June 2026	This document has been reviewed to ensure it remains relevant and applicable. The latest review assessed the content, confirming that while updates were made to align with current industry practices, technologies, and regulatory requirements, the original authorship and copyright have been acknowledged as required.

Approval

Name	Date
Australian Rail Industry Standards Organisation Board	18 June 2026

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Preface

This Standard was prepared by the Rolling Stock Onboard Electrical Energy Storage Development Group, overseen by the ARISO Rolling Stock Standing Committee.

The major changes in this revision are as follows:

(a) Introduction of consistent national guidance to support the integration of onboard energy storage systems across rolling stock and rail networks.

(b) Clarification of system interfaces and requirements to improve interoperability between vehicles, systems and infrastructure.

(c) Alignment with international standards while addressing Australian operating conditions to support harmonisation.

(d) Enhanced safety, reliability and operational efficiency through structured lifecycle requirements for the design, integration and management of energy storage systems.

Objective

The objective of this document is to provide guidance to rail transport operators (RTOs) for the specification and utilization of onboard batteries and electric double-layer capacitors (EDLC) used for traction purposes (propulsion and braking).

This document provides guidance to ensure that they are used safely, effectively and reliably in the Australian context and networks, throughout the life of the energy storage system (ESS). This document provides a basis for RTOs, vehicle manufacturers and ESS manufacturers to understand and communicate the requirements on ESS.

The document provides guidance and an understanding of:

(a) ESS design principles to support safety and reliability;

(b) the ESS's through life assessment factors;

(c) the ESS testing and certification requirements; and

(d) the hazards and risks associated with the ESS integration into vehicles.

This document builds on existing national and international standards by providing additional guidance and requirements for ESS. See Appendix B for a summary of system and subsystem levels applicable to these standards.

Performance based requirements, recommendations and guidance do not replicate existing published requirements and recommendations.

Compliance

There are four types of provisions contained within Australian Standards developed by ARISO:

(a) Requirements.

(b) Recommendations.

(c) Permissions.

(d) Constraints.

Requirements – it is mandatory to follow all requirements to claim full compliance with the Standard. Requirements are identified within the text by the term 'shall'.

Recommendations – do not mention or exclude other possibilities but do offer the one that is preferred. Recommendations are identified within the text by the term ‘should’.

Recommendations recognize that there could be limitations to the universal application of the control, i.e. the identified control is not able to be applied or other controls are more appropriate or better.

For compliance purposes, where a recommended control is not applied as written in the standard it could be incumbent on the adopter of the standard to demonstrate their actual method of controlling the risk as part of their WHS or Rail Safety National Law obligations. Similarly, it could also be incumbent on an adopter of the standard to demonstrate their method of controlling the risk to contracting entities or interfacing organisations where the risk may be shared.

Permissions – conveys consent by providing an allowable option. Permissions are identified within the text by the term ‘may’.

Constraints – provided by an external source such as legislation. Constraints are identified within the text by the term ‘must’.

ARISO Standards identify known hazards relevant to the railway industry. Appendix A provides a non-exhaustive list of hazards relevant to the scope of this Standard.

Appendices in ARISO Standards may be designated either “normative” or “informative”. A "normative" appendix is an integral part of a Standard and compliance with it is a requirement, whereas an "informative" appendix is only for information and guidance.

Commentary

Commentary *C Preface*

This document includes a commentary on some of the clauses. The commentary directly follows the relevant clause, is designated by ‘C’ preceding the clause number and is printed in italics in a box. The commentary is for information and guidance and does not form part of the Standard.

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Section 1 Scope and general

1.1 Scope

This document provides the general design principles and safety requirements for energy storage systems (ESSs) that use batteries and/or electric double-layer capacitors (EDLCs) on new and modified rolling stock in Australia. The document focusses on the hazards and risks associated with lithium-ion batteries and EDLCs and their implementation.

The following is not included in the scope:

(a) Wayside energy storage.

(b) Wayside charging infrastructure excluding on-board interfaces.

(c) Energy storage technologies other than batteries or EDLCs.

(d) Any requirements and recommendations on other systems that are not explicitly related to supporting the ESS function and safety.

1.2 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:

- AS 7501:2019, *Rolling stock compliance certification*
- AS 7509:2017, *Rolling stock – Dynamic Behaviour*
- AS 7520:2023 (all parts), *Australian Railway Rolling Stock – Body Structural Requirements*
- AS 7529.1:2026, *Australian Railway Rolling Stock – Fire Safety*
- AS 7530:2018, *Electrical systems*
- AS 7722:2026, *EMC Management*
- AS 7770:2018, *Rail Cyber Security*
- EN 50126:2017, *Railway Applications – The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS) – Part 2: Systems Approach to Safety*
- IEC 60077-1:2017, Railway applications – Electric equipment for rolling stock – Part 1: General service conditions and general rules
- IEC 61881-3:2012, *Railway Applications – Rolling Stock Equipment – Capacitors for power electronics*
- IEC 62864-1:2016, *Railway Applications – Rolling Stock – Power supply with onboard energy storage system – Part 1: Series Hybrid System: Specifies general requirements for the onboard energy storage system at a system level*
- IEC 62928:2018, *Railway Applications – Rolling Stock – Onboard lithium-ion traction batteries*
- IEC 62933:2025, *Electrical energy storage (EES) systems – Part 5-2: Safety requirements for grid-integrated EES systems – Electrochemical-based systems*
- ISO/IEC/IEEE 15288:2023, *Systems and software engineering — System life cycle processes*
- UL 9540A:2025, *Test Method for Battery Energy Storage Systems (BESS)*