



AUSTRALIAN RAIL INDUSTRY
STANDARDS ORGANISATION

AS 7529.3

Rolling Stock Fire Safety – Part 3: Passenger

STANDARDS



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:

Alstom, Beacon Fire, Consilium Australia Pty Ltd, CSIRO, Egis, MTM, Queensland Rail, and Transport for NSW

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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2026	19 October 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	19 October 2026

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Preface

This standard was prepared by the Rolling Stock Fire Safety – Part 3: Passenger Development Group, overseen by the ARISO Rolling Stock Standing Committee.

The major changes in this revision are as follows:

- (a) Address new zero-emission technology such as lithium-ion batteries and hydrogen.
- (b) Update material testing requirements, particularly for train seats.
- (c) Update detection requirements to align with industry developments.
- (d) Update evacuation requirements to reduce the reliance on international standards.

Objective

The objective of this document is to provide requirements, recommendations and guidance for fire safety for passenger stock operating in Australia.

The requirements aim to ensure rolling stock is designed and maintained to reduce fire ignition risk, control fire growth, minimize fire impacts on people and operations, and support safe occupant egress and emergency intervention.

This document forms part of the AS 7529 series on rolling stock fire safety.

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.

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’.

Using 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.

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.

Commentary

Commentary *C Preface*

This Standard 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.

AS 7529.3 PREVIEW ONLY

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Section 1 Scope and general

1.1 Scope

This document applies to passenger rolling stock.

The document covers the design, construction and maintenance of rolling stock.

This document includes fire safety requirements for passenger rolling stock configured with zero-emission technology used for propulsion or auxiliary supply. This includes battery electric energy storage systems (ESS) and hydrogen fuel cell systems (HFS). These systems introduce distinct fire safety hazards compared to conventional diesel and electric traction.

Section 2 to Section 12 (inclusive) of this document apply to the design and construction of new passenger rolling stock.

Section 13 of this document applies to the maintenance, modification and refurbishment of existing passenger rolling stock.

Operation of rolling stock is not covered in this document.

Rolling stock used on light rail, cane railway and monorail networks are not covered in this document.

While it is not the intention to cover heritage rolling stock within the scope of this document, operators of heritage rolling stock fleets are encouraged to consider the requirements within this document and comply with them if reasonable to do so.

This document deals with explosion risks in the context of reducing the risk of a build-up of flammable gases that could result in an explosion. Mitigating the consequence of a blast from an explosion is not part of the scope of this document. Designers of HFS and ESS equipment would need to consider if blast consequence mitigation needs to be included to control these risks so far as is reasonably practicable (SFAIRP), separate to the requirements of this document.

The requirements of this document are aimed at reducing fire risk to life of passenger rail rolling stock occupants as well as the risks that a fire on such rolling stock could pose to the life safety of other users of the infrastructure.

Compliance with this document represents the minimum requirement under the designer's duties under *Rail Safety National Law*.

The requirements of this document do not address asset protection of either the passenger rolling stock or the infrastructure.

The requirements of this document do not contain any specific mitigations for fire safety risks associated with terrorism, or with fires following train-to-train collision and ignition.

At the time of preparing this document, it is noted that fires involving passenger-carried battery-powered consumer products (e.g. power banks, battery-powered personal mobility devices, etc.) are an emerging fire risk for passenger railways globally. While a small set of research identifies the potential size and growth rates of fires from these products, there has been no research conducted to evaluate the appropriateness of various rolling stock design elements to manage the risk of such fires. Without such reference material available, it is noted that this document contains no explicit control measures for fires involving passenger-carried battery-powered consumer products. These hazards need to be considered by an RSO as part of its RSNL and SFAIRP commitments.

1.2 General information

1.2.1 Zero-emission passenger rolling stock

Energy storage systems (ESS) and hydrogen fuel systems (HFS) present specific fire and explosion risks that are directly influenced by system size, configuration and chemical properties.

ESS capacity in rolling stock typically ranges from 50 kWh to over 15 MWh. The fire risk varies depending on the battery chemistry, housing, energy density and the battery management system. Battery chemistries with higher energy density typically present greater risks of thermal runaway, fire and gas release compared to chemistries designed for enhanced thermal stability and reduced propagation risk. Fire events can involve thermal propagation between cells, gas release, re-ignition after suppression or system failure due to inadequate thermal management.

Electric double-layer capacitors (EDLC) are also used in zero-emission rolling stock for regenerative braking, peak load reduction and short-term energy buffering. EDLCs provide high power density and rapid charge-discharge performance but have lower energy density compared to batteries. While their thermal runaway risk is typically lower than high-energy batteries, EDLCs contain electrolytes that can pose fire and gas release hazards under fault conditions.

HFS typically stores between 100 kg and 5 000 kg of hydrogen depending on the rolling stock type, storage method and operational range. Storage can involve compressed gaseous hydrogen at pressures typically between 350 and 700 bar or alternatively, cryogenic or liquefied hydrogen for larger-capacity systems. The associated hazards include high-pressure storage failure, dispersion of flammable gas creating explosive atmospheres, jet fires from uncontrolled releases and boiling liquid expanding vapour explosion risks in cryogenic systems. Hydrogen combustion can result in flames that are difficult to detect visually, presenting additional challenges for fire detection systems and emergency response.

1.2.2 Alignment with evolving technologies and industry trends

The provisions in this document are based on current practices, acknowledging that national and international standards for zero-emission rolling stock are continually evolving. As new battery chemistries, hydrogen fuel systems and alternative fuels like ammonia are developed, additional or updated safety requirements could become necessary.

Currently, this document does not include specific technical requirements or detailed safety provisions for ammonia-fuelled rolling stock. However, the general fire safety principles outlined herein could be applied where relevant, at the discretion of designers and RSOs.

1.2.3 Operational context

While this document defines design requirements to support fire safety, it does not prescribe operational responses to fire events. Decisions related to train stopping, crew evacuation and response coordination are the responsibility of an RSO in accordance with their safety management system (SMS) and applicable rail safety legislation.

Where performance-based solutions are applied, it is important that fire development timelines and evacuation timings are evaluated as part of demonstrating that the fire safety risk has been reduced SFAIRP.

1.2.4 Fire behaviour and infrastructure considerations for enclosed environments

Hydrogen-powered rolling stock in enclosed environments (such as tunnels) introduce particular fire and explosion risks due to the properties of hydrogen. These risks influence aspects of rolling stock design and can also inform infrastructure planning and operational practices.