

RISSB

RAIL INDUSTRY SAFETY AND STANDARDS BOARD

STANDARDS

AS 7655

Wayside Electrical
Charging Interfaces for
Battery Electric Rolling
Stock



Australian
STANDARD

Notice to users

This RiSSB product has been developed using input from rail experts from across the rail industry and represents good practice for the industry. The reliance upon or manner of use of this RiSSB product is the sole responsibility of the user who is to assess whether it meets their organisation's operational environment and risk profile.

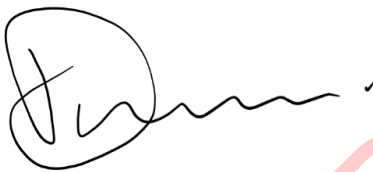
Development of this Standard was prepared by a Rail Industry Safety and Standards Board (RiSSB) Development Group consisting of representatives from the following organisations:

Aurizon, BHP, Pacific National, Transport for NSW, Metro Trains Melbourne, ARTC, Fortescue, Rio Tinto, Ozzy Tech, Wabtec, Plasser Australia, Systra

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

RiSSB 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.



Damien White
Chief Executive Officer
Rail Industry Safety and Standards Board

Keeping RiSSB products up-to-date

Products developed by RiSSB are living documents that reflect progress in science, technology and systems. To maintain their currency, RiSSB products are periodically reviewed, and new editions published when required. Between editions, amendments may be issued. Products developed by RiSSB could also be withdrawn.

It is important that readers assure themselves that the RiSSB product they are using is current, including any amendments that have been issued since the product was published. Information about RiSSB products, including amendments, can be found by visiting www.rissb.com.au.

RiSSB welcomes suggestions for improvements and asks readers to notify us immediately of any apparent inaccuracies or ambiguities. Members are encouraged to use the change request feature of the RiSSB website at: <http://www.rissb.com.au/products/>. Otherwise, please contact us via email at info@rissb.com.au or write to Rail Industry Safety and Standards Board, PO Box 518 Spring Hill Qld 4004, Australia.

Document details

First published as: AS 7655:2025

ISBN: 978 1 76175 094 6

Document history

Publication Version	Effective Date	Reason for and Extent of Change(s)
2025	7 March 2025	Initial version

Approval

Name	Date
Rail Industry Safety and Standards Board	19 February 2025

Copyright

© RISSB

All rights are reserved. No part of this work can be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of RISSB, unless otherwise permitted under the Copyright Act 1968.

Published by the Rail Industry Safety and Standards Board, PO Box 518 Spring Hill Qld 4004, Australia.

Preface

This standard was prepared by the Wayside Electrical Charging Interfaces for Battery Electric Rolling Stock Development Group, overseen by the RISSB Rolling Stock Standing Committee.

Objective

The purpose of this Standard is to specify the requirements for wayside electrical charging interfaces for battery electric powered rolling stock within the ANZ rail industry to assist RSO's in developing, designing, acquiring, testing and integrating battery electric rail vehicles into their fleets as part of industry wide decarbonization initiatives.

Compliance

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

- (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'.

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.

RISSB Standards address known hazards within the railway industry. Hazards, and clauses within this Standard that address those hazards, are listed in Appendix A.

Appendices in RISSB 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 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.

Table of Contents

Section 1	Scope and general.....	7
1.1	Scope	7
1.2	Normative references	7
1.3	Defined terms and abbreviations.....	8
Section 2	General requirements	12
2.1	General compliance with applicable regulations and standards	12
2.2	Safety in design	12
2.3	Fire safety.....	12
2.4	Environmental considerations	13
2.5	Environmental impact and sustainability.....	13
2.6	Reliability, availability, maintainability (RAM)	13
2.7	Traction return rail(s) and overhead line ‘drop zone(s)’	13
2.8	Structure outline, track gauge and multiple gauge track areas.....	14
2.9	Signalling and control system interface	14
2.10	Authenticity, confidentiality and integrity/cyber security	14
2.11	Digital communication	14
2.11.1	Harmonic limits	14
2.11.2	Power factor.....	15
2.11.3	Load balance	15
2.11.4	Voltage fluctuations	15
2.12	EMC/EMF/EMI.....	15
2.13	Installation instructions.....	16
2.14	Safety alarms.....	16
2.15	Emergency stop buttons	16
2.16	Safety integrity levels.....	16
Section 3	Static charging via plug-in receptacle.....	17
3.1	System components and specifications	17
3.2	External charging unit	18
3.3	Voltage converter unit (VCU) ratings and components.....	19
3.4	Ingress protection and access to electrically energised areas.....	20
3.5	Internal wiring.....	20
3.6	Adaptors and extension cords	20
3.7	Earthing provisions.....	20
3.8	Charging connection cable	20
3.9	Plug-in connector (charger outlet/vehicle connector).....	21
3.10	Plug-in receptacle (vehicle inlet/outlet).....	21
3.11	Communication and control system	22
3.12	Interface with BERV.....	22
3.13	Safety measures	22
3.14	Human factors.....	23

3.15	Spacing and connection location	23
3.16	Manual handling	24
3.17	Process of operation	24
3.18	Emergency stop.....	25
Section 4	DC static charging via roof mounted conductors (via reverse pantograph or similar interface).....	26
4.1	System components and specifications	26
4.2	Charging unit	26
4.3	VCU ratings.....	27
4.4	Ingress protection and access to electrically energised areas.....	27
4.5	Cooling system and moisture control	28
4.6	Internal wiring	28
4.7	Reverse pantograph	28
4.8	Earthing provisions.....	28
4.9	Reverse pantograph physical specifications	28
4.10	Safety measures	28
4.11	Communication and control system	29
4.12	Interface with BERV.....	29
4.13	Human factors.....	29
4.14	Connection location	29
4.15	Manual handling	30
4.16	Process of operation	30
4.17	Emergency stop.....	31
4.18	Security.....	31
Section 5	Static and dynamic charging via traditional OLE/pantograph interface or third rail (Up to 25 kV AC or 1,500 V DC)	32
5.1	OLE/Pantograph interface specifications.....	32
5.2	Third rail interface specifications	33
5.3	Requirements for dynamic charging/discharging	33
5.4	Safety measures	33
5.5	Communication & control system	34
5.6	Interface with BERV.....	34
5.7	Human factors.....	34
5.8	Connection/charging location.....	34
5.9	Manual handling	35
5.10	Process of operation	35
5.11	Emergency stop.....	36
5.12	Handshaking.....	36
Section 6	Battery tender vehicles	37
6.1	On-rail static charging for battery swap systems.....	37
6.2	On-rail dynamic charging for battery tender vehicles	37
6.3	Safety measures	38

6.4	Communication system.....	38
6.5	Interface with BERV.....	38
6.6	Human factors.....	38
6.7	Connection location.....	38
6.8	Process of operation.....	40
6.9	Emergency stop.....	40
Section 7	Mobile charging system.....	41
7.1	Requirements for mobile charging system.....	41
7.2	Mobile charger design.....	41
Appendix A	Hazard Register (Informative).....	42
Appendix B	Additional Relevant Regulations, Standards and Guidelines for Charging Systems (Informative).....	44
	Bibliography (Informative).....	46

Figures

Figure 1	Typical interface between regulated plug-in charger and on-board BERV system.....	18
Figure 2	Typical interface between un-regulated plug-in charger and on-board BERV system.....	19
Figure 3	Typical interface between regulated DC static charging via roof mounted conductors and on-board BERV system.....	26
Figure 4	Typical interface between un-regulated DC static charging via roof mounted conductors and on-board BERV system.....	27
Figure 5	Typical interface between OLE and BERV via on-board pantographs.....	32
Figure 6	Typical interface between charging infrastructure, BEV and a BERV.....	39
Figure 7	Typical interface between charging infrastructure, BEV and a BERV (converter on-board).....	39

Section 1 Scope and general

1.1 Scope

This Standard outlines a consistent approach to the electrical charging interfaces between wayside infrastructure and rolling stock to provide alignment between standards for traction power equipment, charging infrastructure design, solutions for different charging strategies and rolling stock with onboard traction energy storage systems for the purposes of charging onboard energy storage systems. The aim of this Standard is to promote seamless integration and interoperability across different ANZ rail networks to reduce cost and complexity.

The Standard provides requirements for the following charging systems:

- (a) DC static charging via plug-in receptacle (both low and high-power charging);
- (b) DC static charging via roof mounted conductors (via a reverse pantograph or similar interface) - with charging control and intelligence contained within the wayside charging equipment;
- (c) overhead traditional pantograph static and dynamic charging via OLE/pantograph interface or 3rd rail (Up to 25 kV AC or 1,500 V DC, see note) with onboard charging control and intelligence;
- (d) battery tender vehicles; and
- (e) mobile charging systems.

NOTE:

A maximum of 25 kV AC and 1,500 V DC was specified based on systems considered, compatibility with existing OLE/rolling stock systems, and development group consensus at the time of writing this Standard.

The Standard excludes:

- (f) requirements for infrastructure upstream of the charging system input terminals (i.e., the wiring section isolator in the case of traditional pantograph) or downstream of the battery electric rail vehicle input terminals (i.e., collector bar/pantograph connection point or receptacle plug on rail vehicle);
- (g) battery systems that involve replaceable batteries intended to be physically removed from the BERV for the purposes of charging and reinstated on the vehicle once charged;
- (h) off rail and vehicle-to-vehicle charging systems; and
- (i) ground-based charging systems including wireless inductive coupling.

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 1319, *Safety signs for the occupational environment*
- AS 2067, *Substations and high voltage installations exceeding 1 kV AC*
- AS 4024, *Safety of machinery*
- AS 7470, *Human Factors Integration in Engineering Design – General Requirements*
- AS 7505, *Signalling Detection Interface*