

AS 1085.20:2020



Railway track materials, Part 20: Welding of steel rail

RiSSB
RAIL INDUSTRY SAFETY AND STANDARDS BOARD

Infrastructure Standard



This Australian Standard® AS 1085.20 Railway track materials, Part 20: Welding of steel rail was prepared by a Rail Industry Safety and Standards Board (RISSB) Development Group consisting of representatives from the following organisations:

ARTC	Aurizon Network	BHP Billiton
Goldschmidt	John Holland Group	LMATS
Monash Institute of Railway Technology	Pandrol	Queensland Rail
Rail Technology International	Rio Tinto	

The Standard was approved by the Development Group and the Infrastructure Standing Committee in June, 2020. On June 23, 2020 the RISSB Board approved the Standard for release.

This Standard was issued for public consultation.

Development of the Standard was undertaken in accordance with RISSB's accredited process. As part of the approval process, the Standing Committee verified that proper process was followed in developing the Standard

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 comment 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.



Deb Spring
Exec. Chair / CEO
Rail Industry Safety and Standards Board

Keeping Standards up-to-date

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 Australian Standards developed by RISSB could also be withdrawn.

It is important that readers assure themselves they are using a current Australian Standard developed by RISSB, which should include any amendments that have been issued since the Standard was published. Information about Australian Standards developed by RISSB, 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.

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.

AS 1085.20:2020

Railway track materials, Part 20: Welding of steel rail

Document details

First published as: AS 1085.20:2020

ISBN 978-1-76072-891-5

Document history

Publication Version	Effective Date	Reason for and Extent of Change(s)
2020	June 23, 2020	First publication 1085.20:2020

Approval

Name	Date
Rail Industry Safety and Standards Board	June 23, 2020

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 SAI Global Limited under licence from the Rail Industry Safety and Standards Board, PO Box 518 Spring Hill Qld 4004, Australia

This Standard was prepared by the Rail Industry Safety and Standards Board (RISSB) Development Group AS 1085.20 Railway track materials, Part 20: Welding of steel rail. Membership of this Development Group consisted of representatives from the organisations listed on the inside cover of this document

This Standard supersedes previous versions of AS 1085.20 in whole.

Objective

The objective of this Standard is to provide owners and maintainers of railway track with specifications for and means of qualification of welding procedures for use with rail steel in railway track.

This Standard does not address the conditions under which the procedures that are described are to be used.

This Standard is not intended to cover welding of worn steel rails using flash butt or aluminothermic welds. However, the principles and procedures may be adapted for the joining of worn rails.

It is not intended to cover existing welds.

This Standard is Part 20 of the AS 1085 (Railway track material) series.

Changes in the 2020 version include:

- a) revised production tests.
- b) annual requalification tests.
- c) the introduction of additional magnetic particle inspections and phased array ultrasonic tests.
- d) clarifications on the microstructural requirements for flash butt welds.

Compliance

There are two types of control contained within Australian Standards developed by RISSB:

- 1. Requirements.
- 2. Recommendations.

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 recognise 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.

Controls in RISSB standards address known railway hazards are addressed in an Appendix A.

Any existing aluminothermic welding or arc welding procedures evidenced to meet the testing requirements of AS 1085.15:1995, AS 1085.20: 2006 or AS 1085.20: 2012 will not need to be requalified unless requalification triggers specified in this Standard have occurred.

Contents

1	Scope and general	6
1.1	Scope	6
1.2	Normative references.....	6
1.3	Terms, definitions, and symbols.....	7
2	Basic requirements.....	10
2.1	General.....	10
2.2	Qualification of the welding procedure	10
2.3	Qualification of welding personnel.....	11
2.4	Documentation.....	11
2.5	Testing.....	11
2.6	Defects	12
3	Fixed plant flash butt welding.....	14
3.1	General.....	14
3.2	Description of the process.....	14
3.3	Qualifying flash butt welding set-up.....	14
3.4	Job document	15
3.5	Welding procedure.....	15
3.6	Maintenance of equipment.....	16
3.7	Inspection and testing of finished welds	16
3.8	Marking and records	18
4	Mobile flash butt welding	19
4.1	General.....	19
4.2	Description of the process.....	19
4.3	Qualifying flash butt welding set-up.....	20
4.4	Job document	20
4.5	Welding procedure.....	21
4.6	Maintenance of equipment.....	22
4.7	Inspection and testing of finished welds	22
4.8	Marking and records	23
5	Aluminothermic welding.....	25
5.1	General.....	25
5.2	Description of process	25
5.3	Qualifying the welding procedure	25
5.4	Job document	26
5.5	Welding procedure.....	26
5.6	Maintenance of equipment.....	27
5.7	Inspection and testing of finished welds	28
5.8	Marking and records	28
6	Aluminothermic rail head repair welding	30
6.1	General.....	30

6.2	Description of process	30
6.3	Qualifying the welding procedure	30
6.4	Job document	31
6.5	Welding procedure	31
6.6	Maintenance of equipment	32
6.7	Inspection and testing of finished welds	33
6.8	Marking and records	33
7	Electric arc rail head repair welding	35
7.1	General	35
7.2	Descriptions of welding methods	35
7.3	Qualifying the welding procedure	35
7.4	Job document	35
7.5	Welding procedure	36
7.6	Maintenance of equipment	37
7.7	Inspection and testing of finished weld	37
7.8	Markings and records	38

Appendix Contents

Appendix A	Hazard register	39
Appendix B	Guidance on this Standard	40
Appendix C	Information to be supplied by purchaser	42
Appendix D	Qualification of welding personnel	43
Appendix E	Visual inspection and alignment	45
Appendix F	Non-destructive testing	51
Appendix G	Hardness tests	62
Appendix H	Macroscopic tests	69
Appendix I	Microscopic test	72
Appendix J	Chemical analysis	76
Appendix K	Slow bend test	77
Appendix L	Fatigue tests	79
Appendix M	Qualification of a flash butt welding procedure	87
Appendix N	Qualification of an aluminothermic welding procedure	91
Appendix O	Qualification of an arc welding procedure	104
Appendix P	Air quenching of flash butt welds	106
Appendix Q	Conventional and phased array ultrasonic testing procedure	111
Appendix R	Bibliography	117

1 Scope and general

1.1 Scope

This Standard specifies requirements for the qualification of welds in steel rail manufactured in accordance with AS 1085.1 or rails that are shown to be metallurgically compatible for use in railway track. The following welding processes are covered:

- (a) Joining of rails by flash butt welding or aluminothermic fusion welding.
- (b) Repair of the railhead by arc welding or aluminothermic fusion welding.

The Standard does not provide strength properties of welds for use in design, apply to the aluminothermic or flash butt welding of tri-metal steel assemblies, or cover the welding of austenitic manganese steels.

NOTES:

1. This Standard is only intended for steel rails used in railway tracks and does not apply to any other applications.
2. Rail produced to specifications other than AS 1085.1 will require a separate qualification process. Appropriate testing and acceptance requirements will also need to be determined.
3. Other welding processes may be used if the welds produced meet all requirements identified in this Standard and are accepted by the rail infrastructure manager.
4. Additional guidance on this Standard is given in Appendix B.

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 1003 Engineers' straightedges (metric units)
- AS 1085.1 Railway track materials, Part 1: Steel rails
- AS 1816.1 Metallic materials—Brinell hardness test, Part 1: Test method (ISO 6506-1:2005, MOD)
- AS 1817.1 Metallic materials—Vickers hardness test, Part 1: Test methods (ISO 6507-1:1997, MOD)
- AS 2083 Calibration blocks and their methods of use in ultrasonic testing
- AS 2193 Calibration and classification of force-measuring systems
- AS 2205.5.1 Methods for destructive testing of welds in metal, Method 5.1: Macro metallographic tests for cross-section examination
- AS 2205.6.1 Methods for destructive testing of welds in metal, Method 6.1: Weld joint hardness test
- AS 2207 Non-destructive testing—Ultrasonic testing of fusion welded joints in carbon and low alloy steel
- ISO 9712 Non-destructive testing—Qualification and certification of NDT personnel

NOTE: Documents for informative purposes are listed in a Bibliography at the back of the Standard as Appendix R.