

Australian Standard<sup>®</sup>

**Railway track material**

**Part 20: Welding of steel rail**

**STANDARDS**  
Australia



This Australian Standard® was prepared by Committee CE-002, Railway Track Materials. It was approved on behalf of the Council of Standards Australia on 29 June 2012. This Standard was published on 29 November 2012.

---

The following are represented on Committee CE-002:

- Australasian Railway Association
  - Australian Chamber of Commerce and Industry
  - Australian Industry Group
  - Bureau of Steel Manufacturers of Australia
  - Monash University
  - Rail Track Association Australia
  - Railway Technical Society of Australasia
  - The Permanent Way Institute
- 

This Standard was issued in draft form for comment as DRAFT AS 1085.20.

Standards Australia wishes to acknowledge the participation of the expert individuals that contributed to the development of this Standard through their representation on the Committee and through the public comment period.

---

#### **Keeping Standards up-to-date**

Australian Standards® are living documents that reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued.

Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments that may have been published since the Standard was published.

Detailed information about Australian Standards, drafts, amendments and new projects can be found by visiting [www.standards.org.au](http://www.standards.org.au)

Standards Australia welcomes suggestions for improvements, and encourages readers to notify us immediately of any apparent inaccuracies or ambiguities. Contact us via email at [mail@standards.org.au](mailto:mail@standards.org.au), or write to Standards Australia, GPO Box 476, Sydney, NSW 2001.

---

Australian Standard<sup>®</sup>

**Railway track material**

**Part 20: Welding of steel rail**

Original as AS 1085.15—1995.  
Previous edition AS 1085.20—2006.  
Second edition 2012.

**COPYRIGHT**

© Standards Australia Limited

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

Published by SAI Global Limited under licence from Standards Australia Limited, GPO Box 476, Sydney, NSW 2001, Australia

ISBN 978 1 74342 282 3

## PREFACE

This Standard was prepared by the Standards Australia Committee CE-002, Railway Track Materials, to supersede AS 1085.20—2006.

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 rails using flash butt or aluminothermic welds. However, the principles and procedures may be adapted for the welding of worn rails.

It is not intended to cover existing welds.

Changes to the 2006 edition include the following:

- (a) Introduction of aluminothermic head repair welding.
- (b) Test methods aligned with current European test methods (where required).
- (c) Revised procedures for non-destructive testing of welds.
- (d) Revised qualification procedures for the fatigue performance of aluminothermic welds.

Any existing welding procedures tested to AS 1085.25—1995 or AS 1085.20—2006 will be accepted as qualified to this Standard and no further testing is required. Any new welding process will need to be tested to the requirements of this Standard.

Statements expressed in mandatory terms in notes to figures are deemed to be requirements of this Standard.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the Appendix to which they apply. A 'normative' Appendix is an integral part of a Standard, whereas an 'informative' Appendix is only for information and guidance.

## CONTENTS

	<i>Page</i>
<b>SECTION 1 SCOPE AND GENERAL</b>	
1.1 SCOPE.....	5
1.2 PURPOSE AND CONTEXT OF USE.....	5
1.3 REFERENCED DOCUMENTS.....	6
1.4 DEFINITIONS.....	6
1.5 NOTATION.....	10
1.6 BASIC REQUIREMENTS .....	10
1.7 QUALIFICATION OF THE WELDING PROCESS .....	11
1.8 QUALIFICATION OF WELDING PERSONNEL .....	11
1.9 DOCUMENTATION.....	11
1.10 TESTING.....	12
<b>SECTION 2 FLASH BUTT WELDING</b>	
2.1 GENERAL.....	13
2.2 DESCRIPTION OF THE PROCESS .....	13
2.3 QUALIFYING THE WELDING PROCEDURE .....	14
2.4 JOB DOCUMENT .....	14
2.5 WELDING PROCEDURE.....	14
2.6 MAINTENANCE OF EQUIPMENT .....	15
2.7 INSPECTION AND TESTING OF FINISHED WELDS.....	15
2.8 MARKING AND RECORDS .....	16
<b>SECTION 3 ALUMINOTHERMIC WELDING</b>	
3.1 GENERAL.....	17
3.2 DESCRIPTION OF THE PROCESS .....	17
3.3 QUALIFYING THE WELDING PROCEDURE .....	17
3.4 JOB DOCUMENT .....	18
3.5 WELDING PROCEDURE .....	18
3.6 MAINTENANCE OF EQUIPMENT .....	19
3.7 INSPECTION AND TESTING OF FINISHED WELDS.....	19
3.8 MARKING AND RECORDS .....	20
<b>SECTION 4 ALUMINOTHERMIC RAIL HEAD REPAIR WELDING</b>	
4.1 GENERAL.....	21
4.2 DESCRIPTION OF THE PROCESS .....	21
4.3 QUALIFYING THE WELDING PROCEDURE .....	22
4.4 JOB DOCUMENT .....	22
4.5 WELDING PROCEDURE.....	22
4.6 MAINTENANCE OF EQUIPMENT .....	23
4.7 INSPECTION AND TESTING OF FINISHED WELDS.....	23
4.8 MARKING AND RECORDS .....	24
<b>SECTION 5 ARC RAIL HEAD REPAIR WELDING</b>	
5.1 GENERAL.....	25
5.2 DESCRIPTIONS OF WELDING METHODS.....	25
5.3 QUALIFYING THE WELDING PROCEDURE .....	25
5.4 JOB DOCUMENT .....	25
5.5 WELDING PROCEDURE.....	26
5.6 MAINTENANCE OF EQUIPMENT .....	27

	<i>Page</i>
5.7 INSPECTION AND TESTING OF FINISHED WELD.....	27
5.8 MARKING AND RECORDS.....	28

## APPENDICES

A COMMENTARY ON THE STANDARD.....	29
B INFORMATION TO BE SUPPLIED WHEN SPECIFYING WELDING FOR STEEL RAIL .....	31
C PRODUCT CONFORMITY .....	32
D QUALIFICATION OF PERSONNEL .....	34
E VISUAL INSPECTION AND ALIGNMENT .....	35
F NON-DESTRUCTIVE TESTING .....	40
G HARDNESS TESTS.....	44
H MACROSCOPIC TESTS.....	55
I MICROSCOPIC TEST .....	58
J CHEMICAL ANALYSIS .....	61
K SLOW BEND TEST.....	62
L FATIGUE TESTS.....	64
M QUALIFICATION OF A FLASH BUTT WELDING PROCEDURE .....	71
N QUALIFICATION OF AN ALUMINOTHERMIC WELDING PROCEDURE .....	75
O QUALIFICATION OF AN ARC WELDING PROCEDURE.....	88

**STANDARDS AUSTRALIA****Australian Standard  
Railway track material****Part 20: Welding of steel rail****SECTION 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 equivalent, 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 nor cover the welding of austenitic manganese steels.

**NOTES:**

- 1 Rail steel is considered to be very difficult to weld for structural purposes. It is not recommended that welded rail be used in applications other than railway track.
- 2 Rail produced to specifications other than AS 1085.1 may require a separate qualification process. Appropriate testing may need to be determined.

**1.2 PURPOSE AND CONTEXT OF USE****1.2.1 Function**

Rail welds join lengths of rail or restore some part of the rail in railway track. They connect the rails together maintaining the quantities of the rail across the join. Rail welds may also be used to repair damage to the rail surface.

**1.2.2 Action**

Rail welds are subjected to —

- (a) loads imposed by the passage of rolling stock and during maintenance;
- (b) loads generated by thermal effects on the rail and by ballast movement; and
- (c) fatigue, wear, corrosion and other damage.