

Australian Standard™

**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 7 November 2005.  
This Standard was published on 28 February 2006.

---

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  
Rail Track Association Australia

---

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

Standards are living documents which 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 Standards may also be withdrawn.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 which may have been published since the Standard was purchased.

Detailed information about Standards can be found by visiting the Standards Web Shop at [www.standards.com.au](http://www.standards.com.au) and looking up the relevant Standard in the on-line catalogue.

Alternatively, the printed Catalogue provides information current at 1 January each year, and the monthly magazine, *The Global Standard*, has a full listing of revisions and amendments published each month.

Australian Standards™ and other products and services developed by Standards Australia are published and distributed under contract by SAI Global, which operates the Standards Web Shop.

We also welcome suggestions for improvement in our Standards, and especially encourage 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 the Chief Executive, Standards Australia, GPO Box 476, Sydney, NSW 2001.

---

*This Standard was issued in draft form for comment as DR 04304.*

Australian Standard™

**Railway track material**

**Part 20: Welding of steel rail**

Originally as AS 1085.15—1995.  
Revised and redesignated as AS 1085.20—2006.

**COPYRIGHT**

© Standards Australia

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.

Published by Standards Australia GPO Box 476, Sydney, NSW 2001, Australia

ISBN 0 7337 7292 7

## PREFACE

This Standard was prepared by the Standards Australia Committee CE-002, Railway Track Materials, to supersede AS 1085.15—1995, *Railway permanent way material, Part 15: Aluminothermic rail welding*.

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

As this is a new Standard, it is expected that existing welding procedures will be accepted as qualified to this Standard (see Appendix A).

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 1995 edition include the following:

- (a) Introduction of performance requirements for aluminothermic rail welding rather than control of consumables.
- (b) Qualification procedure for the personnel.
- (c) Flash butt welding included.
- (d) Metal arc welding included.
- (e) Describes the procedure for qualifying and qualifying a welding process.
- (f) Includes test methods harmonized with proposed European test methods.
- (g) Fatigue performance now assessed using a series of tests known as a staircase.

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 BASIC REQUIREMENTS .....  | 6           |
| 1.5 QUALIFICATION OF THE WELDING PROCESS .....                              | 7           |
| 1.6 QUALIFICATION OF WELDING PERSONNEL .....                                | 7           |
| 1.7 DOCUMENTATION.....  | 7           |
| 1.8 TESTING .....   | 7           |
| 1.9 DEFINITIONS .....   | 8           |
| 1.10 NOTATION .....   | 10          |
| <b>SECTION 2 FLASH BUTT WELDING</b>   |             |
| 2.1 GENERAL .....   | 12          |
| 2.2 DESCRIPTION OF THE PROCESS .....  | 12          |
| 2.3 QUALIFYING THE WELDING PROCEDURE .....                                  | 12          |
| 2.4 JOB DOCUMENT.....   | 13          |
| 2.5 WELDING PROCEDURE .....   | 13          |
| 2.6 MAINTENANCE OF EQUIPMENT.....   | 14          |
| 2.7 INSPECTION AND TESTING OF FINISHED WELDS .....                          | 14          |
| 2.8 MARKING AND RECORDS.....  | 15          |
| <b>SECTION 3 ALUMINOTHERMIC WELDING</b>                                     |             |
| 3.1 GENERAL .....   | 16          |
| 3.2 DESCRIPTION OF THE PROCESS.....   | 16          |
| 3.3 QUALIFYING THE WELDING PROCEDURE .....                                  | 16          |
| 3.4 JOB DOCUMENT.....   | 16          |
| 3.5 WELDING PROCEDURE .....   | 17          |
| 3.6 MAINTENANCE OF EQUIPMENT.....   | 18          |
| 3.7 INSPECTION AND TESTING OF FINISHED WELDS .....                          | 18          |
| 3.8 MARKING AND RECORDS.....  | 18          |
| <b>SECTION 4 ARC WELDING</b>  |             |
| 4.1 GENERAL .....   | 20          |
| 4.2 DESCRIPTIONS OF WELDING METHODS .....                                   | 20          |
| 4.3 QUALIFYING THE WELDING PROCEDURE .....                                  | 20          |
| 4.4 JOB DOCUMENT.....   | 21          |
| 4.5 WELDING PROCEDURE .....   | 21          |
| 4.6 MAINTENANCE OF EQUIPMENT.....   | 22          |
| 4.7 INSPECTION AND TESTING OF FINISHED WELD.....                            | 22          |
| 4.8 MARKING AND RECORDS.....  | 23          |
| <b>APPENDICES</b>   |             |
| A COMMENTARY ON THE STANDARD .....  | 24          |
| B INFORMATION TO BE SUPPLIED WHEN SPECIFYING WELDING FOR<br>STEEL RAIL..... | 26          |
| C MEANS FOR DEMONSTRATING COMPLIANCE WITH THIS STANDARD .....               | 27          |
| D QUALIFICATION OF PERSONNEL .....  | 29          |
| E VISUAL INSPECTION AND ALIGNMENT .....                                     | 30          |

|   |  |    |
|---|--|----|
| F | ULTRASONIC TESTING.....                                    | 34 |
| G | HARDNESS TESTS.....  | 39 |
| H | MACROSCOPIC TESTS .....                                    | 44 |
| I | MICROSCOPIC TESTS.....                                     | 46 |
| J | CHEMICAL ANALYSIS .....                                    | 48 |
| K | SLOW BEND TEST.....  | 49 |
| L | FATIGUE TEST.....  | 51 |
| M | QUALIFICATION OF A FLASH BUTT WELDING PROCEDURE .....      | 58 |
| N | QUALIFICATION OF AN ALUMINOTHERMIC WELDING PROCEDURE ..... | 61 |
| O | QUALIFICATION OF AN ARC WELDING PROCEDURE.....             | 70 |

Currently in preview, click buy full version.

**STANDARDS AUSTRALIA****Australian Standard  
Railway track material****Part 20: Welding of steel rail****SECTION 1 SCOPE AND GENERAL****1.1 SCOPE**

This Standard specifies performance requirements for welds in steel rail in accordance with AS 1085.1 or rails that are shown to be metallurgically equivalent, for use in railway track. The following processes are covered:

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

This Standard covers the joining of rails and the repair of the railhead by welding using the processes described. Other welding is outside the scope of this Standard and should be covered by documentation other than this Standard.

The Standard does not provide strength properties of welds for use in design nor cover the welding of austenitic manganese steels.

**NOTES:**

- 1 Commentary on the background to the Standard is given in Appendix A.
- 2 Guidance on information to be supplied when ordering or supplying is given in Appendix B.
- 3 Guidance on the means for demonstrating compliance with this Standard is given in Appendix C.
- 4 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.
- 5 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 rail together maintaining the qualities 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 subject 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.