

Australian/New Zealand Standard™

Structural steel welding

Part 1: Welding of steel structures

AS/NZS 1554.1:2004

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee WD-003, Welding of Structures. It was approved on behalf of the Council of Standards Australia on 19 December 2003 and on behalf of the Council of Standards New Zealand on 5 March 2004.

This Standard was published on 24 March 2004.

The following are represented on Committee WD-003:

Australian Chamber of Commerce and Industry
Australian Industry Group
AUSTROADS
Bureau of Steel Manufacturers of Australia
Electricity Supply Association of Australia
Institute of Engineers Australia
New Zealand Heavy Engineering Research Association
New Zealand Non-destructive Testing Association
Steel Reinforcement Institute of Australia
University of Sydney
Welding Technology Institute of 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 Standards may also be withdrawn.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 joint Australian/New Zealand Standards can be found by visiting the Standards Web Shop at www.standards.com.au or Standards New Zealand web site at www.standards.co.nz and looking up the relevant Standard in the on-line catalogue.

Alternatively, both organizations publish an annual printed Catalogue with full details of all current Standards. For more frequent listings or notification of revisions, amendments and withdrawals, Standards Australia and Standards New Zealand offer a number of update options. For information about these services, users should contact their respective national Standards organization.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Please address your comments to the Chief Executive of either Standards Australia or Standards New Zealand at the address shown on the back cover.

Australian/New Zealand Standard™

Structural steel welding

Part 1: Welding of steel structures

Originated in Australia as AS CA8—1933.
Originated in New Zealand, in part, as NZS 4701:1981.
Previous edition AS/NZS 1554.1:2000.
Seventh edition 2004.
Reissued incorporating Amendment No. 1 (January 2005).

COPYRIGHT

© Standards Australia/Standards New Zealand

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.

Jointly published by Standards Australia, GPO Box 5420, Sydney, NSW 2001 and Standards New Zealand, Private Bag 2439, Wellington 6020

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee WD-003, Welding of Structures, to supersede AS/NZS 1554.1—2000.

This Standard incorporates Amendment No. 1 (January 2005). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

The objective of this Standard is to provide rules for the welding of a wide range of steel constructions and while it is expected that its main use will be for statically loaded welds, it applies also to some welds subject to fatigue. Although this Standard has been specifically prepared for steel structures, it may be usefully applied to machine frames and other types of steel constructions.

A1 This edition incorporates the following major changes to the 2000 edition:

(a) *Amendments to the following Clauses:*

1.6(a)(i), 1.6(a)(ii), 1.6(b)(i), 1.6(b)(ii), 1.6(b)(iii), 1.7 (new NOTE), 1.8.2 (NOTE deleted), 1.8.3 (new Clause), 2.1 (last paragraph and NOTE), 2.3.4, 3.3.1 (first paragraph), 4.1.2 (first sentence), 4.3, 4.4(c), 4.5.5.1 (second paragraph), 4.5.5.3, 4.6.1.1, 4.7.1 (NOTE 1 deleted), 4.7.9 (second paragraph), 4.7.10 (second sentence), 4.11 (new NOTE), 4.12.1, 4.12.2(f)(ii), 4.12.2 (NOTE 2), 5.1.1 (last two sentences), 5.2.2 (second paragraph), 5.3.3, 5.8.1 (new NOTE), 5.8.4 (new NOTE), 7.2, B3.3, B4.2 (first paragraph), Appendix D (new Item (n)).

(b) *Amendments to the following Tables:*

3.3.5 (Title), 4.7.1, 4.11(A) (Items (b), (c), (e) and (k)), 4.12.2 (NOTE 2), 5.3.4(A), C2, E1 (drawings for joints B-C 8a and B-C 8b), E4 (new joints H-C 1c and H-C 1d).

(c) *Amendments to the following Figures:*

3.4.1(c), 4.5.5.2 (new), 4.5.5.3 (NOTES), 5.3.4(A).

The Standard requires that weld preparations, welding consumables and welding procedures be qualified before commencement of welding. Prequalified joint preparations, welding consumables and welding procedures are also given in the Standard.

The Standard, in catering for structures subject to fatigue conditions as well as statically loaded structures, provides two categories of welds with two differing levels of weld quality assurance associated with the different types of service to which the welds are subjected. The intention is that the designer select the category suited to the severity of the service and nominate this on the drawings. Where a structure contains both categories, this nomination of appropriate categories will ensure that appropriate levels of supervision and inspection will be applied to the relevant parts of the structure.

Statements expressed in mandatory terms in notes to tables and 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>
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE	5
1.2 EXCLUSIONS	6
1.3 INNOVATION	6
1.4 REFERENCED DOCUMENTS	6
1.5 DEFINITIONS	6
1.6 WELD CATEGORIES	7
1.7 BASIC WELDING REQUIREMENTS	7
1.8 SAFETY	8
SECTION 2 MATERIALS OF CONSTRUCTION	
2.1 PARENT MATERIAL	9
2.2 BACKING MATERIAL	9
2.3 WELDING CONSUMABLES	9
SECTION 3 DETAILS OF WELDED CONNECTIONS	
3.1 GENERAL	11
3.2 BUTT WELDS	11
3.3 FILLET WELDS	12
3.4 COMPOUND WELDS	16
3.5 SEAL WELDS	17
3.6 PLUG WELDS	17
3.7 SLOT WELDS	17
3.8 COMBINING STEEL SECTIONS	17
SECTION 4 QUALIFICATION OF PROCEDURES AND PERSONNEL	
4.1 QUALIFICATION OF WELDING PROCEDURE	19
4.2 METHODS FOR QUALIFYING A WELDING PROCEDURE	20
4.3 PREQUALIFIED WELDING PROCEDURES	21
4.4 PORTABILITY OF QUALIFIED WELDING PROCEDURES	21
4.5 PREQUALIFIED JOINT PREPARATIONS	21
4.6 QUALIFICATION OF WELDING CONSUMABLES	29
4.7 QUALIFICATION OF WELDING PROCEDURE BY TESTING	35
4.8 EXTENSION OF QUALIFICATION	39
4.9 COMBINATION OF PROCESSES	40
4.10 RECORDS OF TESTS	40
4.11 REQUALIFICATION OF WELDING PROCEDURES	40
4.12 QUALIFICATION OF WELDING PERSONNEL	43
SECTION 5 WORKMANSHIP	
5.1 PREPARATION OF EDGES FOR WELDING	47
5.2 ASSEMBLY	47
5.3 PREHEATING AND INTER-RUN CONTROL	48
5.4 WELDING UNDER ADVERSE WEATHER CONDITIONS	55
5.5 TACK WELDS	55
5.6 WELD DEPTH-TO-WIDTH RATIO	55
5.7 CONTROL OF DISTORTION AND RESIDUAL STRESS	56
5.8 BACKGOUGING AND REPAIR OF DEFECTS IN WELDS	56
5.9 TEMPORARY ATTACHMENTS	57

	<i>Page</i>
5.10 ARC STRIKES.....	58
5.11 CLEANING OF FINISHED WELDS.....	58
5.12 DRESSING OF BUTT WELDS	58
 SECTION 6 QUALITY OF WELDS	
6.1 CATEGORIES OF WELDS	59
6.2 METHODS OF INSPECTION AND PERMISSIBLE LEVELS OF IMPERFECTIONS	59
6.3 RADIOGRAPHY	64
6.4 ULTRASONIC EXAMINATION	65
6.5 MAGNETIC PARTICLE EXAMINATION.....	65
6.6 LIQUID PENETRANT EXAMINATION	66
6.7 WELD DEFECTS.....	66
6.8 REPORTING.....	66
 SECTION 7 INSPECTION	
7.1 GENERAL	67
7.2 QUALIFICATIONS OF INSPECTORS	67
7.3 VISUAL INSPECTION OF WORK.....	67
7.4 NON-DESTRUCTIVE EXAMINATION OTHER THAN VISUAL.....	67
 APPENDICES	
A REFERENCED DOCUMENTS	69
B BRITTLE FRACTURE	72
C TYPICAL FORMS FOR WELDING PROCEDURES	77
D MATTERS FOR RESOLUTION.....	80
E WELDED JOINT AND PROCESS IDENTIFICATION	82

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard
Structural steel welding

Part 1: Welding of steel structures

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies requirements for the welding of steel structures made up of combinations of steel plate, sheet or sections, including hollow sections and built-up sections, or castings and forgings, by the following processes:

- A1
- (a) Manual metal-arc welding (MMAW).
 - (b) Submerged arc welding (SAW).
 - (c) Gas metal-arc welding (GMAW or MIG), including pulsed mode.
 - (d) Gas tungsten-arc welding (GTAW or TIG).
 - (e) Flux-cored arc welding (FCAW).
 - (f) Electroslag (including consumable guide) welding (ESW).
 - (g) Electrogas welding (EGW).

The Standard is limited to the welding of steel parent material with a specified minimum yield strength not exceeding 500 MPa.

The Standard applies to the welding of steelwork in structures complying with AS 3990, AS 4100, AS/NZS 4600 or NZS 3404.1. Where welded joints in these structures are governed by dynamic loading conditions, the Standard applies only to those welded joints that comply with the fatigue provisions of AS 3990, AS 4100 or NZS 3404.1, as limited by Item (ii) below, or the directly equivalent fatigue provisions of other application Standards.

Welded joints complying with the above requirements are those that are —

- (i) not subject to fatigue conditions; or
- (ii) subject to fatigue conditions, where—
 - (A) the stress range in the welded joint complies with the permissible stress range of stress categories C, D, E or F of AS 3990, or weld categories lower than or equal to detail category 112 of AS 4100 or NZS 3404.1; or
 - (B) the stress range in the welded joint is not more than 80% of the permissible stress range of stress category B of AS 3990.

In addition to the abovementioned structures the Standard applies to the welding of cranes, hoists and other dynamically loaded structures, the welding of road and pedestrian bridges and the welding of steelwork in applications other than structural.

NOTE: Further information on this Standard, which the drafting committee could not incorporate, is given in WTIA Technical Note 11.