

Australian/New Zealand Standard™

Structural steel welding

Part 1: Welding of steel structures



AS/NZS 1554.1:2011

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 18 May 2011 and on behalf of the Council of Standards New Zealand on 1 June 2011.

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New Zealand Heavy Engineering Research Association
New Zealand Non-destructive Testing Association
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Australian/New Zealand Standard™

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Part 1: Welding of steel structures

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee WD-003, Welding of Structures, to supersede AS/NZS 1554.1:2004.

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.

This edition incorporates the following major changes to the 2004 edition:

(a) *Amendments to the following Clauses:*

1.2, 1.7 (new title), 1.7.1 (new), 2.1(c), 2.3.1, 3.2.5 (new paragraph), 4.1.2(d)(f)(h)(j)(k) (new sub clauses), 4.1.2 (k), 4.2 (b), 4.6.1.1, 4.6.1.3 (new), 4.10 (new note), 4.12.2, 5.1.1 (new note), 5.1.2 (note added), 5.3.3 (second paragraph—new), 5.3.4 (note added), 5.3.5 (new), 5.7.1 (note added), 6.4.3 (note added), 7.2(a) (new), 7.3 (first paragraph—new), Appendix F (new), Appendix G (new).

(b) *Amendments to the following Tables:*

4.6.1(A), 4.6.1(B), 4.6.1(C), 4.6.2, 4.7.1 (new notes, notes 1 and 3 amended), 4.11(D) (new), 4.11(A) (items b, e, o, u), 4.11(C) item (d), 4.12.2.3 (A), 4.12.2.3(B) (new), 5.3.4(A), B1 (new steel types added), E4 (items deleted).

(c) *Amendments to the following Figure:*

3.2.5(c) (new).

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.

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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:

- (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 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 greater 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, is given in WTIA Technical Note 11.

1.2 EXCLUSIONS

The Standard does not apply to the welding of structures by the following processes:

- (a) Oxyacetylene welding (OAW).
- (b) Friction welding (FW).
- (c) Thermit welding (TW).
- (d) Resistance welding (RW).

The Standard does not apply to the welding of pressure vessels and pressure piping.

This Standard does not apply to underwater welding.

The Standard does not cover the design of welded connections or permissible stresses in welds, nor the production, rectification or repair of castings.

NOTES:

- 1 Resistance welds in structures complying with AS/NZS 4600 should be made in accordance with AWS C1.1 or AWS C1.3, as appropriate.
- 2 For guidance on underwater welding the user should refer to ISO 15614-10, ISO 15618-1 or ISO 15618-2, as appropriate.

1.3 INNOVATION

Any alternative materials, welding processes, consumables, methods of construction or testing that give equivalent results to those specified, but do not comply with the specific requirements of this Standard or are not mentioned in it, are not necessarily prohibited.

NOTE: The Joint Standards Australia/Standards New Zealand Committee on welding of structures can act in an advisory capacity concerning equivalent suitability, but specific approval remains the prerogative of the inspecting authority.

1.4 NORMATIVE REFERENCES

Documents referenced for normative purposes are listed in Appendix A.

NOTE: Documents referenced for informative purposes are listed in the Bibliography.

1.5 DEFINITIONS AND SYMBOLS

1.5.1 Definitions

For the purpose of this Standard, the definitions given in AS 2812 and those below apply.

1.5.1.1 *Fabricator*

The person or organization responsible for the welding of the structure during fabrication or erection.

1.5.1.2 *Inspecting authority*

The authority having statutory powers to control the design and erection of buildings or structures.

NOTE: Where the structure is not subject to statutory jurisdiction, the principal is deemed to be the inspecting authority.

1.5.1.3 *Inspector*

A person employed by or acceptable to the inspecting authority or principal for the purpose of inspecting welding in accordance with this Standard.

1.5.1.4 *May*

Indicates the existence of an option.

1.5.1.5 *Principal*

The purchaser or owner of the structure being fabricated or erected, or a nominated representative.

NOTE: The nominated representative should be suitably qualified to deal with the technical issues of this Standard.

1.5.1.6 *Shall*

Indicates that a statement is mandatory.

1.5.1.7 *Should*

Indicates a recommendation.

1.5.2 Symbols

For the purposes of this Standard, the symbols given in AS 1101.3 shall apply.

1.6 WELD CATEGORIES

The Standard provides two categories of welds based on the type of application (see Clause 6.1), which in turn necessitates two levels of quality assurance (i.e. inspection and acceptance of weld imperfections) suitable for different weld applications and service conditions.

The two weld categories shall be designated as follows:

- (a) *GP (general purpose)*—GP to be generally selected where —
 - (i) the weld is essentially statically loaded and designed to meet the appropriate requirements of AS 4100 or NZS 3404.1;
 - (ii) the weld is stressed to not more than 50% of the relevant maximum permissible stress as specified in AS 3990; or
 - (iii) the welding application is other than structural.

NOTE: Welds nominated as Category SP, but not complying with the requirements of that category, may be considered as Category GP welds, provided the requirements of the design Standard are satisfied and the principal has agreed.
- (b) *SP (structural purpose)*—SP to be generally selected where —
 - (i) the weld is essentially statically loaded and designed to meet the appropriate requirements of AS 4100 or NZS 3404.1;
 - (ii) the weld is stressed to more than 50% of the relevant maximum permissible stress as specified in AS 3990; or
 - (iii) the weld is subject to the dynamic loading, within the limits stipulated in Clause 1.1.

1.7 MANAGEMENT OF QUALITY

1.7.1 Quality management

Fabricators shall ensure that all welding and related activities prescribed within Clause 1.7.2 and this Standard are managed under a suitable quality management system.

Such a system should generally comply with the requirements of AS/NZS ISO 3834 and its parts, particularly where fabrication activities require the approval of the principal or inspecting authority, or where the fabrication of large, complex or critical structures is being undertaken.

1.7.2 Basic welding requirements

The basis of this Standard is that a weld shall—

- (a) be made in accordance with a qualified welding procedure;
- (b) be carried out by a welder suitably qualified to carry out such a procedure;
- (c) be carried out under the supervision of a welding supervisor who is employed by or contracted to the fabricator; and
- (d) comply with the appropriate requirements of this Standard.

For certain conditions prescribed herein, the welding procedure is deemed to be prequalified and may not require full qualification testing (see Clause 4.3 and Table 4.7.1).

1.8 SAFETY

1.8.1 Safety equipment and procedures

Welding shall be carried out in accordance with the relevant requirements of the following Standards:

AS 1470, AS 1674.1, AS 1674.2, AS 2865, AS/NZS 1336, AS/NZS 1337, AS/NZS 1338.1.

1.8.2 Welding equipment

Welding plant and equipment shall comply with the relevant sections of appropriate regulations, and the following relevant Standards:

AS 60974.1, AS 2799, AS/NZS 1995.

1.8.3 Other hazards

The fabricator shall identify and manage any other risks and hazards from welding that are not covered by Clauses 1.8.1 and 1.8.2. In particular, due consideration shall be given to the control of emitted fumes, especially when welding through paints, primers and other surface coatings.

NOTES:

- 1 Guidance on the management of risk is given in AS/NZS ISO 31000.
- 2 Further guidance on safety precautions is given in WTIA Technical Notes 7 and 22.