AS/NZS 1554.4:2010

Australian/New Zealand Standard™

Structural steel welding

Part 4: Welding of high strength quenched and tempered steels

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 9 December 2009 and on behalf of the Council of Standards New Zealand on 27 January 2010.

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The following are represented on Committee WD-003:

Australian Chamber of Commerce and Industry
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Bureau of Steel Manufacturers of Australia
Electricity Supply Association of Australia
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New Zealand Heavy Engineering Research Association
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Australian/New Zealand Standard™

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Part 4: Welding of high strength quenched and tempered steels

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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 1554.4:2004.

The objective of this Standard is to provide rules for the welding of a wide range of steel constructions, using high strength quenched and tempered steel parent material.

The objective of this edition is to update the Standard and bring it in line with the latest edition of AS/NZS 1554.1, *Structural steel welding,* Part 1: *Welding of steel structures*.

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), 2.3.1, 3.2.5 (new paragraph), 4.1.2(d)(f)(h)(j) (new subclauses), 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), 5.3.4 (note added), 5.7.1 (note added), 7.2(a) (new), 7.3 (first paragraph—new), Appendix F (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, note 3 amended), 4.11(D) (new), 4.11(A) (items b, e, o, u), 4.11(C) item (d), 4.12.2(B) (new), 5.3.4, 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 three categories of welds with three 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 should select the category suited to the severity of the service and nominate this on the drawings. Where a structure contains more than one category, 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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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), including pulsed mode.

(d) Gas tungsten-arc welding (GTAW or TIG).

(e) Flux-cored arc welding (FCAW).

(f) Electroslag (including consumable guide) welding (ESW) (see Note).

(g) Electrogas welding (EGW) (see Note).

NOTE: These processes may not be suitable for welding quenched and tempered steels in all cases (see WTIA Technical Note 15).

The Standard is limited to the welding of quenched and tempered steel parent material complying with Clause 2.1.

The Standard applies to the welding of steelwork in structures complying with appropriate Standards. 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 limited by Item (ii) below, or with the directly equivalent fatigue provisions of other application Standards.

The Standard applies to welded joints that are—

(i) not subject to fatigue conditions; or

(ii) subject to fatigue conditions; and—

(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 (Category SP weld, see Clause 1.5.2); or

(C) the stress range in the welded joint is greater than 80% of the permissible stress range for stress Category B of AS 3990, or exceeds the stress range permitted for detail Category 112 of AS 4100 or NZS 3404.1 (Category FP weld, see Clause 1.5.2), but does not exceed the maximum stress ranges permitted for these categories.

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

NOTES:

1 Further information on this Standard is given in WTIA Technical Note 11.

2 Complementary codes that facilitate design and fabrication of high strength quenched and tempered steels include the following:

(a) American Institute of Steel Construction Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

(b) American Association of State Highway and Transportation Officials, Standard Specifications for Highway Bridges.

(c) American Railway Engineering Association Specifications for Steel Railway Bridges.

3 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.

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

1.2 EXCLUSIONS

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

(a) Oxy-fuel gas welding (GW).

(b) Resistance welding (RW).

(c) Friction welding (FW).

(d) Thermit welding (TW).

The Standard does not apply to the welding of pressure vessels and pressure piping, nor to underwater welding.

NOTE: For guidance on underwater welding the user should refer to ISO 15614-10, ISO 15618-1 and ISO 15618-2 as appropriate.

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

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.

The Joint Standards Australia/Standards New Zealand Committee WD-003, 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 referred to for normative purposes are listed in Appendix A.

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

1.5 DEFINITIONS

For the purpose of this Standard, the symbols and definitions given in AS 1101.3, AS 2812 and those below apply.

1.5.1 Fabricator

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

1.5.2 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.

1.5.3 Inspector

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

1.5.4 May

Indicates the existence of an option.

1.5.5 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.

1.5.6 Shall

Indicates that a statement is mandatory.

1.5.7 Should

Indicates a recommendation.

1.6 WELD CATEGORIES

The Standard provides three 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 three weld categories shall be designated as follows:

(a) *GP (general purpose)*—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; or

(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 for 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)*—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 dynamic loading within the limits specified in Clause 1.1.

(c) *FP (fatigue purposes)*—to only be selected where the weld is subjected to high levels of dynamic loading where the stress ranges exceed detail Category 112 of AS 4100 or NZS 3404.1; or where they exceed 80% of the permissible stress range for Category B of AS 3990.

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

1.8.2 Welding equipment

Welding plant and equipment shall comply with the relevant sections of the appropriate regulations, and the relevant requirements of AS 1966.1, AS 1966.2, AS 2799, AS/NZS 1995 and IEC 60974-1.

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.