AS/NZS 4600:2018

Australian/New Zealand Standard™

Cold-formed steel structures

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The following are represented on Committee BD-082:

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Australian Chamber of Commerce and Industry
Australian Industry Group
Australian Steel Association
Australian Steel Institute
Bureau of Steel Manufacturers of Australia
Engineers Australia
National Association of Steel Framed Housing, Australia
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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 Standards Australia or the New Zealand Standards Executive at the address shown on the back cover.

This Standard was issued in draft form for comment as DR AS/NZS 4600:2017.

Australian/New Zealand Standard™

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee BD-082, Cold-formed Steel Structures. AS/NZS 4600:2005 will also remain current for 12 months after the date of publication of this Standard and after this time it will be superseded by AS/NZS 4600:2018. Regulatory authorities that reference this Standard in regulation may apply these requirements at a different time. Users of this Standard are advised to consult with these authorities to confirm their requirements.

The objective of this Standard is to provide designers of cold-formed steel structures with specifications for cold-formed steel structural members used for load-carrying purposes in buildings and other structures.

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

(a) Inclusion of G500 and G550 steels in Clause 1.5.1.3 for steels where the effects of welding do not need to be tested.

(b) Inclusion of reference to first order elastic, second order elastic and advanced analyses in Clause 1.6.2.

(c) Earthquake design for Australia in Clause 1.6.4.1 based on structural ductility index and structural performance factor to align with latest edition of AS 1170.4.

(d) Earthquake design for New Zealand in Clause 1.6.4.2 allows structural ductility factors up to 6.

(e) Non-circular holes added to uniformly compressed stiffened elements in Clause 2.2.2.

(f) New Clause 2.2.5 on intermittent connections in uniformly compressed elements.

(g) Elastic buckling moments in Clause 3.3 moved to Paragraph D2.1, Appendix D, for members subject to bending.

(h) Elastic buckling stresses in Clause 3.4 moved to Paragraph D1.1, Appendix D, for concentrically loaded compression members.

(i) New Clause 3.7 for sections subject to combined bending and torsional loading.

(j) New Clause 4.1.2 for compression members composed of two sections in contact.

(k) Old Clause 4.3.3.3 for bracing of cleatless roof systems under gravity load deleted.

(l) Revised Clause 4.3.3.3 (old Clause 4.3.3.4) for neither flange connected to sheeting has improved equations and a new diagram.

(m) New equation for net section tension in Clause 5.3.3 has improved shear lag factor.

(n) Bolted connections in bearing in Clause 5.3.4 now includes oversize and short-slotted holes.

(o) Screws in shear and tension now allow the limit state based on testing of the screws.

(p) Screwed connections in tension in Clause 5.4.3.2 now include round head, hex head, pancake screw washer head, hex washer head and domed head.

(q) New rules in Clause 5.4.3.2 for screwed connections attaching roof battens.

(r) New rules for screwed connections in combined bending and tension.

(s) Design of power-actuated fasteners (PAFs) now included in Clause 5.5.

(t) Revised equations for block shear rupture in Clause 5.7.3 based on active shear planes.

(u) Range of prequalified members in Clause 7.1.1 (Table 7.1) for the direct strength method (DSM) extended to a wider range of sections with multiple intermediate stiffeners and return lips.

(v) Compression and flexural members with holes and flexural members with inelastic reserve capacity now included in the DSM Clauses 7.2.1 and 7.2.2.

(w) Shear and combined bending and shear added to the DSM in Clause 7.2.3.

(x) Combined compression/tension and bending added to the DSM in Clause 7.2.4.5 respectively.

(y) Design values based on prototype testing in Clause 8.4.1 can now use the average test value.

(z) Strength prediction model from testing based on verification model BV1 of National Construction Code (NCC).

(aa) New Section 9, Fire design, added for steel sections made from AS 1397, steel and with a fire resistant barrier.

(bb) New Appendix B, Paragraph B2, First order elastic analysis, Paragraph B3, Second order elastic analysis and Paragraph B4, Advanced analysis, added.

(cc) Appendix D extended to buckling stresses and actions for sections in compression, bending and shear including sections with holes.

(dd) Informative Appendix G added for members subject to non-uniform temperature distribution.

Notes to the text contain information and guidance. They are not an integral part of the Standard.

Sections of this Standard have been reproduced from AISI S100, *North American Specification for the Design of Cold-Formed Steel Structural Members*, with permission from the American Iron and Steel Institute.

Standards Australia thanks NASH (National Association of Steel-framed Housing) for permission to reproduce sections of NASH Standard—*Residential and Low-rise Steel Framing, Part 1: Design Criteria* in Clause 1.6 and Clause 8.4 of this Standard.

A statement expressed in mandatory terms in a note to a table is deemed to be a requirement 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

Page

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard
Cold-formed steel structures

S E C T I O N 1 S C O P E A N D G E N E R A L

1.1 SCOPE

This Standard sets out minimum requirements for the design of structural members cold-formed to shape from carbon or low-alloy steel sheet, strip, plate or bar not more than 25 mm in thickness and used for load-carrying purposes in buildings. It is also applicable for structures other than buildings, provided appropriate allowances are made for dynamic effects.

This Standard does not apply to the design of structures subject to brittle fracture.

1.2 NORMATIVE REFERENCES

Normative documents referenced in this Standard are listed in Appendix A.

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

1.3 DEFINITIONS

For the purpose of this Standard, the definitions below apply. Definitions peculiar to a particular clause or section are also given in that clause or section.

1.3.1 Action

Set of concentrated or distributed forces acting on a structure (direct action), or deformation imposed on a structure or constrained within it (indirect action).

1.3.2 Action effect (internal effects of actions, load effects)

Internal forces and bending moments due to actions (stress resultants).

1.3.3 Arched compression element

A circular or parabolic arch-shaped compression element having an inside radius-to-thickness ratio greater than 8, stiffened at both ends by edge stiffeners. See Figure 1.3(C).

1.3.4 Assemblage of elements

A system of interconnected cold-formed steel elements that act together to resist earthquake action in such a way that the strength and deformation capacity of the system is not adversely affected by the buckling or crippling of any one element of the assemblage.

1.3.5 Bend

Portion adjacent to flat elements and having a maximum inside radius-to-thickness ratio (r_i/t) of 8. See Figure 1.3(A).

1.3.6 Braced member

Member for which the transverse displacement of one end of the member relative to the other is effectively prevented.

1.3.7 Can

Implies a capability or possibility and refers to the ability of the user of the Standard, or to a possibility that is available or that might occur.

1.3.8 Capacity design principles

Appropriate material Standard design and detailing provisions, which enable zones where post-elastic response is acceptable to be identified and detailed in a manner that ensures these zones are capable of accepting the inelastic demands placed upon them.

NOTE: All other zones are to be designed to ensure that all other undesirable inelastic response mechanisms are suppressed and detailed in a manner that the ultimate limit state horizontal deformations that they are expected to be subjected to, can be sustained without significant (e.g. greater than 20%) loss of load-carrying capacity after four complete cycles of loading.

1.3.9 Capacity reduction factor

A factor used to multiply the nominal capacity to obtain the design capacity.

1.3.10 Clinching

Structural fastening of two or more flat elements by single-point embossing or piercing without using additional material.

1.3.11 Cold-formed steel structural members

Shapes that are manufactured by press-braking blanks sheared from sheets, cut lengths of coils or plates, or by roll forming cold- or hot-rolled coils or sheets; both forming operations being performed at ambient room temperature, that is, without manifest addition of heat as required for hot-forming.

1.3.12 Direct strength method

An alternative design method that provides predictions of member resistance without the use of effective widths.

1.3.13 Design action effect

The action effect computed from the design values of the actions or design loads.

1.3.14 Design capacity

The product of the capacity reduction factor and the nominal capacity.

1.3.15 Distortional buckling

A mode of buckling involving change in cross-sectional shape, excluding local buckling.

1.3.16 Doubly-symmetric section

A section symmetric about two orthogonal axes through its centroid. See Figure 1.3(E).

1.3.17 Effective design width (or effective width)

Where the flat width of an element is reduced for design purposes.

1.3.18 Elements

Simple shapes into which a cold-formed structural member is considered divided and may consist of the following shapes:

(a) *Flat elements* Appearing in cross-section as rectangles. See Figure 1.3(B).

(b) *Bends* Appearing in cross-section as sectors of circular rings, having the inside radius-to-thickness ratio less than or equal to eight ($r_i/t \leq 8$). See Figure 1.3(B).

(c) *Arched elements* Circular or parabolic elements having the inside radius-to-thickness ratio greater than eight ($r_i/t > 8$). See Figure 1.3(B).

1.3.19 Feed width (w_f)

Width of coiled or flat steel used in the production of a cold-formed product.

1.3.20 Flexural-torsional buckling

A mode of buckling in which compression members can bend and twist simultaneously without change of cross-sectional shape.

1.3.21 Length (of a compression member)

The actual length (l) of an axially loaded compression member, taken as the length centre-to-centre of intersections with supporting members, or the cantilevered length in the case of a freestanding member.

1.3.22 Limit states

States beyond which the structure no longer satisfies the design criteria.

NOTE: Limit states separate desired states (conformance) from undesired states (non-conformance).

1.3.23 Limit states, serviceability

States that correspond to conditions beyond which specified service criteria for a structure or structural element are no longer met.

1.3.24 Limit states, stability

States that correspond to the loss of static equilibrium of a structure considered as a rigid body.

1.3.25 Limit states, ultimate

States associated with collapse, or with other similar forms of structural failure.

NOTE: This generally corresponds to the maximum load-carrying resistance of a structure or structural element, but, in some cases, to the maximum applicable strain or deformation.

1.3.26 Load

The value of a force appropriate for an action.

1.3.27 Local buckling

A mode of buckling involving plate flexure alone without transverse deformation of the line or lines of intersection of adjoining plates.

1.3.28 May

Indicates the existence of an option.

1.3.29 Multiple-stiffened element

An element that is stiffened between webs, or between a web and a stiffened edge, by means of intermediate stiffeners that are parallel to the direction of stress. See Figure 1.3(C).

1.3.30 Nominal action effect or nominal load

An unfactored action effect or load determined in accordance with the relevant loading Standard.

1.3.31 Nominal capacity

The capacity of a member or connection, calculated using the parameters specified in this Standard.

1.3.32 Nominal dimension

A specified manufactured dimension.