Australian/New Zealand Standard®

Cold-formed steel structures

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This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee BD/82, Cold-formed Steel Structures. It was approved on behalf of the Council of Standards Australia on 4 October 1996 and on behalf of the Council of Standards New Zealand on 4 October 1996. It was published on 5 December 1996.

The following interests are represented on Committee BD/82:

Association of Consulting Engineers, Australia
Australian Chamber of Commerce and Industry
Australian Institute of Steel Construction
Bureau of Steel Manufacturers of Australia
CSIRO, Division of Building, Construction and Engineering, Australia
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Cold-formed steel structures

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee BD/82 on Cold-formed Steel Structures to supersede AS 1538—1988, *Cold-formed Steel Structures Code*.

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) The Standard is now in a limit states format.

(b) The use of cold-formed carbon or low-alloy steel sheet, strip, plate or bar not more than 25 mm in thickness is included.

(c) Ductility, the design for earthquake, stiffened and unstiffened elements with stress gradient, partial edge and intermediate stiffeners, design of members subject to tension, beams and columns with one flange through-fastened to deck or sheeting, the use of a reduction factor for the design of purlins, distortional buckling, design of concentrically loaded compression members, combined axial tensile load and bending, cylindrical tubular members, screw fasteners, and testing allowing for variability of the structural units and testing provisions for single-point fasteners, are included.

Sections 1, 2, 3, 4 and 5 of this Standard are mainly based on the 1996 edition of the American Iron and Steel Institute Load and Resistance Factor Design Specification for Cold-Formed Steel Structural Members.

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.

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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 may also be used 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 fire, fatigue and brittle fracture.

1.2 REFERENCED DOCUMENTS The documents referred to in this Standard are listed in Appendix A.

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.

NOTE: In this Standard, terms in square brackets relate to New Zealand use.

1.3.1 Action [Effect]—the cause of stress, dimensional change, or displacement in a structure or a component of a structure.

1.3.2 Action effect [Action] or load effect [action]—the internal force, moment, deformation, crack, or like effect caused by one or more actions [effects].

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(d).)

1.3.4 Bend—portion adjacent to flat elements and having a maximum inside radius-to-thickness ratio (r_i/t) of 8. (See Figure 1.1.)

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

1.3.6 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.

1.3.7 Capacity [Strength reduction] factor—a factor used to multiply the nominal capacity to obtain the design capacity.

1.3.8 Clinching—structural fastening of two or more flat elements by single-point embossing or piercing without using additional material.

1.3.9 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.

1.3.10 Design action effect [Design action] or design load effect [design action]—the action [effect] or load effect [action] calculated from the design actions [design forces] or design loads.

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1.3.11 Design action [Design force] or design load—the combination of the nominal actions [nominal effects] or loads and the load factors, as specified in the relevant loading Standard.

1.3.12 Design capacity—the product of the nominal capacity and the capacity [strength reduction] factor.

1.3.13 Distortional buckling—a mode of buckling involving change in cross-sectional shape, excluding local buckling.

1.3.14 Effective design width—where the flat width of an element is reduced for design purposes, the reduced design width is termed the effective width or effective design width.

1.3.15 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 1.2.)

(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 1.2.)

(c) Arched elements—circular or parabolic elements having the inside radius-to- thickness ratio greater than eight ($r_i/t > 8$). (See Figure 1.2.)

1.3.16 Feed width (w_f)—width of coiled or flat steel used in production of a cold-formed product.

1.3.17 Flexural-torsional buckling—a mode of buckling in which compression members can bend and twist simultaneously without change of cross-sectional shape.

1.3.18 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.

1.3.19 Limit state—any limiting condition beyond which the structure ceases to fulfil its intended function.

1.3.20 Load—an externally applied limit state force including self weight.

1.3.21 Local buckling—a mode of buckling involving plate flexure alone without transverse deformation of the line or lines of intersection of adjoining plates.

1.3.22 May—indicates the existence of an option.

1.3.23 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).)

1.3.24 Nominal action [Nominal effect] or nominal load—an unfactored action [effect] or load determined in accordance with the relevant loading Standard.

1.3.25 Nominal capacity—the capacity of a member or connection calculated using the parameters specified in this Standard.

1.3.26 Point-symmetric section—a section symmetrical about a point (centroid) such as a Z-section having equal flanges. (See Figure 1.5(b).)

1.3.27 Proof testing—the application of test loads to a structure, sub-structure, member or connection to ascertain the structural characteristics of only that one unit under test.

1.3.28 Prototype testing—the application of test loads to one or more structures, sub-structures, members or connections to ascertain the structural characteristics of that class of structures, sub-structures, members or connections which are nominally identical to the units tested.

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1.3.29 Pull-over (pull-through)—failure of a single-point connection by the sheet being pulled over the head of the fastener or the head of the fastener being pulled through the sheet.

1.3.30 Pull-out—failure of a single-point connection by the embedded part of the fastener being pulled out of the member.

1.3.31 Segment (in a member subjected to bending)—the length between adjacent cross-sections, which are fully or partially restrained, or the length between an unrestrained end and the adjacent cross-section which is fully or partially restrained.

1.3.32 Serviceability limit state—a limited state of an acceptable in-service condition.

1.3.33 Shall—indicates that a statement is mandatory.

1.3.34 Should—indicates a recommendation.

1.3.35 Single-point fastener—a mechanical connection at a single discrete point such as a screw or rivet.

1.3.36 Special study—a procedure for the analysis or design, or both, of the structure, agreed between the authority having statutory powers to control the design and erection of a structure, and the design engineer.

1.3.37 Stability limit state—a limit state corresponding to the loss of static equilibrium of a structure considered as a rigid body.

NOTE: In New Zealand, the stability limit state is part of the ultimate limit state.

1.3.38 Stiffened or partially stiffened compression element—a flat compression element (i.e. a plane compression flange of a flexural member or a plane web or flange of a compression member) of which both edges parallel to the direction of stress are stiffened by a web, flange, edge stiffener, intermediate stiffener, or the like. (See Figure 1.3(a).)

1.3.39 Stiffeners

1.3.39.1 *Edge stiffener*—formed element at the edge of a flat compression element. (See Figure 1.4(a).)

1.3.39.2 *Intermediate stiffeners*—formed elements, employed in multiple stiffened segments, and located between edges of stiffened elements. (See Figure 1.4(b).)

1.3.40 Strength [Ultimate] limit state—a limit state of collapse or loss of structural integrity.

1.3.41 Structural ductility factor—a numerical assessment of the ability of a structure to sustain cyclic inelastic displacements.

1.3.42 Structural performance factor—a numerical assessment of the ability of a building to survive cyclic displacements.

1.3.43 Structural response factor—the level of force reduction available for a given system compared with an elastic structural system.

1.3.44 Sub-element—the portion between adjacent stiffeners, or between web and intermediate stiffener, or between edge and stiffener.

1.3.45 Tensile strength—the minimum ultimate strength in tension specified for the grade of steel in the appropriate Standard.

1.3.46 Thickness—the base steel thickness (t), exclusive of coatings.

1.3.47 Unformed steel—steel as received from the steel producer or warehouse before being cold-worked as a result of fabricating operations.

1.3.48 Unformed steel properties—mechanical properties of unformed steel, such as yield stress, tensile strength and ductility.

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1.3.49 Unstiffened compression element—a flat compression element which is stiffened at only one edge parallel to the direction of stress. (See Figure 1.3(b).)

1.3.50 Yield stress—the minimum yield stress in tension specified for the grade of steel in the appropriate Standard.

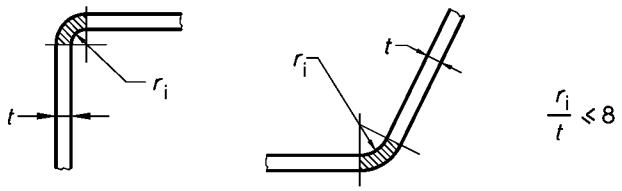
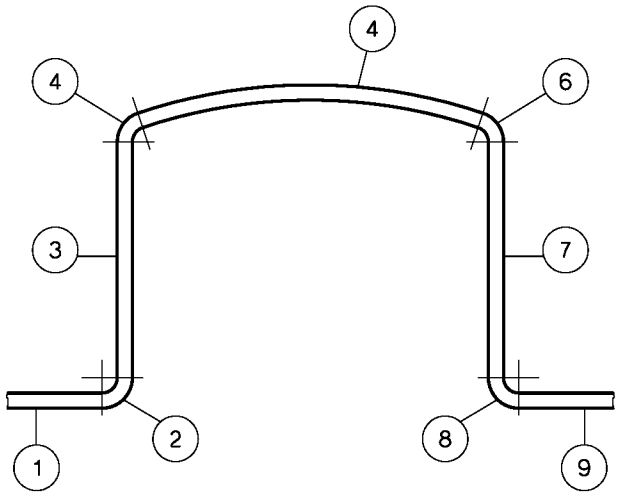


FIGURE 1.1 BENDS



NOTE: The member illustrated consists of the following nine elements:

(a) Elements 1, 3, 7, 9 are flat elements (flats).

(b) Elements 2, 4, 6, 8 are bends ($r_i/t \leq 8$).

(c) Element 5 is an arched element ($r_i/t > 8$).

FIGURE 1.2 ELEMENTS

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