



AISI S200-12



**American
Iron and Steel
Institute**

AISI STANDARD

North American Standard for Cold-Formed Steel Framing — General Provisions

2012 Edition



Documents

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The material contained herein has been developed by the American Iron and Steel Institute (AISI) Committee on Framing Standards. The Committee has made a diligent effort to present accurate, reliable, and useful information on cold-formed steel framing design and installation. The Committee acknowledges and is grateful for the contributions of the numerous researchers, engineers, and others who have contributed to the body of knowledge on the subject. Specific references are included in the *Commentary*.

With anticipated improvements in understanding of the behavior of cold-formed steel framing and the continuing development of new technology, this material will become dated. It is anticipated that AISI will publish updates of this material as new information becomes available, but this cannot be guaranteed.

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PREFACE

The American Iron and Steel Institute (AISI) Committee on Framing Standards has developed AISI S200, *North American Standard for Cold-Formed Steel Framing - General Provisions*, to address requirements for construction with cold-formed steel framing that are common to prescriptive and engineered design. This standard is intended for adoption and use in the United States, Canada and Mexico. This edition supersedes the previous edition, designated as AISI S200-2007.

Compared with the 2007 edition of the standard, the following major revisions were made:

- (1) Consolidations and clarifications were made between AISI cold-formed steel framing standards regarding applicable material, material specification, base steel thickness, manufacturing tolerances, and product dimensions. As a result, the following sections were revised: A3, Material; A4, Corrosion Protections; and A5, Products.
- (2) Section C3.4.4, End Bearing, was revised to clarify when the stud end gap needs to be considered and specified.
- (3) Provisions related to *nonstructural members* were moved from this standard to AISI S220. Changes were made in Sections A1, Scope; A3, Material; A4, Corrosion Protection; and Section A5, Products.
- (4) Section A2, Definitions, was revised to include those used in other *cold-formed steel* framing standards.
- (5) Section A6, Referenced Documents, was updated.

While not necessary, use of the more stringent requirements for *structural members* that are in this standard for *nonstructural members* should be permitted, since these should demonstrate equivalent performance for the intended use to those specified in AISI S220.

The Committee acknowledges and is grateful for the contributions of the numerous engineers, researchers, producers and others who have contributed to the body of knowledge on the subjects. The Committee wishes to also express its appreciation for the support of the Canadian Sheet Steel Building Institute.

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NORTH AMERICAN STANDARD FOR COLD-FORMED STEEL FRAMING – GENERAL PROVISIONS

A. GENERAL

A1 Scope

This standard shall apply to the design and installation of *structural members* utilized in *cold-formed steel* framing applications where the specified minimum *base steel thickness* is not greater than 118 *mils* (0.1180 inches) (2.997 mm). Elements not specifically addressed by this standard shall be constructed in accordance with *applicable building code* requirements or an *approved* design.

This standard shall not preclude the use of other materials, assemblies, structures or designs not meeting the criteria herein, when the other materials, assemblies, structures or designs demonstrate equivalent performance for the intended use to those specified in this standard. Where there is a conflict between this standard and other reference documents, the requirements contained within this standard shall govern.

This standard includes Sections A through E in their entirety.

A2 Definitions

In this standard, “shall” is used to express a mandatory requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the standard. Provisions described as “permitted” are optional, and the election to use such provisions is at the discretion of the user.

Where the following terms appear in this standard in italics, they shall have the meaning herein indicated. Terms included in square brackets shall be specific to *Limit States Design (LSD)* terminology. Where a country is indicated in square brackets following the definition, the definition shall apply only in the country indicated. Terms not defined in Section A2 shall have the ordinary accepted meaning for the context for which they are intended.

Adjusted Shear Resistance. In *Type II shear walls*, the unadjusted shear resistance multiplied by the shear resistance adjustment factor.

Amplified Seismic Load. Load determined in accordance with the *applicable building code* seismic load combinations that includes the system overstrength factor, Ω_o , for *strength design (LRFD)* or for *allowable strength design (ASD)*. [USA and Mexico]

ASD (Allowable Strength Design). Method of proportioning structural components such that the *allowable strength* equals or exceeds the *required strength* of the component under the action of the *ASD load combinations*. [USA and Mexico]

ASD Load Combination. Load combination in the *applicable building code* intended for *allowable stress design (allowable strength design)*. [USA and Mexico]

Allowable Strength. Nominal strength divided by the safety factor R_n/Ω . [USA and Mexico]

Allowable Stress Design. Also known as *allowable strength design*, an outdated term used in some reference documents. [USA and Mexico]

Applicable Building Code. The building code under which the building is designed.

Approved. Approved by the authority having jurisdiction or *design professional*.

Available Strength. Design strength or *allowable strength*, as appropriate. [USA and Mexico]

Average Grade. The average elevation of the finished ground level adjoining the building at

all exterior walls.

Base Steel Thickness. The thickness of bare steel exclusive of all coatings.

Bearing Stiffener. Additional material that is attached to the *web* to strengthen the member against web crippling. Also called a *web stiffener*.

Blocking. *C-shaped* member, break shape, flat *strap* material, or component assemblies attached to *structural members*, flat *strap* or sheathing panels to transfer shear forces or stabilize members.

Boundary Member. *Diaphragm* and *shear wall boundary member* to which the *diaphragm* transfers forces. *Boundary members* include chords and drag struts at *diaphragm* and *shear wall* perimeters, interior openings, discontinuities and re-entrant corners.

Braced Wall Line. A wall that is constructed to resist racking from seismic or wind forces and that contains a series of *Type I braced wall panels* or *Type II braced walls*.

Bracing. Structural elements that are installed to provide restraint or support (or both) to other framing members so that the complete assembly forms a stable structure.

Capacity Based Design. Method for designing a *seismic force resisting system* in which a) specific elements or mechanisms are designed to dissipate energy; b) all other elements are sufficiently strong for this energy dissipation to be achieved; c) structural integrity is maintained; d) elements and connections in the horizontal and vertical *load* paths are designed to resist these seismic *loads* and corresponding principal and companion *loads* as defined by the NBCC; e) *diaphragms* and *collector* elements are capable of transmitting the *loads* developed at each level to the vertical *seismic force resisting system*; and f) these *loads* are transmitted to the foundation. [Canada]

Ceiling Joist. A horizontal *structural member* that supports ceiling components and which may be subject to attic *loads*.

Chord. Member of a *shear wall* or *diaphragm* that forms the perimeter, interior opening, discontinuity or re-entrant corner.

Chord Member. A *structural member* that forms the top or bottom component of a *truss*.

Chord Splice. The connection region between two *truss chord members* where there is no change in slope.

Chord Stud. Axial load-bearing studs located at the ends of *Type I braced wall panels* or *Type II braced walls*.

Clip Angle. An L-shaped short piece of steel (normally with a 90-degree bend) typically used for *connections*.

Cold-Formed Sheet Steel. Sheet steel or strip steel that is manufactured by (1) press braking blanks sheared from sheets or cut length of coils or plates, or by (2) continuous roll forming of cold- or hot-rolled coils of sheet steel; both forming operations are performed at ambient room temperature, that is, without any addition of heat such as would be required for hot forming.

Cold-Formed Steel. See *Cold-Formed Sheet Steel*.

Collector. Also known as a drag strut, a member that serves to transfer forces between *diaphragms* and members of the lateral force resisting system.

Component. See *structural component*.

Connection. Combination of structural elements and joints used to transmit forces between two or more members.

Cripple Stud. A *stud* that is placed between a *header* and a window or door head *track*, a

header and wall top *track*, or a window sill and a bottom *track* to provide a backing to attach finishing and sheathing material.

C-Shape. A cold-formed steel shape used for structural and nonstructural members consisting of a web, two (2) flanges and two (2) lips (edge stiffeners).

Curtain Wall. A wall that transfers transverse (out of plane) *loads* and is limited to a superimposed vertical *load*, exclusive of sheathing materials, of not more than 100 lb/ft (1.46 kN/m), or a superimposed vertical *load* of not more than 200 lbs (0.890 kN).

Deflection Track. A *track* manufactured with extended *flanges* and used at the top of a wall to provide for vertical movement of the structure, independent of the wall *stud*.

Design Load. Applied *load* determined in accordance with either *LRFD load combinations* or *ASD load combinations*, whichever is applicable. [USA and Mexico]

Design Professional. An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the state, province or territory in which the project is to be constructed.

Design Strength. *Resistance Factor* multiplied by the *nominal strength*, ϕR_n . [USA and Mexico]

Design Thickness. The steel thickness used in design.

Designation Thickness. The minimum *base steel thickness* expressed in *mils* and rounded to a whole number.

Diaphragm. Roof, floor or other membrane or bracing system that transfers in-plane forces to the lateral force resisting system.

Eave Overhang. The horizontal projection of the roof measured from the outside face of exterior wall framing to the outside edge of the roof.

Edge Stiffener. See *Lip*.

Factored Load. Product of a *specified load* and appropriate *load factor*. [Canada]

Factored Resistance. Product of *nominal resistance* and appropriate *resistance factor*. [Canada]

Fiberboard. A fibrous, homogeneous panel made from lignocellulosic fibers (usually wood or cane) and having a density of less than 31 pounds per cubic foot (pcf) (497 kg/m³) but more than 10 pcf (160 kg/m³).

Flange. For a *C-shape*, *U-shape* or *track*, that portion of the framing member that is perpendicular to the *web*. For a furring channel, that portion of the framing member that connects the *webs*.

Floor Joist. A horizontal *structural member* that supports floor *loads* and superimposed vertical *loads*.

Girt. Horizontal *structural member* that supports wall panels and is primarily subjected to bending under horizontal *loads*, such as wind *load*.

Grade. The designation of the minimum *yield strength*.

Gusset Plate. A *structural member* used to facilitate the *connection* of *truss chord* or *web members* at a *heel*, *ridge*, other pitch break, or *panel point*.

Hat-Shape. A singly-symmetric shape consisting of at least two vertical *webs* and a horizontal stiffened *flange* which is used as a *chord member* in a *truss*.

Heel. The *connection region* between the top and bottom *truss chords* of a non-parallel *chord truss*.

Header. A horizontal structural framing member used over floor, roof or wall openings to transfer *loads* around the opening to supporting structural framing members.

Hold-Down (tie-down). A device used to resist overturning forces in a shear wall, or uplift forces in a *cold-formed steel* framing member.

Jack Stud. A *stud* that does not span the full height of the wall and provides bearing for headers.

Joist. A *structural member* primarily used in floor and ceiling framing.

King Stud. A *stud*, adjacent to a *jack stud*, that spans the full height of the wall and supports vertical and lateral loads.

Light-Frame Construction. Construction where the vertical and horizontal structural elements are primarily formed by a system of repetitive *cold-formed steel* or wood framing members.

Limit States. Those conditions in which a structural member ceases to fulfill the function for which it was designed. Those states concerning safety are called the ultimate limit states. The ultimate limit state for strength is the maximum *load-carrying capacity*. *Limit states* that restrict the intended use of a member for reasons other than safety, such as deflection and vibration, are called serviceability *limit states*. [Canada]

LSD (Limit States Design). Method of proportioning *structural components* (members, connectors, connecting elements and assemblages) such that no applicable *limit state* is exceeded when the structure is subjected to all appropriate *load combinations*. [Canada]

Lip. That part of a framing member that extends from the *flange* as a stiffening element.

Load. Force or other action that results from the weight of building materials, occupants and their possessions, environmental effects, differential movement, or restrained dimensional changes.

Load Effect. Forces, stresses, and deformations produced in a *structural component* by the applied loads.

Load Factor. Factor that accounts for deviations of the actual *load* from the *nominal load*, for uncertainties in the analysis that transforms the *load* into a *load effect*, and for the probability that more than one extreme *load* will occur simultaneously. [USA and Mexico]

LRFD (Load and Resistance Factor Design). Method of proportioning *structural components* such that the *design strength* equals or exceeds the *required strength* of the *component* under the action of the *LRFD load combinations*. [USA and Mexico]

LRFD Load Combination. *Load combination* in the *applicable building code* intended for *Strength Design (Load and Resistance Factor Design)*. [USA and Mexico]

Mean Roof Height. The average of the roof eave height and the height to the highest point on the roof surface, except that eave height shall be used for roof angles less than or equal to 10 degrees (0.18 rad).

Mil. A unit of measurement equal to 1/1000 inch.

Multiple Span. The *span* made by a continuous member having intermediate supports.

Nominal Load. Magnitude of the *load* specified by the *applicable building code*. [USA and Mexico]

Nominal Resistance. Capacity of a structure or *component* to resist the effects of *loads*, determined in accordance with this standard using specified material strengths and dimensions. [Canada]

Nominal Strength. Strength of a structure or *component* (without the *resistance factor* or *safety factor*) to resist the *load effects*, as determined in accordance with this standard. [USA and Mexico]

Nonstructural Member. A member in a steel-framed system that is not a part of the gravity load resisting system, lateral force resisting system or building envelope.

Panel Point. The connection region between a *web* and *chord member*.

Pitch Break. The connection region between two *truss chord members* where there is a change in slope, excluding the *heel*.

Plan Aspect Ratio. The ratio of the length (longer dimension) to the width (shorter dimension) of the building.

Punchout. A hole made during the manufacturing process in the *web* of a steel framing member.

Purlin. Horizontal structural member that supports roof deck and is primarily subjected to bending under vertical *loads* such as snow, wind, or dead *loads*.

Rake Overhang. The horizontal projection of the roof measured from the outside face of a gable endwall to the outside edge of the roof.

Repetitive Framing. A framing system where the wall, floor and roof *structural members* are spaced no greater than 24 inches (610 mm) on center. Larger spaces are permitted at openings where the structural *loads* are transferred to headers or lintels and supporting *studs, joists* or *rafters*.

Required Strength. Forces, stresses, and deformations produced in a structural component, determined by either structural analysis, for the *LRFD* or *ASD load combinations*, as appropriate, or as specified by this standard. [USA and Mexico]

Resistance Factor (ϕ). Factor that accounts for unavoidable deviations of the actual strength from the *nominal strength* [nominal value] and for the manner and consequences of failure.

Ridge. The horizontal line formed by the joining of the top edges of two upward sloping roof surfaces.

Rim Track. A horizontal *structural member* that is connected to the end of a *floor joist*.

Roof Rafter. A horizontal or sloped, *structural member* that supports roof *loads*.

Safety Factor (Ω). Factor that accounts for the desired level of safety, including deviations of the actual *load* from the *nominal load* and uncertainties in the analysis that transforms the *load* into a *load effect*, in determining the *nominal strength* and for the manner and consequences of failure. [USA and Mexico]

Seismic Design Category (SDC). Classification assigned to a building based upon its importance and the severity of the design earthquake ground motion at the building site as given in the *applicable building code*.

Seismic Force Resisting System. That part of the structural system that has been considered in the design to provide the required resistance to the earthquake forces and effects. [Canada]

Shear Wall. Wall that provides resistance to lateral *loads* in the plane of the wall and provides stability for the structural system.

Single Span. The *span* made by one continuous structural member without any intermediate supports.

Span. The clear horizontal distance between bearing supports.

Specified Load. Magnitude of the *load* specified by the *applicable building code*, not including *load factors*. [Canada]

Static Load. A *load* or series of *loads* that are supported by or are applied to a structure so gradually that forces caused by change in momentum of the *load* and structural elements

can be neglected and all parts of the system at any instant are essentially in equilibrium.

Steel Sheet. A thin steel panel used in lieu of structural sheathing for wall bracing applications.

Strap. Flat or coiled sheet steel material typically used for *bracing* and *blocking*, which transfers *loads*, by tension and/or shear.

Strap Bracing. Steel straps, applied diagonally to form a vertical truss as part of the lateral force resisting system.

Strength Design. Also known as *load and resistance factor design*, an outdated term used in some reference documents. [USA and Mexico]

Structural Component. Member, connector, connecting element or assemblage.

Structural Member. A member that resists *design loads* [*factored loads*] as required by the applicable building code, except when defined as a *nonstructural member*.

Structural Sheathing. The covering used directly over *structural members* that is capable of distributing *loads*, bracing members, and generally strengthening the assembly.

Stud. A vertical framing member in a wall system or assembly.

Track. A framing member consisting of only a *web* and two (2) *flanges*. *Track web* depth measurements are taken to the inside of the *flanges*.

Truss. A coplanar system of *structural members* joined together at their ends, usually to construct a series of triangles that form a stable beam-like framework.

Truss Design Engineer. Person who is licensed to practice engineering as defined by the legal requirements of the jurisdiction in which the building is to be constructed and who supervises the preparation of the *truss design drawings*.

Truss Designer. Person responsible for the preparation of the *truss design drawings*.

Truss Design Drawing. Written, graphic and pictorial depiction of an individual *truss*.

Truss Manufacturer. An individual or organization engaged in the manufacturing of site-built or in-plant *trusses*.

Truss Member. A *chord member* or *web member* of a *truss*.

Type I Braced Wall Panel. *Type I braced wall panels* are sheathed for the full height of the wall with wood *structural sheathing* panels or *steel sheet* on one side, have no openings, and have continuous sheathing between *hold-down* anchors.

Type I Shear Wall. Wall designed to resist in-plane lateral forces that is fully sheathed and that is provided with *hold-down* anchors at each end of the wall segment. *Type I shear walls* are only permitted to have openings where detailing for force transfer around the openings is provided.

Type II Braced Wall. *Type II braced walls* are fully sheathed for the full height of the wall with wood *structural sheathing* panels or *steel sheet* on one side, and are permitted to have openings between *hold-down* anchors.

Type II Shear Wall. Wall designed to resist in-plane lateral forces that is sheathed with wood structural panels or sheet steel that contains openings, but which has not been specifically designed and detailed for force transfer around wall openings. *Hold-down* anchors for *Type II shear walls* are only required at the ends of the wall.

Type II Shear Wall Segment. Section of *shear wall* (within a *Type II shear wall*) with full-height sheathing (i.e., with no openings) and which meets specific aspect ratio limits.

Web. That portion of a framing member that connects the *flanges*.

Web Member. A structural member in a *truss* that is connected to the top and bottom *chords*, but is not a *chord member*.

Wind Exposure. Wind exposure in accordance with the *applicable building code*.

Yield Strength. Stress at which a material exhibits a specified limiting deviation from the proportionality of stress to strain as defined by ASTM.

Z-Shape. A point-symmetric or non-symmetric section that is used as a *chord member* in a *truss*.

A3 Material

Structural members utilized in *cold-formed steel* framed construction shall be cold-formed to shape from sheet steel complying with the requirements of ASTM A1003/A1003M, subject to the following limitations:

- (a) Type H (high ductility): No limitations.
- (b) Type L (low ductility): Limited to *purlins*, *girts* and *curtain wall studs*. Additional country-specific limitations for *curtain wall studs* are provided in Section A2.3.5 of AISI S100 [CSA S136] Appendix A or B, as applicable.

For Canada: Alternatively, *structural members* are permitted to be cold-formed to shape from sheet steel complying with the requirements of ASTM A653/A653M Type SS or ASTM A792/A792M Type SS.

A4 Corrosion Protection

A4.1 *Structural members* utilized in *cold-formed steel* framed construction shall have a protective coating as specified in Table A4-1.

Table A4-1
Coating Designations

Coating Classification	Coating Designator	Minimum Coating Requirements			
		Zinc Coated ^A oz/ft ² (g/m ²)	Zinc Iron ^B oz/ft ² (g/m ²)	55% Al-Zinc ^C oz/ft ² (g/m ²)	Zinc-5% ^D oz/ft ² (g/m ²)
Metallic Coated	CP 60	G60 [Z180]	A60 [ZF180]	AZ50 [AZM150]	CF30 [ZGF90]
	CP 90	G90 [Z275]	Not Applicable	AZ50 [AZM150]	CF45 [ZGF135]
Painted Metallic	PM	The metallic coated substrate shall meet the requirements of metallic coated. In addition, the paint film shall have a minimum thickness of 0.5 mil per side (primer plus topcoat) with a minimum primer thickness of 0.1 mil per side. ^E			

^A Zinc-coated steel sheet as described in ASTM A653/A653M.

^B Zinc-iron alloy-coated steel sheet as described in ASTM A653/A653M.

^C 55% aluminum-zinc alloy-coated steel sheet as described in ASTM A792/A792M.

^D Zinc-5% aluminum alloy-coated steel sheet as described in ASTM A875/A875M.

^E In accordance with the requirements of ASTM A1003/A1003M.

For Canada: *Structural members* utilized in *cold-formed steel* framed construction shall have a metallic coating of G60 [Z180] complying with the requirements of ASTM A653/A653M or AZ50 [AZM150] complying with the requirements of ASTM A792/A792M.

A4.2 Additional corrosion protection shall not be required on edges of metallic-coated steel framing members, shop or field cut, punched or drilled.

A4.3 Unless additional corrosion protection is provided, framing members shall be located within the building envelope and shielded from direct contact with moisture from the ground or the outdoor climate.