AISI S214-07/S2-08

American Iron and Steel Institute

AISI STANDARD

Supplement 2 to the North American Standard for Cold-Formed Steel Framing - Truss Design

2007 Edition

Endorsed by Steel Framing Alliance

Steel Framing Alliance™

DISCLAIMER

The material contained herein has been developed by the American Iron and Steel Institute 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.

The materials set forth herein are for general purposes only. They are not a substitute for competent professional advice. Application of this information to a specific project should be reviewed by a design professional. Indeed, in many jurisdictions, such review is required by law. Anyone making use of the information set forth herein does so at their own risk and assumes any and all liability arising therefrom.

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PREFACE

The American Iron and Steel Institute Committee on Framing Standards has developed Supplement 2 to AISI S214-07, the *North American Standard for Cold-Formed Steel Framing – Truss Design, 2007 Edition*, to better describe design responsibilities and criteria for loading, manufacturing quality, installation and bracing.

This Supplement 2 to AISI S214-07 replaces Supplement 1 to AISI S214-07.

This Supplement revises and replaces Chapters A, B, C, E and F of AISI S214-07.

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 their appreciation for the support of the Steel Framing Alliance.

The Committee acknowledges the significant investment and guidance provided by the Construction Market Council of the Steel Market Development Institute, a business unit of AISI.

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SUPPLEMENT 2 TO THE NORTH AMERICAN STANDARD FOR COLD-FORMED STEEL FRAMING – TRUSS DESIGN

A. GENERAL

A1 Scope

The design of *cold-formed steel trusses* for load carrying purposes in buildings shall be in accordance with AISI S100 [CSA S136] and AISI S200, except as modified by the provisions of this standard. This standard shall also apply to manufacturing, quality criteria, installation and testing as they relate to the design of *cold-formed steel trusses*.

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.

The responsibilities defined in this standard are not intended to preclude alternate provisions as agreed upon by the parties involved.

This standard shall include Sections A through G inclusive.

A2 Definitions

Where terms appear in this standard in italics, such terms shall have meaning as defined in this section or in AISI S200. Terms included in square brackets are specific to *LSD* terminology. Terms not italicized shall have the ordinary accepted meaning in the context for which they are intended.

Building Designer. Owner of the building or the person that contracts with the owner for the design of the framing structural system and/or who is responsible for the preparation of the *construction documents*. When mandated by the legal requirements, the *building designer* shall be a *registered design professional*.

Construction Documents. Written, graphic and pictorial documents prepared or assembled for describing the design (including the framing structural system), location and physical characteristics of the elements of a building necessary to obtain a building permit and construct a building.

Registered Design Professional. Architect or engineer, who is licensed to practice their respective design profession as defined by the legal requirements of the jurisdiction in which the building is to be constructed.

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

Truss Submittal Package. Package consisting of each individual *truss design drawing*, and, as

applicable, the *truss placement diagram*, the cover/truss index sheet, permanent individual *truss member* restraint/bracing details designed in accordance with generally accepted engineering practice, applicable permanent individual *truss member* restraint/bracing details, and any other structural details germane to the *trusses.*

A3 Loads and Load Combinations

Buildings or other structures, and all parts therein, shall be designed to safely support all loads that are expected to affect the structure during its life in accordance with the *applicable building code.* In the absence of an *applicable building code*, the loads, forces, and combinations of loads shall be in accordance with accepted engineering practice for the geographical area under consideration as specified by the applicable sections of *Minimum Design Loads for Buildings and Other Structures* (ASCE 7) in the United States and Mexico, and the *National Building Code of Canada* (NBCC) in Canada.

A4 Referenced Documents

The following documents or portions thereof are referenced within this standard and shall be considered part of the requirements of this document.

1. AISI S100-07, *North American Specification for the Design of Cold-Formed Steel Structural* Members, American Iron and Steel Institute, Washington, DC.
2. AISI S200-07, *North American Standard for Cold-Formed Steel Framing - General Provisions*, American Iron and Steel Institute, Washington, DC.
3. AISI S902-02, *Stub-Column Test Method for Effective Area of Cold-Formed Steel Columns*, American Iron and Steel Institute, Washington, DC.
4. AISI S905-02, *Test Methods for Mechanically Fastened Cold-Formed Steel Connections*, American Iron and Steel Institute, Washington, DC.
5. ASCE 7-05 Including Supplement No. 1, *Minimum Design Loads for Buildings and Other Structures*, American Society of Civil Engineers, Reston, VA.
6. CAN/CSA-S136-07, *North American Specification for the Design of Cold-Formed Steel Structural Members*, Canadian Standards Association, Mississauga, Ontario, Canada.
7. NBCC 2005, *National Building Code of Canada*, 2005 Edition, National Research Council of Canada, Ottawa, Ontario, Canada.

B. TRUSS DESIGN RESPONSIBILITIES

B1 Design of Trusses

Cold-formed steel trusses shall be designed in accordance with one of the following methods:

(a) **Designed by a Design Professional.** If the *building designer* or a delegated *registered design professional* designs the *cold-formed steel trusses*, all design criteria, details and specifications with respect to the *trusses* shall be indicated on the *construction documents* or contract as required by the *applicable building code*.

(b) **Designed by a Truss Design Engineer or Truss Designer.** *Cold-formed steel truss* design shall be in accordance with Sections B2.1, B2.2 and B2.3.

B2 Responsibilities of Truss Design Engineer / Truss Designer

B2.1 Preparation of Truss Design Drawings

B2.1.1 Truss Design Engineer

The *truss design engineer* shall supervise the preparation of the *truss design drawings* based on the *truss* design criteria and requirements set forth in the *construction documents* or as otherwise set forth in writing by the *registered design professional* for the building as supplied to the *truss design engineer* by the contractor through the *truss manufacturer*.

B2.1.2 Truss Designer

The *truss designer* shall be responsible for the individual *truss* component design and the preparation of the *truss design drawings* based on the *truss* design criteria and requirements set forth in the *construction documents* or as otherwise set forth in writing by the *building designer* as supplied to the *truss designer* by the *truss manufacturer*.

B2.2 Truss Design Criteria, Assumptions and Calculations

The *truss designer* shall make available as part of the truss submittal package, upon request, design calculations, including the following:

(1) loads and load combinations considered;

(2) axial forces, moments, and shears resulting from the applied loads and load combinations; and / or

(3) design assumptions.

B2.3 Truss Design Drawings

The *truss design drawings* shall consist of the individual *truss design drawings* and referenced details, if any. The *truss design drawings* shall be part of the *truss submittal package* and include, at a minimum, the information specified below:

(1) *applicable building code* used for design, unless specified on a cover / truss index sheet;

(2) slope or depth, span, and spacing;

(3) number of plies if greater than one;

(4) bearing locations and minimum bearing lengths;

(5) design loading(s) as applicable, including:
  (a) top chord roof or floor live load;
  (b) top chord roof snow load;
  (c) top chord dead load;
  (d) bottom chord live load;
  (e) bottom chord dead load;
  (f) additional loads and locations;
  (g) environmental design loads (e.g., wind and snow) and all applicable factors as required to calculate the *truss* loads; and
  (h) other lateral loads, including drag strut loads;

(6) reaction forces and direction, including maximum downward, lateral and uplift reaction forces, where applicable, based on *nominal* [*specified*] *loads*;

(7) location of all *truss member* connections;

(8) *gusset plate* locations, sizes, and material specifications;

(9) fastening type, size, quantities, and locations;

(10) shape and material specification for each *truss member*;

(11) maximum axial compressive force in all *truss members* based on *nominal* [*specified*] *loads*;

(12) *truss*-to-*truss* connection and *truss* field assembly requirements;

(13) calculated span-to-deflection ratio and/or maximum vertical and horizontal deflection for *nominal* [*specified*] live and total *load,* as applicable;

(14) locations of required permanent individual *truss member* restraint in accordance with Section B6(a) or B6(c), if required; and

(15) design and details for individual *truss member* reinforcement in accordance with Section B6(b), if required.

B2.4 Truss Design Drawings Seal and Signature

Where required by the *building designer, registered design professional* for the building or the authority having jurisdiction, each individual *truss design drawing* shall bear the seal and signature of the *truss design engineer*. When an individual *truss design drawing* has multiple pages, only the first page shall be required to be signed and sealed by the *truss design engineer*. When a cover/truss index sheet is used, it shall be the only document required to be signed and sealed by the *truss design engineer*.

B3 Responsibilities of Truss Manufacturer

B3.1 Truss Design Criteria and Requirements

The *truss manufacturer* shall obtain the *truss* design criteria and requirements from the *construction documents*.

B3.2 Communication to Truss Design Engineer

The *truss manufacturer* shall communicate the *truss* design criteria and requirements to the *truss design engineer* or *truss designer*, as applicable.

B3.3 Truss Placement Diagram

Where required by the *construction documents* or contract, the *truss manufacturer* shall prepare the *truss placement diagram* that identifies the assumed location for each individually designated *truss* and references the corresponding *truss design drawing*. The *truss placement diagram* shall be permitted to include identifying marks for other products including structural elements, so that they may be more easily identified by the contractor during field installation. When the *truss placement diagram* serves only as a guide for *truss* installation and requires no engineering input, it does not require the seal of any *truss design engineer* or *registered design professional*.

B3.4 Truss Submittal Package

Where required by the *construction documents* or contract or the building official, the *truss manufacturer* shall provide the appropriate *truss submittal package* to one or more of the following: building official; *building designer; registered design professional* for the building and / or contractor for review and / or approval.

B3.4.1 Information Provided to the Building Designer / Registered Design Professional for the Building

The contractor, after reviewing and / or approving the *truss submittal package*, shall forward the *truss submittal package* for review by the *building designer* and / or *registered design professional* for the building.

B3.5 Reliance on Construction Documents

The *truss manufacturer* shall be permitted to rely on the accuracy and completeness of information furnished in the *construction documents* or otherwise furnished in writing by the *building designer*, *registered design professional* for the building and / or contractor.

B4 Responsibilities of Building Designer / Registered Design Professional for the Building

B4.1 Preparation of Construction Documents

The *construction documents* shall be prepared by the *building designer* or *registered design professional* for the building and shall be of sufficient clarity to indicate the location, nature and extent of the work proposed in accordance with the *applicable building code.*

B4.2 Deferred Submittals

The *building designer* or *registered design professional* for the building shall list the deferred submittals on the *construction documents*. The *building designer* or *registered design professional* shall review deferred submittals in accordance with Section B4.3.

B4.3 Review Submittal Packages

The *building designer* or *registered design professional* for the building shall review the *truss submittal package*. All such submittals shall include a notation indicating that they have been reviewed.

B4.4 Required Information in Construction Documents

The *building designer* or *registered design professional* for the building, through the *construction documents*, shall provide information sufficiently accurate and reliable to be used

for facilitating the supply of the structural elements and other information for developing the design of the *trusses* for the building, and shall provide the following:

(1) All *truss* and structural element orientations and locations;

(2) Information to fully determine all *truss* profiles;

(3) All structural element and *truss* support locations and bearing conditions;

(4) The location, direction, and magnitude of all dead, live, and lateral loads applicable to each *truss* including, but not limited to, loads attributable to: roof, floor, partition, mechanical, fire sprinkler, attic storage, rain and ponding, wind, snow (including snow drift and unbalanced snow), seismic; and any other loads on the *truss*;

(5) All *truss* anchorage required to resist uplift, gravity, and lateral loads consisting of *approved* hardware or methods designed by a *registered design professional*;

(6) *Truss* to structural element connections, but not *truss*-to-*truss* connections, consisting of *approved* hardware or methods designed by a *registered design professional*;

(7) Permanent building stability *bracing*; including *truss* anchorage connections to the permanent building stability *bracing*;

(8) Criteria related to serviceability issues including:

(a) Allowable vertical, horizontal or other required deflection criteria;

(b) Any dead load and live load deflection criteria for flat roofs subject to ponding loads;

(c) Any differential deflection criteria from *truss*-to-*truss* or *truss*-to-adjacent structural member;

(d) Any deflection and vibration criteria for floor *trusses* including any strongback bridging requirements or any dead load and live load deflection criteria for floor *trusses* supporting stone or ceramic tile finishes; and

(e) Anticipated moisture, temperature, corrosive chemicals and gases expected to affect the trusses and requirements for any additional corrosion protection.

B4.5 Permanent Individual Truss Member Restraint/Bracing

The *building designer* and/or the *registered design professional* for the building shall be permitted to specify the method of the permanent individual *truss member* restraint/bracing in accordance with Section B6.

B5 Responsibilities of Contractor

B5.1 Information Provided to Truss Manufacturer

The contractor shall provide to the *truss manufacturer* a copy of all *construction documents* pertinent to the framing structural system and the design of the *trusses* (i.e., framing plans, specifications, details, structural notes), and the name of the *building designer* and/or the *registered design professional* for the building if not noted on the *construction documents*.

Amended *construction documents* upon approval through the plan review/permitting process shall be immediately communicated to the *truss manufacturer*.

B5.2 Information Provided to Building Designer / Registered Design Professional

The contractor, after approving the *truss submittal package*, shall forward the *truss submittal package* for review by the *building designer* and / or the *registered design professional* for the building.

B5.3 Truss Submittal Package Review

The contractor shall not proceed with the *truss* installation until the *truss submittal package* has been reviewed by the *building designer* and / or the *registered design professional* for the building.

B5.4 Means and Methods

The contractor is responsible for the construction means, methods, techniques, sequences, procedures, programs, and safety in connection with the receipt, storage, handling, installation, restraining, and bracing of the *trusses*.

B5.5 Truss Installation

The contractor shall ensure that the building support conditions are of sufficient strength and stability to accommodate the loads applied during the *truss* installation process. *Truss* installation shall comply with installation tolerances shown in the standard industry details. Permanent individual *truss member* restraint / bracing for the completed building in accordance with Section B6 and any other construction work related directly or indirectly to the *trusses* shall be installed by the contractor.

B5.6 Alterations to Trusses

Truss members and components shall not be cut, notched, drilled, spliced or otherwise altered in any way without written concurrence and approval of any *registered design professional*. Alterations resulting in the addition of loads to any member (i.e., HVAC equipment, piping, additional roofing or insulation, etc.) shall not be permitted without verification by the *truss design engineer* or *truss designer* that the *truss* is capable of supporting such additional loading.

B6 Design of Permanent Individual Truss Member Restraint / Bracing

Where permanent individual *truss member* restraint / bracing is required, it shall be accomplished by one of the following methods:

(a) **Standard Industry Details.** Standard industry permanent individual *truss member* restraint / bracing details supplied in accordance with B3.4.

(b) **Substitution with Reinforcement.** *Truss member* reinforcement designed by the *truss design engineer* or *truss designer* to eliminate the need for permanent individual *truss member* restraint / bracing. The permanent individual *truss member* reinforcement design and details shall be noted / shown on the *truss* design drawings or on supplemental *truss member* buckling reinforcement details provided by the *truss design engineer* or *truss designer*.

(c) **Project Specific Design.** A project specific permanent individual *truss member* restraint / bracing design specified by any *registered design professional*, as specified in the contract documents and / or *construction documents*, and supplied in accordance with B3.4.

C. RESERVED

E. QUALITY CRITERIA FOR STEEL TRUSSES

E1 Manufacturing Quality Criteria

The *truss manufacturer* shall manufacture the *trusses* in accordance with the final *truss design drawings*, using the quality criteria required by the manufacturer's quality control program unless more stringent quality criteria is required by the owner in writing or through the *construction documents*.

E2 Member Identification

Truss chord members and *web members* shall be identified in accordance with the Product Identification requirements for framing members defined in AISI S200.

E3 Assembly

Trusses shall have steel members that are accurately cut, in accordance with the *truss* design, so that the assembled *truss* has close fitting steel members. The maximum gap between *web members* shall not exceed ½ inch (12.7 mm) unless approved by the *truss design engineer* or *truss designer*. The location of *chord members*, *web members*, and joints shall be as specified in the *truss* design.

Truss dimensions which vary from the *truss* design shall not exceed the tolerances shown in Table E8. Inaccuracies exceeding these allowable tolerances shall be acceptable upon approval and follow-up documentation by the *truss design engineer* or *truss designer*. Any shop modifications or repairs shall be documented by the *truss design engineer* or *truss designer*.

Table E8
Manufacturing Tolerances For Finished Truss Units

Length[1]	Variance from Design Dimensions
Up to 30 ft (9.14 m)	½ inch (12.7 mm)
Over 30 feet (9.14 m)	¾ inch (19.1 mm)
Height[2]	**Variance from Design Dimensions**
Up to 5 feet (1.52 m)	¼ inch (6.4 mm)
Over 5 feet (1.52 m)	½ inch (12.7 mm)

[1] Length, for manufacturing tolerance purposes, is the overall length of the *truss* unit, excluding overhangs, and extensions.

[2] Height, for manufacturing tolerances purpose, is the overall height of the *truss* unit measured from the top of the top *chord member* to the bottom of the bottom *chord member* at the highest point of the *truss*, excluding projections above the top *chord member* and below the bottom *chord member*, overhangs, and extensions.

F. TRUSS INSTALLATION

F1 Installation Tolerances

F1.1 Straightness

Trusses shall not be installed with an overall bow or bow in any *chord member* or panel which exceeds the lesser of L/200 or 2 inches (50.8 mm), where L is the length of the *truss, chord member*, or panel in inches.

F1.2 Plumbness

Trusses shall not be installed with a variation from plumb (vertical tolerance) at any point along the length of the *truss* from top to bottom which exceeds 1/50 of the depth of the *truss* at that point or 2 inches (50.8 mm) whichever is less, unless *trusses* are specifically designed to be installed out of plumb.

F1.3 Top Chord Bearing Trusses

For top chord bearing *trusses* a maximum gap tolerance between the inside of the bearing and the first diagonal or vertical *web member* shall be specified in the design.

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