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INTRODUCTION TO COLD-FORMED STEEL FRAMING STANDARDS

This Tech Note Updates and Replaces Tech Note B004-20

Summary: The AISI Committee on Framing Standards was established in 1998 with a mission to eliminate regulatory barriers and increase the reliability and cost competitiveness of cold-formed steel framing in residential and light commercial building construction through improved design and installation standards. This Tech Note summarizes the efforts and work products of the Committee.

Disclaimer: Designs cited herein are not intended to preclude the use of other materials, assemblies, structures or designs when these other designs demonstrate equivalent performance for the intended use. CFSEI documents are not intended to exclude the use and implementation of any other design or construction technique.

Design of cold-formed steel framing assemblies has a long history of using the AISI S100, *North American Specification for the Design of Cold-Formed Steel Structural Members*. However, AISI S100 primarily reflects the behavior of individual members and connections. It has been recognized in the engineering community that assemblies may have inherent strength due to the synergistic behavior of the assembly components. For example, the wall stud track, although not explicitly recognized by AISI S100, contributes to the web crippling capacity of a curtain wall stud. To enable more economical framing design solutions, AISI framing standards are developed to recognize the assembly behavior. Although AISI S100 remains a primary reference, the framing standards enable evaluation of the assembly performance.

INTRODUCTION TO THE FRAMING STANDARDS

The AISI Committee on Framing Standards was authorized by AISI in 1997 and first met face-to-face in 1998. The Committee issued its first four framing standards in 2001 which were adopted by IBC 2003:



- GP-2001, *North American Standard for Cold-Formed Steel Framing—General Provisions,* 2001 Edition
- HEADER-2001, *North American Standard for Cold-Formed Steel Framing—Header Design,* 2001 Edition
- PM-2001, *North American Standard for Cold-Formed Steel Framing—Prescriptive Method for One- and Two-Family Dwellings,* 2001 Edition
- TRUSS-2001, *North American Standard for Cold-Formed Steel Framing—Truss Design,* 2001 Edition

In 2004, these standards were updated and two new standards focused on wall stud design and lateral system design were completed and adopted by IBC 2006:



- AISI/COFS/GP-2004, *Standard for Cold-Formed Steel Framing—General Provisions,* 2004 Edition
- AISI/COFS/HEADER-2004, *Standard for Cold-Formed Steel Framing—Header Design,* 2004 Edition
- AISI/COFS/LATERAL-2004, *Standard for Cold-Formed Steel Framing—Lateral Design,* 2004 Edition
- PM-2004, *Standard for Cold-Formed Steel Framing—Prescriptive Method for One- and Two-Family Dwellings,* 2004 Edition
- AISI/COFS/TRUSS-2004, *Standard for Cold-Formed Steel Framing—Truss Design,* 2004 Edition
- AISI/COFS/WSD-2004, *Standard for Cold-Formed Steel Framing—Wall Stud Design,* 2004 Edition

The 2007 standards ushered in a change to a common nomenclature that identified the documents as AISI standards. In addition to updating existing standards, two new standards were completed and ultimately all were adopted in IBC 2009 or referenced by other standards:



- AISI S200-07, *North American Standard for Cold-Formed Steel Framing - General Provisions,* 2007 Edition
- AISI S201-07, *North American Standard for Cold-Formed Steel Framing - Product Data,* 2007 Edition
- AISI S210-07, *North American Standard for Cold-Formed Steel Framing - Floor and Roof System Design,* 2007 Edition
- AISI S211-07, *North American Standard for Cold-Formed Steel Framing – Wall Stud Design,* 2007 Edition
- AISI S212-07, *North American Standard for Cold-Formed Steel Framing – Header Design,* 2007 Edition
- AISI S213-07, *North American Standard for Cold-Formed Steel Framing – Lateral Design,* 2007 Edition
- AISI S214-07 w/S2-08, *North American Standard for Cold-Formed Steel Framing – Truss Design,* 2007 Edition
- AISI S230-07 w/S2-08, *North American Standard for Cold-Formed Steel Framing – Prescriptive Method for One- and Two-Family Dwellings,* 2007 Edition

In 2011, two new standards, the first code of standard practice, AISI S202 and also nonstructural design standard, AISI S220, were issued. For IBC 2012, the 2007 standards were reaffirmed and a supplement was issued for AISI S213:



- AISI S200-07, *North American Standard for Cold-Formed Steel Framing - General Provisions,* 2007 Edition
- AISI S201-07, *North American Standard for Cold-Formed Steel Framing - Product Data,* 2007 Edition
- AISI S210-07, *North American Standard for Cold-Formed Steel Framing - Floor and Roof System Design,* 2007 Edition
- AISI S211-07, *North American Standard for Cold-Formed Steel Framing – Wall Stud Design,* 2007 Edition
- AISI S212-07, *North American Standard for Cold-Formed Steel Framing – Header Design,* 2007 Edition
- AISI S213-07 w/S1-09, *North American Standard for Cold-Formed Steel Framing – Lateral Design,* 2007 Edition
- AISI S214-07 w/S2-08, *North American Standard for Cold-Formed Steel Framing – Truss Design,* 2007 Edition
- AISI S230-07 w/S2-08, *North American Standard for Cold-Formed Steel Framing – Prescriptive Method for One- and Two-Family Dwellings,* 2007 Edition

In anticipation of the 2015 IBC, the existing framing standards were updated (or reaffirmed) in 2012:



- AISI S200-12, *North American Standard for Cold-Formed Steel Framing - General Provisions,* 2012 Edition
- AISI S201-12, *North American Standard for Cold-Formed Steel Framing - Product Data,* 2012 Edition
- AISI S210-07 (2012), *North American Standard for Cold-Formed Steel Framing - Floor and Roof System Design,* 2007 Edition (Reaffirmed 2012)
- AISI S211-07 w/S1-12 (2012), *North American Standard for Cold-Formed Steel Framing – Wall Stud Design,* 2007 Edition (Reaffirmed 2012)
- AISI S212-07 (2012), *North American Standard for Cold-Formed Steel Framing – Header Design,* 2007 Edition (Reaffirmed 2012)
- AISI S213-07 w/S1-09 (2012), *North American Standard for Cold-Formed Steel Framing – Lateral Design,* 2007 Edition (Reaffirmed 2012)
- AISI S214-12, *North American Standard for Cold-Formed Steel Framing – Truss Design,* 2012 Edition
- AISI S220-11, *North American Standard for Cold-Formed Framing - Nonstructural Members,* 2011 Edition
- AISI S230-07 w/S3-12 (2012), *North American Standard for Cold-Formed Steel Framing – Prescriptive Method for One- and Two-Family Dwellings,* 2007 Edition with Supplement 3 (Reaffirmed 2012)

The 2015 framing standards marked a change in presentation for the framing standards. Instead of issuing six individually focused standards the framing standards were merged into one new AISI S240 standard. This standard addresses design for gravity, wind and low-seismic loading. To better enable design for high-seismic loading, AISI S400 was issued. The suite of framing standards adopted in 2018 IBC or referenced by other standards included the following:



- AISI S201-17, *North American Standard for Cold-Formed Steel Framing - Product Data,* 2017 Edition
- AISI S202-15, *Code of Standard Practice for Cold-Formed Steel Structural Framing,* 2015 Edition
- AISI S220-15*, North American Standard for Cold-Formed Steel Framing—Nonstructural Members,* 2015 Edition
- AISI S230-15*, Standard for Cold-Formed Steel Framing—Prescriptive Method for One- and Two-Family Dwellings,* 2015 Edition
- AISI S240-15, *North American Standard for Cold-Formed Steel Structural Framing,* 2015 Edition
- AISI S400-15 w/S1-16, *North American Standard for Seismic Design of Cold-Formed Steel Structural Systems,* 2015 Edition

In anticipation of the 2021 IBC, the content of AISI S201 integrated into AISI S220 and AISI 240, as applicable, and the framing standards were updated, as follows:



- AISI S202-20, *Code of Standard Practice for Cold-Formed Steel Structural Framing,* 2020 Edition
- AISI S220-20, *North American Standard for Cold-Formed Steel Framing—Nonstructural Members*, 2020 Edition
- AISI S230-19, *Standard for Cold-Formed Steel Framing—Prescriptive Method for One- and Two-Family Dwellings,* 2020 Edition
- AISI S240-20, *North American Standard for Cold-Formed Steel Structural Framing*, 2020 Edition
- AISI S400-20, *North American Standard for Seismic Design of Cold-Formed Steel Structural Systems*, 2020 Edition

In 2021, AISI S250-21, *North American Standard for Thermal Transmittance of Building Envelopes with Cold-Formed Steel Framing* was published by AISI.

All current framing standards are available as free download in PDF format for engineers at www.aisistandards.org. Previous framing standards are also available free of charge for engineers in PDF format from the Technical Library of the Wei-Wen Yu Center for Cold-Formed Steel Structures at the Missouri University for Science and Technology (Wei-Wen Yu Center for Cold-Formed Steel Structures (CCFSS), Missouri University of Science and Technology Research, Scholars' Mine).

CURRENT FRAMING STANDARDS

AISI S202, *Code of Standard Practice for Cold-Formed Steel Structural Framing*

The practices in AISI S202, *Code of Standard Practice for Cold-Formed Steel Structural Framing* are a model to address the design, fabrication and installation. AISI S202 defines the commonly accepted standards of custom and usage for fabrication and installation. When adopted wholly or in part by a contract or construction document, the trade practices that are defined in AISI S202 shall govern.

AISI S220, *North American Standard for Cold-Formed Steel Framing – Nonstructural Members*

The design and installation of cold-formed steel nonstructural members shall be in accordance with AISI S220, *North American Standard for Cold-Formed Steel Framing – Nonstructural Members*. AISI S220 is based on the premise that the consequence of failure for a nonstructural member is less than for a structural member and consequently permits a lower reliability; i.e. lower safety factor, for nonstructural members.

AISI S230, *North American Standard for Cold-Formed Steel Framing—Prescriptive Method for One- and Two-Family Dwellings*

The provisions of AISI S230, *North American Standard for Cold-Formed Steel Framing—Prescriptive Method for One- and Two-Family Dwellings*, apply to the construction of detached one- and two-family dwellings, townhouses and other attached single-family dwellings not more than three stories in height.

AISI S240, *North American Standard for Cold-Formed Steel Structural Framing*

AISI S240, *North American Standard for Cold-Formed Steel Structural Framing*, represents a compilation of the previous six design standards, AISI S200 and AISI S210 through AISI S214. (See Figure 1: Table of Contents.)



As Figure 1 illustrates, the assemblies previously considered by the six individual framing standards are now subsections of AISI S240. In addition, a new Section D, “Quality Control and Quality Assurance”, has been added.

In regard to lateral design, AISI S240 continues to provide guidance for wind loading. For seismic design, AISI S240 only permits design when R = 3. For R > 3, AISI S400 provides the design guidance.

NORTH AMERICAN STANDARD FOR COLD-FORMED STEEL STRUCTURAL FRAMING

A. GENERAL
A1 Scope
A2 Definitions
A3 Material
A4 Corrosion Protection
A5 Products
A6 Reference Documents
B. DESIGN
B1 General
B2 Floor and Ceiling Framing
B3 Wall Framing
B3.3 Header Design
B4 Roof Framing
B5 Lateral Force-Resisting Systems
C. INSTALLATION
C1 General
C2 Material Condition
C3 Structural Framing
C4 Connections
C5 Miscellaneous
D. QUALITY CONTROL AND QUALITY ASSURANCE
D1 General
D2 Quality Control Programs
D3 Quality Control Documents
D4 Quality Assurance Agency Documents
D5 Inspection Personnel
D6 Inspection Tasks
D7 Nonconforming Material and Workmanship
E. TRUSSES
E1 General
E2 Truss
E3 Loading
E4 Truss Design
E5 Quality Criteria for Steel Trusses
E6 Truss Installation
E7 Test-Based Design
F. TESTING
F1 General
APPENDIX 1. CONTINUOUSLY BRACED DESIGN FOR DISTORTIONAL BUCKLING RESISTANCE
APPENDIX 2. TEST METHODS FOR TRUSS COMPONENTS AND ASSEMBLIES

Figure 1: Table of Contents for AISI S240

AISI S400, *North American Standard for Seismic Design of Cold-Formed Steel Structural Systems*



AISI S400, *North American Standard for Seismic Design of Cold-Formed Steel Structural Systems* provides design and construction guidance for cold-formed steel members and connections used in seismic force-resisting systems and diaphragms. In the United States and Mexico, in seismic design categories B or C and where the seismic response modification coefficient, R, used to determine the seismic design forces is taken equal to 3 design need only be in accordance with AISI S240.

AISI S250, *North American Standard for Thermal Transmittance of Building Envelopes With Cold-Formed Steel Framing*

AISI S250 is a single source for calculating the thermal transmittance (U-factors) of walls and ceiling/roof envelope assembles that contain cold-formed steel framing. The standard is intended for adoption and use in the United States, Canada and Mexico. AISI S250-21 was developed to eventually supersede the many methods currently found in various energy codes and standards, most of which are limited to calculating wall assemblies at 16 or 24 inches on center framing only.

OTHER COMMONLY REFERENCED STANDARDS



ASTM A1003, *Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members* defines the sheet steel's material characteristics and all framing standards require shapes be cold-formed from material complying with the requirements of this ASTM standard. For more information, reference CFSEI Tech Note G801, *ASTM A 1003 – No Cause for Rejection*. CFSEI Tech Note G800, *ASTM Standards for Cold-Formed Steel* provides an overview of the principal ASTM standards affecting cold-formed steel framing.

Cold-formed steel framing is to be designed in accordance with the applicable building code to support the expected loads. In the absence of a building code, the AISI framing standards reference ASCE 7, *Minimum Design Loads for Buildings and Other Structures*.

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