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North American Standard for Cold-Formed Steel Framing -- Product Data, 2017 Edition

American Iron and Steel Institute

AISI S201-17

American Iron and Steel Institute

AISI STANDARD

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DISCLAIMER

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.

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.

1st Printing – April 2018

PREFACE

The American Iron and Steel Institute Committee on Framing Standards has developed AISI S201, *North American Standard for Cold-Formed Steel Framing – Product Data*, to standardize requirements for *cold-formed steel* framing products. This standard is intended to establish and encourage the production and use of standardized products in the United States, Canada and Mexico. This edition supersedes the previous edition, designated as AISI S201-2012.

Since this standard is intended for use in Canada, Mexico and the United States, it was necessary to develop a format that would allow for provisions particular to each country. This resulted in a main document, Chapters A through D, and one country-specific appendix applicable only to Canada. No technical differences are intended between the provisions in Appendix A and the main body of the standard. Appendix A is intended to represent a subset of the broader range of standard products offered in the United States and Mexico.

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— PRODUCT DATA

A. GENERAL

A1 Scope

This Standard provides criteria, including material and product requirements, for *structural members* and *nonstructural members* utilized in *cold-formed steel light-frame construction* applications.

The components covered in this standard include *C-shape studs*, *joists*, *track*, U-channels, furring channels and angles.

This Standard shall not preclude the use of other products not meeting the criteria herein, when the other products 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 shall include Sections A through D, and Appendix A, as applicable.

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 terms appear in this Standard in italics, such terms shall have the meaning as defined in AISI S240. Terms included in square brackets are specific to *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 ordinary accepted meaning for the context for which they are intended.

☞ **Note**: See Appendix A for Provisions applicable to Canada.

A3 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. American Iron and Steel Institute, 25 Massachusetts Avenue NW, Suite 800, Washington, DC 20001:

   AISI S240-15, *North American Standard for Cold-Formed Steel Structural Framing*

   AISI S220-15, *North American Standard for Cold-Formed Steel Framing – Nonstructural Members*

☞ **Note**: See Appendix A for Provisions applicable to Canada.

B. MATERIALS

B1 Material Specification

Structural members shall be cold-formed to shape from sheet steel in compliance with the requirements of AISI S240 Section A3. *Nonstructural members* shall be cold-formed to shape from sheet steel in compliance with the requirements of AISI S220 Section A4. *Structural members* shall be limited to Grade 33 [230] and Grade 50 [340]. *Nonstructural members* shall be limited to Grade 33 [230].

☞ Note: See Appendix A for Provisions applicable to Canada.

B2 Base Steel Thickness

Structural members shall be cold-formed to shape from sheet steel with a minimum *base steel thickness* listed in Table B2-1. *Nonstructural* members shall be cold-formed to shape from sheet steel with a minimum base steel thickness listed in Table B2-2. Member thickness shall be referenced to the corresponding *designation thickness*.

☞ Note: See Appendix A for Provisions applicable to Canada.

Table B2-1
Standard Thickness—Structural Members

Designation Thickness	Minimum Base Steel Thickness		Design Thickness	
	(inch)	(mm)	(inch)	(mm)
33	0.0329	0.836	0.0346	0.879
43	0.0428	1.087	0.0451	1.146
54	0.0538	1.367	0.0566	1.438
68	0.0677	1.720	0.0713	1.811
97	0.0966	2.454	0.1017	2.583
118	0.1180	2.997	0.1242	3.155

Table B2-2
Standard Thickness—Nonstructural Members

Designation Thickness	Minimum Base Steel Thickness		Design Thickness	
	(inch)	(mm)	(inch)	(mm)
18	0.0179	0.455	0.0188	0.478
27	0.0269	0.683	0.0283	0.719
30	0.0296	0.752	0.0312	0.792

B3 Corrosion Protection

Structural members shall have a Zinc or 55% Al-Zinc protective coating in accordance with the requirements of Section A4.1 of AISI S240. *Nonstructural members* shall have a Zinc or 55% Al-Zinc protective coating in accordance with the requirements of Section A5.1 of AISI S220.

☞ **Note:** See Appendix A for Provisions applicable to Canada.

C. PRODUCTS

C1 Product Designator

References to *structural members* and *nonstructural members* shall use a four-part product designator that identifies the size (both *web* depth and *flange* width), style, and thickness. The standard designator as described (i.e. based on U.S. Customary units) shall be used for either U.S. Customary or SI Metric units. The product designator shall consist of the following sequential codes:

A three- or four-digit numeral indicating member *web* depth in 1/100 inch. A letter indicating:

S = *Stud* or joist framing member which has *lips*

T = *Track* section

U = Channel or *stud* framing section which does not have *lips*

F = Furring channels

L = Angle or L-*header*

A three-digit numeral indicating *flange* width in 1/100 inch, followed by a dash. A two- or three-digit numeral indicating *designation thickness*.

When specifying material for use in structural applications, the material *grade* used in design shall be identified on the contract documents and when ordering the material.

C2 Standard Shapes

The standard shapes for *structural members* and *nonstructural members* shall be any combination of the basic dimensions listed in Tables C2-1 through C2-5, depending on the member type. The standard shapes are illustrated in Figure C2-1.

☞ **Note**: See Appendix A for Provisions applicable to Canada.

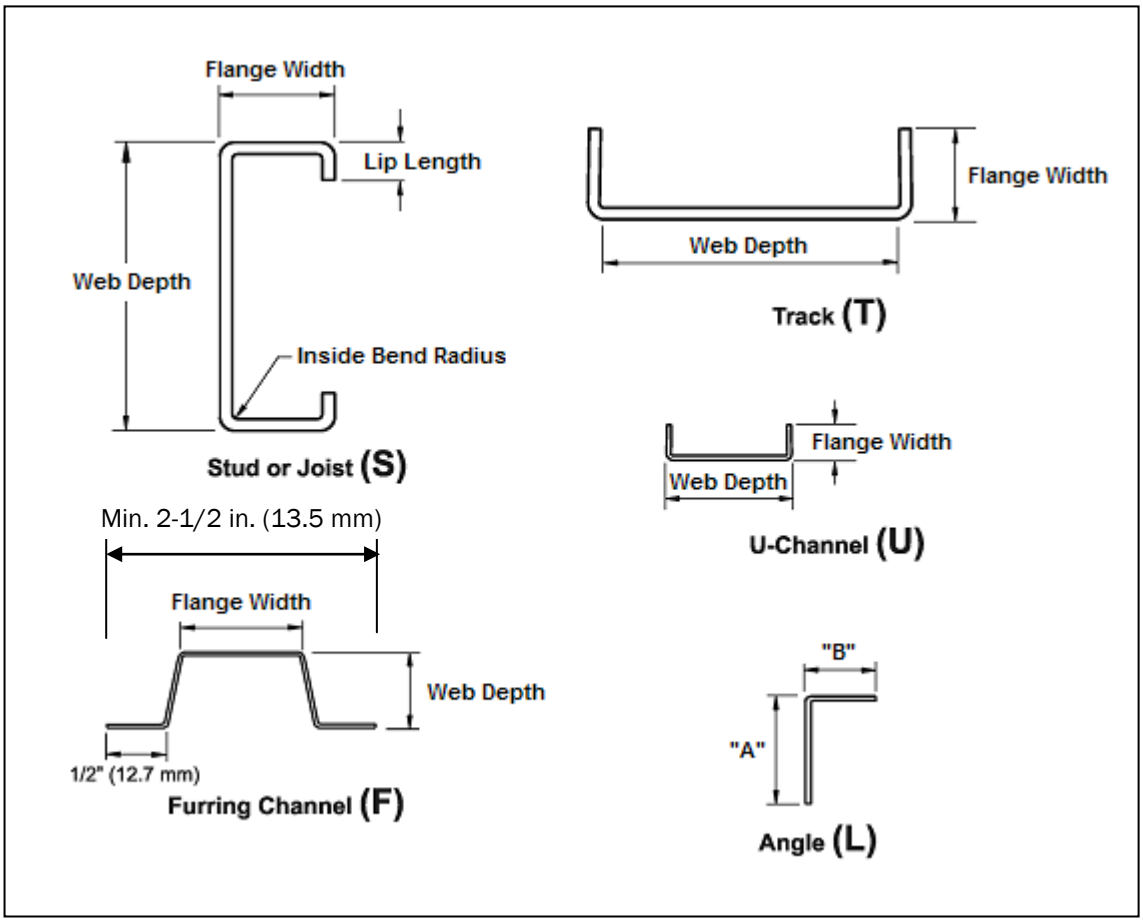

Figure C2-1 Cold-Formed Steel Framing Member Types

Table C2-1
Standard Dimensions for C-Shape Studs and Joists (S)

Web Depth		
Depth Designation	Design Depth	
	(inch)	(mm)
162	1-5/8	41.3
250	2-1/2	63.5
350	3-1/2	88.9
362	3-5/8	92.1
400	4	102
550	5-1/2	140
600	6	152
800	8	203
1000	10	254
1200	12	305
1400	14	356

Flange Width		
Width Designation	Design Width	
	(inch)	(mm)
125	1-1/4	31.8
137	1-3/8	34.9
162	1-5/8	41.3
200	2	50.8
250	2-1/2	63.5
300	3	76.2
350	3-1/2	88.9

Note: Not all shapes are available in every standard thickness.

Table C2-2
Standard Dimensions for Track (T)

Web Depth		
Depth Designation	Design Depth	
	(inch)	(mm)
162	1-5/8	41.3
250	2-1/2	63.5
350	3-1/2	88.9
362	3-5/8	92.1
400	4	102
550	5-1/2	140
600	6	152
800	8	203
1000	10	254
1200	12	305
1400	14	356

Flange Width		
Width Designation	Design Width	
	(inch)	(mm)
125	1-1/4	31.8
200	2	50.8
250	2-1/2	63.5
300	3	76.2

Note: Not all shapes are available in every standard thickness.

Table C2-3
Standard Dimensions for U-Channel (U)

Web Depth		
Depth Designation	Design Depth	
	(inch)	(mm)
75	3/4	19.1
150	1-1/2	38.1
200	2	50.8
250	2-1/2	63.5

Flange Width		
Width Designation	Design Width	
	(inch)	(mm)
50	1/2	12.7
75	3/4	19.1

Note: Not all shapes are available in every standard thickness.

Table C2-4
Standard Dimensions for Furring Channel (F)

Web Depth		
Depth Designation	Design Depth	
	(inch)	(mm)
87	7/8	22.2
150	1-1/2	38.1

Flange Width		
Width Designation	Design Width	
	(inch)	(mm)
125	1-1/4	31.8

Note: Not all shapes are available in every standard thickness.

Table C2-5
Standard Dimensions for Angles (L)

"A" Flange Width		
Depth Designation	Design Depth	
	(inch)	(mm)
62	5/8	15.9
87	7/8	22.2
137	1-3/8	34.9
150	1-1/2	38.1
200	2	50.8
300	3	76.2

"B" Flange Width		
Width Designation	Design Width	
	(inch)	(mm)
62	5/8	15.9
87	7/8	22.2
137	1-3/8	34.9
150	1-1/2	38.1
200	2	50.8
300	3	76.2

Note: Not all shapes are available in every standard thickness.

C3 Inside Bend Radius

The size of the inside bend radius used for design shall comply with the requirements shown in Table C3-1.

Table C3-1
Design Inside Bend Radius

Designation Thickness	Inside Bend Radius	
	(inch)	(mm)
18	0.0843	2.141
27	0.0796	2.022
30	0.0781	1.984
33	0.0764	1.941
43	0.0712	1.808
54	0.0849	2.156
68	0.1069	2.715
97	0.1525	3.874
118	0.1863	4.732

C4 Lip Length

The *lip* length on a *C-shape stud* or *joist structural member* or *nonstructural member* shall be related to the *flange* width as listed in Table C4-1.

Table C4-1
Design Lip Length for C-Shape Studs and Joists (S)

Section	Flange Width		Design Lip Length	
	(inch)	(mm)	(inch)	(mm)
S125	1-1/4	31.8	3/16	4.8
S137	1-3/8	34.9	3/8	9.5
S162	1-5/8	41.3	1/2	12.7
S200	2	50.8	5/8	15.9
S250	2-1/2	63.5	5/8	15.9
S300	3	76.2	5/8	15.9
S350	3-1/2	88.9	1	25.4

C5 Punchouts

Unless specified otherwise by the manufacturer, factory *punchouts* (perforations) shall comply with the following conditions:

(1) *Punchouts* shall be spaced along the centerline of the *web* of the framing member;

(2) *Punchouts* shall have a center-to-center spacing of not less than 24 inches (610 mm);

(3) *Punchouts* shall have a width not greater than half the member depth or 2-1/2 inches (63.5 mm), whichever is less;

(4) *Punchouts* shall have a length not exceeding 4-1/2 inches (114 mm); and

(5) The distance from the center of the last *punchout* to the end of the member shall not be less than 12 inches (305 mm), unless otherwise specified.

Any configuration or combination of holes that fits within the *punchout* width and length limitations is permitted.

C6 Product Identification

Structural members shall be identified in accordance with the requirements of Section A5.5 of AISI S240. *Nonstructural members* shall be identified in accordance with the requirements of Section A6.5 of AISI S220.

☞ **Note**: See Appendix A for Provisions applicable to Canada.

C7 Manufacturing Tolerances

Structural members shall comply with the manufacturing tolerances listed in Section A5.4 of AISI S240. *Nonstructural members* shall comply with the manufacturing tolerances listed in Section A6.4 of AISI S220.

D. QUALITY ASSURANCE

Structural members and *nonstructural members* shall be manufactured in accordance with a properly documented quality control program. Manufacturers shall establish filing methods that document the proper application of quality assurance procedures throughout the manufacturing process.

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Appendix A:
Provisions Applicable to Canada

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APPENDIX A: PROVISIONS APPLICABLE TO CANADA

The material contained in this appendix provides the range of products that are standard in Canada.

A section number ending with a letter indicates that the provisions herein supplement the corresponding section in Chapters A through D of the Standard. A section number not ending with a letter indicates that the section gives the entire provision.

A2a Definitions

Nonstructural Member. A member in a steel-framed system which is limited to a transverse (out-of-plane) load of not more than 0.50 kPa (10 psf); a superimposed axial load, exclusive of sheathing materials, of not more than 1.46 kN/m (100 lb/ft); or a superimposed vertical load of not more than 0.89 kN (200 lbs).

A3a Referenced Documents

In addition to the documents referenced in Section A3, the following documents or portions thereof are referenced within Appendix A and shall be considered part of the requirements of Appendix A.

2. ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959:

   ASTM A653/A653M-15e1, *Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process*

   ASTM A792/A792M-10(2015), *Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process*

B1a Material Specification

Alternatively, *structural members* and *nonstructural members* shall be cold-formed to shape from sheet steel in compliance with the requirements of ASTM A653 Type SS or ASTM A792 Type SS.

The design *yield strength* of the material shall be related to the thickness as listed in Table B1-1a.

Table B1-1a
Standard Yield Strength and Thickness

Designation Thickness	Design Yield Strength	
	(ksi)	(MPa)
18	33	230
33	33	230
43	33	230
54	50	345
68	50	345
97	50	345

B2 Base Steel Thickness

Structural members and *nonstructural members* shall be cold-formed to shape from sheet steel with a minimum *base steel thickness* listed in Table B2-1. Member thickness shall be referenced to the corresponding *designation thickness*.

Table B2-1
Standard Thickness

Designation Thickness	Minimum Base Steel Thickness		Design Thickness	
	(inch)	(mm)	(inch)	(mm)
18	0.0179	0.455	0.0188	0.478
33	0.0329	0.836	0.0346	0.879
43	0.0428	1.087	0.0451	1.146
54	0.0538	1.367	0.0566	1.438
68	0.0677	1.720	0.0713	1.811
97	0.0966	2.454	0.1017	2.583

B3a Corrosion Protection

Structural members and *nonstructural members* shall comply with the minimum metallic coating weight [mass] requirements shown in Table B3-1a.

Table B3-1a
Coating Weight [Mass] Requirements (Metallic Coatings)

Member Type	Coating Designation
Structural	G60 [Z180][A] AZ50 [AZM150][B]
Non-Structural	G40 [Z120][A] AZ50 [AZM150][B]

[A] Zinc-coated steel sheet as described in ASTM Specification A653/A653M.
[B] 55% aluminum-zinc alloy-coated steel sheet as described in ASTM Specification A792/A792M.

C2a Standard Shapes

Exception: The standard shapes for *studs*, *joists*, and *track* shall be any combination of the basic dimensions listed in Tables C2-1a and C2-2a, depending on the member type.

Table C2-1a
Standard Dimensions for C-Shape Studs and Joists (S)

Web Depth		
Depth Designation	Design Depth	
	(inch)	(mm)
162	1-5/8	41.3
250	2-1/2	63.5
362	3-5/8	92.1
400	4	102
600	6	152
800	8	203
1000	10	254
1200	12	305
1400	14	356

Flange Width		
Width Designation	Design Width	
	(inch)	(mm)
125	1-1/4	31.8
162	1-5/8	41.3
200	2	50.8
250	2-1/2	63.5
300	3	76.2

Note: Not all shapes are available in every standard thickness.

Table C2-2a
Standard Dimensions for Track (T)

Web Depth		
Depth Designation	Design Depth	
	(inch)	(mm)
162	1-5/8	41.3
250	2-1/2	63.5
362	3-5/8	92.1
400	4	102
600	6	152
800	8	203
1000	10	254
1200	12	305
1400	14	356

Flange Width		
Width Designation	Design Width	
	(inch)	(mm)
125	1-1/4	31.8
200	2	50.8

Note: Not all shapes are available in every standard thickness.

C6 Product Identification

C6.1 Structural Members

Structural members shall be marked legibly with the following minimum information:

(1) Manufacturer (name, logo or initials); and

(2) Steel *designation thickness*.

C6.2 Nonstructural Members

Nonstructural members shall be marked legibly in compliance with the customer's requirements.

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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

This *Commentary* is intended to facilitate the use and provide an understanding of the background of AISI S201, *North American Standard for Cold-Formed Steel Framing – Product Data*. The *Commentary* illustrates the substance and limitations of the various provisions of the standard.

In the *Commentary*, sections, equations, figures, and tables are identified by the same notation as used in the Standard. Words that are italicized are defined in the Standard. Terms included in square brackets are specific to Limit States Design (*LSD*) terminology.

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COMMENTARY ON THE NORTH AMERICAN STANDARD FOR COLD-FORMED STEEL FRAMING – PRODUCT DATA

A. GENERAL

AISI S201 is intended to establish and encourage the production and use of standardized products in the United States, Canada and Mexico. As such, the Standard applies to *structural members* and *nonstructural members* utilized in *cold-formed steel* framing applications within a practical and industry accepted range of *base steel thicknesses* and covers the most common and readily available shapes and dimensions.

The Standard does not intend to stifle innovation. As such, it states, "This Standard shall not preclude the use of other products not meeting the criteria herein, when the other products demonstrate equivalent performance for the intended use to those specified in this Standard."

In 2015, AISI S240, *North American Standard for Cold-Formed Steel Structural Framing*, was published, which integrated the following AISI Standards:

- AISI S200-12, *North American Standard for Cold-Formed Steel Framing-General Provisions* (AISI, 2012b)
- AISI S210-07 (2012), *North American Standard for Cold-Formed Steel Framing–Floor and Roof System Design* (Reaffirmed 2012) (AISI, 2012c)
- AISI S211-07(2012), *North American Standard for Cold-Formed Steel Framing–Wall Stud Design* (Reaffirmed 2012) (AISI, 2012d)
- AISI S212-07(2012), *North American Standard for Cold-Formed Steel Framing–Header Design* (Reaffirmed 2012) (AISI, 2012e)
- AISI S213-07w/S1-09(2012), *North American Standard for Cold-Formed Steel Framing–Lateral Design with Supplement 1* (Reaffirmed 2012) (AISI, 2012f)
- AISI S214-12, *North American Standard for Cold-Formed Steel Framing–Truss Design* (AISI, 2012g)

Consequently, AISI S240 has superseded all previous editions of the above-mentioned individual AISI Standards.

In 2017, the provision that the Standard applies to applications where the specified minimum *base steel thickness* is between 18 mils (0.0179 inches)(0.455 mm) and 118 mils (0.1180 inches) (2.997 mm) was replaced by "*light-frame construction*" to be consistent with the scope of AISI S240.

B. MATERIALS

B1. Material Specification

In 2012, as part of an exercise to synchronize all relevant codes and specifications, provisions of this section for *structural members* were moved to AISI S200 (AISI 2012b) Section A3 and provisions for *nonstructural members* were moved to AISI S220 (AISI, 2011) Section A4. In 2015, AISI S200 was integrated into AISI S240.

B2 Base Steel Thickness

Gauge thickness is an obsolete method of specifying sheet and strip thickness. Gauge numbers are only a very rough approximation of steel thickness and should not be used to order, design or specify any sheet or strip product. Listed in Table B2-2 are the common thicknesses equivalents for gauge numbers used with *cold-formed steel* framing. Note that these thickness equivalents do not conform to gauge systems used for other *cold-formed sheet steel* products (e.g. steel deck, ductwork and cladding).

Table B2-2
Reference Gauge Numbers

Designation Thickness	Gauge Number (for reference only)
18	25
27	22
30	20 - Drywall [1]
33	20 - Structural [1]
43	18
54	16
68	14
97	12
118	10

[1] Historically, 20 gauge material has been furnished in two different thicknesses for structural and drywall (non-structural) applications.

The values for metric (mm) steel thickness in Tables B2-1 and B2-2 (minimum and design thicknesses) in the Standard are converted from the calculated U.S. Customary (inch) values rounded to 1/1000 inch. This means that the metric *base steel thickness* will not be exactly 95% of the metric *design thickness*.

B3 Corrosion Protection

In 2012, as part of an exercise to synchronize all relevant codes and specifications, provisions of this section for *structural members* were moved to AISI S200 (AISI, 2012b) Section A4 and provisions for *nonstructural members* were moved to AISI S220 (AISI, 2011) Section A5. In 2015, AISI S200 was integrated into AISI S240.

C. PRODUCTS

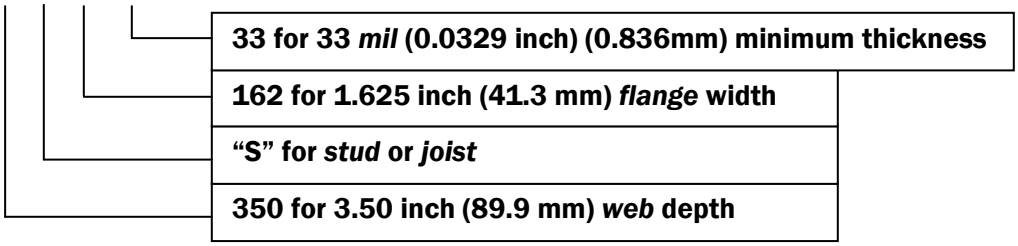
C1 Product Designators

The Standard has adopted a standard designator system for identifying *cold-formed steel* framing members. The intent for using a standard designator system was to overcome the varied designators that were produced by each individual manufacturer. In addition, the designator is used to identify not only a specific *cold-formed steel* framing member, but also in identifying the section properties of that same member through the use of the manufacturer's product technical information documents.

The following presents an example of the standard designator for a *cold-formed steel stud*:

350S162-33 represents a member with the following:

350S162-33



C3 Inside Bend Radius

The U.S. Customary (inch) values for design inside bend radius in Table C3-1 of the Standard are based on standard industry practice, which is the maximum of 3/32 – t/2 or 1.5t, truncated after the fourth decimal place (t = *design thickness*). The values for metric (mm) design inside bend radius in Table C3-1 are converted from the computed U.S. Customary (inch) values.

C5 Punchouts

Size and spacing requirements for factory *punchouts* (perforations) are included in this Standard to encourage standardization and facilitate the development of load and span tables based on punched members. The manufacturer may deviate from these requirements, provided that the manufacturer specifies the *punchout* size and spacing and furnishes data to demonstrate compliance with AISI S240 (AISI, 2015) and AISI S100 [CSA S136], (AISI, 2012a; CSA, 2012). These limitations are intended for the manufactured product, not for additional *web* holes provided by others in the field.

C6 Product Identification

In 2012, as part of an exercise to synchronize all relevant codes and specifications, provisions of this section for *structural members* were moved to AISI S200 (AISI, 2012b) Section A5.5 and provisions for *nonstructural members* were moved to AISI S220 (AISI, 2011) Section A6.5. In 2015, AISI S200 was integrated into AISI S240.

C7 Manufacturing Tolerances

In 2012, as part of an exercise to synchronize all relevant codes and specifications, provisions of this section for *structural members* were moved to AISI S200 (AISI, 2012b) Section A5.4 and provisions for *nonstructural members* were moved to AISI S220 (AISI, 2011) Section A6.4. In 2015, AISI S200 was integrated into AISI S240.

REFERENCES

(AISI, 2012a), AISI S100-12, *North American Specification for the Design of Cold-Formed Steel Structural Members*, American Iron and Steel Institute, Washington, DC, 2012.

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(AISI, 2012d), AISI S211-07(2012), *North American Standard for Cold-Formed Steel Framing–Wall Stud Design* (Reaffirmed 2012), American Iron and Steel Institute, Washington, DC, 2012.

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(AISI, 2012g), AISI S214-12, *North American Standard for Cold-Formed Steel Framing–Truss Design*, American Iron and Steel Institute, Washington, DC, 2012.

(AISI, 2011), AISI S220-11, *North American Standard for Cold-Formed Steel Framing - Nonstructural Members*, American Iron and Steel Institute, Washington, DC, 2011.

(CSA, 2012), CAN/CSA S136-12, *North American Specification for the Design of Cold-Formed Steel Structural Members*, Canadian Standards Association, Mississauga, Ontario, Canada, 2012.

Commentary on Appendix A: Provisions Applicable to Canada

2017 EDITION

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COMMENTARY ON APPENDIX A: PROVISIONS APPLICABLE TO CANADA

In 2012, Appendix A was added, which contains additional provisions that are applicable only to Canada.

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