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DIVISION 05 - METALS

SECTION 05 40 00

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05/15

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SECTION 05 40 00

COLD-FORMED METAL FRAMING
05/15

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)

ACI 318 (2014; Errata 1-2 2014; Errata 3-4 2015)
Building Code Requirements for Structural
Concrete and Commentary

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI S100 (2012) North American Specification for
the Design of Cold-Formed Steel Structural
Members

AISI S110 (2007; Suppl 1; Reaffirmed 2012) Standard
for Seismic Design of Cold-Formed Steel
Structural Systems - Special Bolted Moment
Frames

AISI S200 (2007) North American Standard for
Cold-Formed Steel Framing - General
Provision

AISI S201 (2007) North American Standard for
Cold-Formed Steel Framing - Product Data

AISI S202 (2011) Code of Standard Practice for
Cold-formed Steel Structural Framing

AISI S211 (2007) North American Standard for
Cold-Formed Steel Framing - Wall Stud
Design

AISI S212 (2007) North American Standard for
Cold-Formed Steel Framing - Header Design

AISI S213 (2007; Suppl 1 2009) North American
Standard for Cold-Formed Steel Framing -
Lateral Design

AISI S214 (2012) North American Standard for
Cold-Formed Steel Framing - Truss Design

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2015) Structural Welding Code - Steel

AWS D1.3/D1.3M

(2008; Errata 2008) Structural Welding
Code - Sheet Steel

ASTM INTERNATIONAL (ASTM)

ASTM A1003/A1003M

(2015) Standard Specification for Steel
Sheet, Carbon, Metallic- and
Nonmetallic-Coated for Cold-Formed Framing
Members

ASTM A123/A123M

(2013) Standard Specification for Zinc
(Hot-Dip Galvanized) Coatings on Iron and
Steel Products

ASTM A153/A153M

(2009) Standard Specification for Zinc
Coating (Hot-Dip) on Iron and Steel
Hardware

ASTM A307

(2014) Standard Specification for Carbon
Steel Bolts and Studs, 60 000 PSI Tensile
Strength

ASTM A370

(2014) Standard Test Methods and
Definitions for Mechanical Testing of
Steel Products

ASTM A653/A653M

(2015) Standard Specification for Steel
Sheet, Zinc-Coated (Galvanized) or
Zinc-Iron Alloy-Coated (Galvannealed) by
the Hot-Dip Process

ASTM C1007

(2011a) Standard Specification for
Installation of Load Bearing (Transverse
and Axial) Steel Studs and Related
Accessories

ASTM C1513

(2013) Standard Specification for Steel
Tapping Screws for Cold-Formed Steel
Framing Connections

ASTM C955

(2015) Load-Bearing (Transverse and Axial)
Steel Studs, Runners (Tracks), and Bracing
or Bridging for Screw Application of
Gypsum Panel Products and Metal Plaster
Bases

ASTM E119

(2014) Standard Test Methods for Fire
Tests of Building Construction and
Materials

ASTM E329

(2014a) Standard Specification for
Agencies Engaged in the Testing and/or
Inspection of Materials Used in
Construction

ASTM E488/E488M

(2015) Standard Test Methods for Strength
of Anchors in Concrete and Masonry Elements

ASTM F1554 (2007a; E 2011) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

ASTM F1941 (2010) Standard Specification for Electrodeposited Coatings on Threaded Fasteners (Unified Inch Screw Threads (UN/UNR))

ASTM F2329 (2013) Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2012) International Building Code

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01 (2013; Change 1) Structural Engineering

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor QC approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29, SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Framing Components; G[, [_____]]

SD-03 Product Data

Steel Studs, Joists, Tracks, Bracing, Bridging and Accessories

[SD-05 Design Data

Metal Framing Calculations; G[, [_____]]

SD-07 Certificates

Load-Bearing Cold-Formed Metal Framing

Welds

SD-11 Closeout Submittals

Recycled Content of Steel Products; S

1.3 DELIVERY, STORAGE, AND HANDLING

Steel framing and related accessories shall be stored and handled in accordance with the AISI S202, "Code of Standard Practice for Cold-Formed

Steel Structural Framing".

1.4 LOAD-BEARING COLD-FORMED METAL FRAMING

Include [top and bottom tracks,] bracing, fastenings, and other accessories necessary for complete installation. Framing members shall have the structural properties indicated. Where physical structural properties are not indicated, they shall be as necessary to withstand all imposed loads. [Design framing in accordance with [AISI S100](#).] [Non-load-bearing metal framing, furring, and ceiling suspension systems are specified in Section [09 22 00](#) SUPPORTS FOR PLASTER AND GYPSUM BOARD.] [Metal suspension systems for acoustical ceilings are specified in Section [09 51 00](#) ACOUSTICAL CEILINGS.]

Submit mill certificates or test reports from independent testing agency, qualified in accordance with [ASTM E329](#), showing that the steel sheet used in the manufacture of each cold-formed component complies with the minimum yield strengths and uncoated steel thickness specified. Test reports shall be based on the results of three coupon tests in accordance with [ASTM A370](#).

1.5 MAXIMUM DEFLECTION

Deflections of structural members shall not exceed the more restrictive of the limitations of [ICC IBC](#) and [UFC 3-301-01](#).

[For scissor roof trusses limit the horizontal deflection at supports to less than [[1-1/4 inches](#)][____].]

1.6 QUALITY ASSURANCE

- a. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a registered professional engineer.
- b. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to [ASTM E329](#) for testing indicated.
- c. Product Tests: Mill certificates or data from a qualified independent testing agency[, or in-house testing with calibrated test equipment] indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- d. Welding Qualifications: Qualify procedures and personnel according to the following:
 - (1) [AWS D1.1/D1.1M](#), "Structural Welding Code - Steel".
 - (2) [AWS D1.3/D1.3M](#), "Structural Welding Code - Sheet Steel".
- e. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per [ASTM E119](#) by, and displaying a classification label from, a testing and inspecting agency acceptable to authorities having jurisdiction.
- f. AISI Specifications and Standards: Comply with:

- (1) [AISI S100](#), "North American Specification for the Design of Cold-Formed Steel Structural Members".
- (2) [AISI S110](#), "Standard for Seismic Design of Cold-Formed Steel Structural Systems - Special Bolted Moment Frames".
- (3) [AISI S200](#), "North American Standard for Cold-Formed Steel Framing - General Provision".
- (4) [AISI S201](#), "North American Standard for Cold-Formed Steel Framing - Product Data".
- (5) [AISI S202](#), "Code of Standard Practice for Cold-Formed Steel Structural Framing".
- (6) [AISI S211](#), "North American Standard for Cold-Formed Steel Framing - Wall Stud Design".
- (7) [AISI S212](#), "North American Standard for Cold-Formed Steel Framing - Header Design".
- (8) [AISI S213](#), "North American Standard for Cold-Formed Steel Framing - Lateral Design".
- (9) [AISI S214](#), "North American Standard for Cold-Formed Steel Framing - Truss Design".

1.6.1 Drawing Requirements

Submit [framing components](#) to show sizes, thicknesses, layout, material designations, methods of installation, and accessories including the following:

- a. Cross sections, plans, and/or elevations showing component types and locations for each framing application; including shop coatings and material thicknesses for each framing component.
- b. Connection details showing fastener type, quantity, location, and other information to assure proper installation.
- c. Drawings depicting panel configuration, dimensions, components, locations, and construction sequence if the Contractor elects to install prefabricated/prefinished frames.

[Sign and seal fabrication drawings by a registered professional engineer.]

1.6.2 Design Data Required

Submit [metal framing calculations](#) with design criteria and structural loading to verify sizes, thickness, and spacing of members and connections signed and sealed by a registered professional engineer. Show methods and practices used in installation.

]PART 2 PRODUCTS

2.1 STEEL [STUDS](#), [JOISTS](#), TRACKS, BRACING, BRIDGING AND ACCESSORIES

Framing components shall comply with [ASTM C955](#) and the following.

- a. **Recycled Content of Steel Products:** Provide products with an average recycled content of steel products so postconsumer recycled content plus one half of preconsumer recycled content not less than [25][_____] percent.
- b. Steel Sheet: **ASTM A1003/A1003M**, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 - (1) Grade: [ST33H (ST230H)][ST50H (ST340H)][[_____]][As required by structural performance].
 - (2) Coating: [G60 (Z180), A60 (ZF180), AZ50 (AZ150), or GF30 (ZGF90)][G90 (Z275)][[_____]].
- c. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - (1) Minimum Base-Metal Thickness: [0.0329 inch][0.0428 inch][0.0538 inch][0.0677 inch][0.0966 inch].
 - (2) Flange Width: [1-3/8 inches][1-5/8 inches][2 inches][2-1/2 inches].
- d. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
 - (1) Minimum Base-Metal Thickness: [0.0329 inch][0.0428 inch][0.0538 inch][0.0677 inch][0.0966 inch][Matching steel studs].
 - (2) Flange Width: [[1-1/4 inches] [_____]].
- e. Roof Truss Members: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, and as follows:
 - (1) Minimum Base-Metal Thickness: [0.0329 inch][0.0428 inch][0.0538 inch][0.0677 inch][0.0966 inch][Matching steel studs].
 - (2) Flange Width: [[1-5/8 inches] [_____]], minimum at top and bottom chords connecting to sheathing or directly fastened construction.
- f. Floor Truss Members: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, and as follows:
 - (1) Minimum Base-Metal Thickness: [0.0329 inch][0.0428 inch][0.0538 inch][0.0677 inch][0.0966 inch][Matching steel studs].
 - (2) Flange Width: [[1-5/8 inches] [_____]], minimum at top and bottom chords connecting to sheathing or directly fastened construction.

2.1.1.1 Studs and Joists of 54 mils (0.054 Inch) and Heavier

Galvanized steel, **ASTM A653/A653M** and **ASTM A1003/A1003M**, SS Grade 50, [G60] [G90].

2.1.2 Studs and Joists of 43 mils (0.043 Inch) and Lighter

Studs and Joists of 43 mils (0.043 Inch) and Lighter, Track, and Accessories (All thicknesses): Galvanized steel, ASTM A653/A653M and ASTM A1003/A1003M, SS, Grade 33 33,000 psi G60.

2.1.3 Sizes, Thickness, Section Modulus, and Other Structural Properties

Size and thickness [as indicated][as required].

2.2 MARKINGS

Studs and track shall have product markings stamped on the web of the section. The markings shall be repeated throughout the length of the member at a maximum spacing of 4 feet on center and shall be legible and easily read. The product marking shall include the following:

- a. An ICC number.
- b. Manufacturer's identification.
- c. Minimum delivered uncoated steel thickness.
- d. Protective coating designator.
- e. Minimum yield strength.

2.3 CONNECTIONS

2.3.1 Steel-To-Concrete Connections

- a. Anchor Rods: ASTM F1554, [Grade 36][Grade 55]; galvanized per ASTM A153/A153M.
- b. Post-Installed Concrete Anchors: Adhesive or expansion anchors fabricated from corrosion-resistant materials with allowable load capacities in accordance with ICC-ES AC193 and ACI 318 greater than or equal to the design load as determined by testing per ASTM E488/E488M conducted by a qualified testing agency.
- c. Power-Actuated Fasteners: Fabricated from corrosion-resistant materials with allowable load capacities in accordance with ICC-ES AC 70 greater than or equal to the design load as determined by testing per ASTM E1190 conducted by a qualified testing agency

2.3.2 Steel-To-Steel Connections

- a. Screws: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping steel screws of the type and size indicated. Provide low-profile head beneath sheathing and manufacturer's standard elsewhere. Electroplated to a minimum of 5 micron zinc coating per ASTM F1941 or hot-dipped galvanized per ASTM A123/A123M or ASTM A153/A153M.
- b. Bolts: ASTM A307 coated by hot-dip process per ASTM F2329 or zinc-coated by mechanical-deposition process per ASTM B695, Class 55.
- c. Welding Electrodes: Comply with AWS standards.

2.4 PLASTIC GROMMETS

Supply plastic grommets for stud webs as recommended by stud manufacturer, to protect electrical wires and plumbing piping. Prevent metal-to-metal contact between wiring/piping and studs.

2.5 SEALER GASKET

Closed-cell neoprene foam, $\frac{1}{4}$ -inch thick, selected from manufacturer's standard widths to match width of bottom track on concrete slab or foundation.

PART 3 EXECUTION

3.1 TRUSS FABRICATION

- a. Fabricate cold-formed steel trusses and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
- b. Truss must be fabricated either on site or off site prior to erection.
- c. Fabricate trusses using jigs or templates.
- d. Splices can only occur at joints.
- e. Cut truss members by sawing or shearing: do not torch cut.
- f. Fasten cold-formed steel truss members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator.
- g. Fasten other materials to cold-formed steel trusses by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- h. Reinforce, stiffen, and brace trusses to withstand handling, delivery, and erection stresses. Lift fabricated trusses to prevent damage or permanent distortion.

3.2 FASTENING

Fasten framing members together by welding or by using self-drilling, self-tapping screws. Electrodes and screw connections shall be as required and indicated in the design calculations.

3.2.1 Welds

All welding shall be performed in accordance with AWS D1.3/D1.3M, as modified by AISI S100. All welders, welding operations, and welding procedures shall be qualified according to AWS D1.3/D1.3M. Submit certified copies of welder qualifications test records showing qualification in accordance with AWS D1.3/D1.3M. All welds shall be cleaned and coated with rust inhibitive galvanizing paint. Do not field weld materials lighter than 43 mils.

3.2.2 Screws

Screws shall be of the self-drilling self-tapping type, size, and location [as indicated][as required]. Screw penetration through joined materials shall not be less than three exposed threads. Minimum spacings and edge distances for screws shall be as specified in [AISI S100](#). Screws covered by sheathing materials shall have low profile heads.

3.2.3 Anchors

Anchors shall be of the type, size, and location [as indicated][as required].

3.2.4 Powder-Actuated Fasteners

Powder-actuated fasteners shall be of the type, size, and location [as indicated][as required].

3.3 INSTALLATION

Install cold-formed framing in accordance with [ASTM C1007](#) and [AISI S200](#).

Install cold-formed steel framing according to [AISI S202](#) and to manufacturer's written instructions unless more stringent requirements are indicated.

3.3.1 Tracks

Provide accurately aligned runners at top and bottom of studs. Install sealer gasket under bottom of track on concrete slab or foundation. Anchor tracks as indicated in design calculations. Butt weld joints in tracks or splice with stud inserts. Fasteners shall be at least [3 inches](#) from the edge of concrete slabs.

3.3.2 Studs

Cut studs square and set with firm bearing against webs of top and bottom tracks. Position studs vertically in tracks and space as indicated in design. Do not splice studs. Provide at least two studs at jambs of doors and other openings [2 feet](#) wide or larger. Provide jack studs over openings, as necessary, to maintain indicated stud spacing. Provide tripled studs at corners, positioned to receive interior and exterior finishes. Fasten studs to top and bottom tracks by welding or screwing both flanges to the tracks. Framed wall openings shall include headers and supporting components as shown on the drawings. Headers shall be installed in all openings that are larger than the stud spacing in a wall. In curtain wall construction, provide for vertical movement where studs connect to the structural frame. Provide horizontal bracing in accordance with the design calculations and [AISI S100](#). Bracing shall be not less than the following:

<u>LOAD</u>	<u>HEIGHT</u>	<u>BRACING</u>
Wind load only	Up to 10 feet	One row at mid-height

LOAD	HEIGHT	BRACING
	Over 10 feet	Rows 5'-0" o.c. maximum
Axial load	Up to 10 feet	Two rows at 1/3 points
	Over 10 feet	Rows 3'-4" o.c. maximum

3.3.3 Joists and Trusses

- a. Provide a stud directly under each joist or truss. The maximum spacing of studs as indicated shall be maintained.
- b. Install, bridge, and brace cold-formed steel trusses according to AISI S200, AISI S214, AISI's "Code of Standard Practice for Cold-Formed Steel Structural Framing," and manufacturer's written instructions unless more stringent requirements are indicated.
- c. Install temporary bracing and supports. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- d. Do not alter, cut, or remove framing members or connections of trusses.

3.3.4 Erection Tolerances

- a. Framing members which will be covered by finishes such as wallboard, plaster, or ceramic tile set in a mortar setting bed, shall be within the following limits:
 - (1) Layout of walls and partitions: 1/4 inch from intended position;
 - (2) Plates and runners: 1/4 inch in 8 feet from a straight line;
 - (3) Studs: 1/4 inch in 8 feet out of plumb, not cumulative; and
 - (4) Face of framing members: 1/4 inch in 8 feet from a true plane.
- b. Framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive shall be within the following limits:
 - (1) Layout of walls and partitions: 1/4 inch from intended position;
 - (2) Plates and runners: 1/8 inch in 8 feet from a straight line;

(3) Studs: $\frac{1}{8}$ inch in 8 feet out of plumb, not cumulative; and

(4) Face of framing members: $\frac{1}{8}$ inch in 8 feet from a true plane.

-- End of Section --