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SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Load-bearing wall framing.
 2. Floor joist framing.
 3. Roof rafter framing.
 4. Ceiling joist framing.
 5. Soffit framing.
- B. Related Requirements:

Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies, with height limitations.
3. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.2 PREINSTALLATION MEETINGS

Retain "Preinstallation Conference" Paragraph below if Work of this Section is extensive or complex enough to justify a conference.

- A. Preinstallation Conference: Conduct conference at **[Project site]** <Insert location>.

If needed, insert list of conference participants not mentioned in Section 013100 "Project Management and Coordination."

1. <Insert participants>.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Cold-formed steel framing materials.
2. Load-bearing wall framing.
3. Vertical deflection clips.
4. Single deflection track.
5. Double deflection track.
6. Drift clips.
7. Floor joist framing.
8. Roof-rafter framing.
9. Ceiling joist framing.
10. Soffit framing.
11. Post-installed anchors.
12. Power-actuated anchors.
13. Sill sealer gasket.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

Retain "Delegated Design Submittal" Paragraph below if design services have been delegated to Contractor.

C. Delegated Design Submittal: For cold-formed steel framing.

1.4 INFORMATIONAL SUBMITTALS

Coordinate "Qualification Data" Paragraph below with qualification requirements in Section 014000 "Quality Requirements" and as may be supplemented in "Quality Assurance" Article.

A. Qualification Data: For testing agency.

Retain "Welding certificates" Paragraph below if retaining "Welding Qualifications" Paragraph in "Quality Assurance" Article.

B. Welding certificates.

Retain "Product Certificates" Paragraph below to require submittal of product certificates from manufacturers.

C. Product Certificates: For each type of code-compliance certification for studs and

tracks.

- D. Product Test Reports: For each listed product, for tests performed by **[manufacturer and witnessed by a qualified testing agency]** **[a qualified testing agency]**.
1. Steel sheet.
 2. Expansion anchors.
 3. Power-actuated anchors.
 4. Mechanical fasteners.
 5. Vertical deflection clips.
 6. Horizontal drift deflection clips
 7. Miscellaneous structural clips and accessories.
- E. Research Reports:
1. For nonstandard cold-formed steel framing **[post-installed anchors]** **[and]** **[power-actuated fasteners]**, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
 2. For sill sealer gasket/termite barrier, showing compliance with ICC-ES AC380.

1.5 QUALITY ASSURANCE

Retain "Testing Agency Qualifications" Paragraph below if Contractor or manufacturer selects testing agency or if Contractor is required to provide services of a qualified testing agency in "Field Quality Control" Article. Qualification requirements are in addition to those specified in Section 014000 "Quality Requirements," which also defines "NRTL" (nationally recognized testing laboratory).

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

Usually retain "Product Tests" Paragraph below. Retain option if permitted. Insert option for testing ductility if required. See "Mill Certification" Paragraph in "Materials" Article in the Evaluations for more information.

- B. 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.

Retain "Code-Compliance Certification of Studs and Tracks" Paragraph below for third-party verification that products meet the requirements of model codes and industry standards. Coordinate retained certification program(s) with the member companies in Part 2 "Manufacturers" Article below. See "Code-Compliance Certification Programs" Article in the Evaluations.

- C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified in accordance with ICC.

Retain "Welding Qualifications" Paragraph below if shop or field welding is required. If retaining,

also retain "Welding certificates" Paragraph in "Informational Submittals" Article.

- 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."

Consider retaining paragraph below if Project is limited to one- and two-family residential construction, framing is fully detailed, and this AISI document is acceptable to authorities having jurisdiction.

- E. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI S202.

PART 2 - PRODUCTS

2.1 COLD-FORMED METAL FRAMING

Retain "Basis-of-Design Product" Paragraph and list of manufacturers below to identify a specific product or a comparable product from manufacturers listed.

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **CRACO Mfg., Inc.; SmartFrame Structural Framing System (SmartStud)** or comparable product by one of the following:
1. <Insert manufacturer's name>

2.2 PERFORMANCE REQUIREMENTS

Retain "Delegated Design" and "Structural Performance" paragraphs below if Contractor is required to assume responsibility for design. Coordinate this article with other Part 2 articles, deleting prescriptive requirements, such as steel thickness and minimum yield strength unless imposing minimum design restrictions. Insert other performance and design criteria below to suit Project, or add them to Drawings. AIA Document A201 requires Owner or Architect to specify performance and design criteria to be satisfied.

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding

design loads within limits and under conditions indicated.

1. Design Loads: **[As indicated on Drawings]** <Insert design loads>.
2. Deflection Limits: Design framing systems to withstand **[design loads]** without deflections greater than the following:

Component deflection limits in first seven subparagraphs below are examples only. Retain deflection limits in applicable subparagraphs, or insert other limits as appropriate for wall, floor, and ceiling finish materials.

- a. Exterior Load-Bearing Wall Framing: Horizontal deflection of **[1/240]** **[1/360]** **[1/600]** **[1/720]** of the wall height.
 - b. Interior Load-Bearing Wall Framing: Horizontal deflection of **[1/240]** **[1/360]** of the wall height under a horizontal load of **5 lbf/sq. ft.**
 - c. Exterior Non-Load-Bearing Framing: Horizontal deflection of **[1/240]** **[1/360]** **[1/600]** **[1/720]** <Insert ratio> of the wall height.
 - d. Interior Non-Load-Bearing Framing: Horizontal deflection of **[1/240]** **[1/360]** of the wall height under a horizontal load of **5 lbf/sq. ft.**
 - e. Floor Joist Framing: Vertical deflection of **[1/360]** **[1/480]** for live loads and 1/240 for total loads of the span.
 - f. Roof Rafter Framing: Vertical deflection of **[1/120]** **[1/240]** **[1/360]** of the horizontally projected span for live loads.
 - g. Ceiling Joist Framing: Vertical deflection of **[1/120]** **[1/240]** **[1/360]** of the span for live loads and 1/240 for total loads of the span.
3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of **120 deg F**.

Retain first subparagraph below for non-load-bearing and load-bearing walls if design responsibility for cold-formed framing is delegated to Contractor. Indicate locations on Drawings if different movement is anticipated for different building elements. If preferred, change deflection limits to ratios, such as L/300 for floors and L/200 for roofs.

4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of **[1/2 inch]** **[3/4 inch]** **[1 inch]** **[1-1/2 inches]**.

Usually retain subparagraph below for exterior non-load-bearing wall framing, particularly for brick-veneer backup framing.

5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

Retain "Cold-Formed Steel Framing Standards" Paragraph below whether delegating design or prescriptively specifying cold-formed steel framing; revise to suit Project.

Retain first option in paragraph below for IBC 2012; retain second option for IBC 2015; retain third option for IBC 2018 and IBC 2021.

- C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing complies with AISI S100 and **[ASTM C955] [AISI S200 and ASTM C955, Section 8] [AISI S240]**.

Retain "Fire-Resistance Ratings" Paragraph below only if products specified are part of a fire-resistance-rated assembly. Indicate rating, testing agency, and testing agency's design designation on Drawings.

- D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

Retain this article to supplement specific framing articles that follow.

Retain "Recycled Content of Steel Products" Paragraph below to specify recycled content if required. An alternative method of requiring recycled content is to retain requirement in Project's Division 01 sustainable design requirements Section that gives Contractor the option and responsibility to determine how recycled content requirements will be met.

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25] <Insert value>** percent.

Retain first option in "Framing Members, General" Paragraph below for IBC 2012; retain second option for IBC 2015; retain third option for IBC 2018 and IBC 2021.

- B. Framing Members, General: Comply with **[ASTM C955] [AISI S200 and ASTM C955, Section 8] [AISI S240]** for conditions indicated.
- C. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

Retain minimum grade requirements from options in "Grade" Subparagraph below. If more than one grade option is required, indicate location of each on Drawings.

- 1. Grade: **[ST33H] [ST50H] [As required by structural performance] <Insert grade>**.

Minimum coating requirement for Structural Grade, Type H steel is G60 (Z180) or equivalent. Retain first option in "Coating" Subparagraph below if ASTM A1003/A1003M's designation of minimum coating thicknesses is required. This minimum coating designation assumes normal exposure conditions and construction practices. When more severe exposure conditions are

probable, for example, in coastal areas, consider specifying a heavier coating. BIA recommends G90 (Z275) coating for stud backup applications. Verify availability of heavier-coated steel. If more than one coating designation is required, indicate location of each on Drawings or by inserts.

2. Coating: [**G60, A60, AZ50, or GF30**] [**G90 or equivalent**] <Insert coating designation>.

Retain "Steel Sheet for (Vertical Deflection) (Drift) Clips" Paragraph below if applicable.

- D. Steel Sheet for [**Vertical Deflection**] [**Drift**] Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
 1. Grade: [**33**] [**50, Class 1**] [**As required by structural performance**] <Insert grade>.
 2. Coating: [**G60**] [**G90**] <Insert coating designation>.

2.4 LOAD-BEARING WALL FRAMING

Retain this article if load-bearing steel studs are required. Distinguish location of axial load-bearing framing from exterior non-load-bearing wall framing in paragraphs below or on Drawings. Indicate stud and track web depth on Drawings or insert in paragraphs below.

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

Steel-thickness sequence in "Minimum Base-Metal Thickness" Subparagraph below corresponds to common thickness designators 33, 43, 54, 68, and 97 and obsolete 20-, 18-, 16-, 14-, and 12-gage designations. If retaining different thicknesses for different components, indicate locations here or in framing articles below.

1. Minimum Base-Metal Thickness: [**0.0329 inch**] [**0.0428 inch**] [**0.0538 inch**] [**0.0677 inch**] [**0.0966 inch**] <Insert dimension>.

Flange-width sequence in "Flange Width" Subparagraph below corresponds to common flange-width designators 137, 162, 200, and 250. Flange widths may vary with application. If sheathing or masonry ties are required, consider minimum flange width of 1-5/8 inches (41 mm).

2. Flange Width: [**1-3/8 inches**] [**1-5/8 inches**] [**2 inches**] [**2-1/2 inches**] <Insert dimension>.

Retain "Section Properties" Subparagraph below if not delegating design responsibility to Contractor. If retaining, indicate whether design is based on gross or effective section properties.

3. Section Properties: <Insert minimum allowable calculated section modulus, moment of inertia, and allowable moment>.

- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:

Steel-thickness sequence in "Minimum Base-Metal Thickness" Subparagraph below

corresponds to common thickness designators 33, 43, 54, 68, and 97 and obsolete 20-, 18-, 16-, 14-, and 12-gage designations.

1. Minimum Base-Metal Thickness: [**0.0329 inch**] [**0.0428 inch**] [**0.0538 inch**] [**0.0677 inch**] [**0.0966 inch**] [**Matching steel studs**] <Insert dimension>.
2. Flange Width: [**1-1/4 inches**] <Insert dimension if manufacturer's standard width is insufficient>.

- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:

Steel-thickness sequence in "Minimum Base-Metal Thickness" Subparagraph below corresponds to common thickness designators 33, 43, 54, 68, and 97 and obsolete 20-, 18-, 16-, 14-, and 12-gage designations. If retaining different thicknesses for different locations, indicate locations here or in the framing articles below.

1. Minimum Base-Metal Thickness: [**0.0329 inch**] [**0.0428 inch**] [**0.0538 inch**] [**0.0677 inch**] [**0.0966 inch**] <Insert dimension>.

Flange widths may vary with application; coordinate with wall width.

2. Flange Width: [**1-3/8 inches**] [**1-5/8 inches**] [**2 inches**] [**2-1/2 inches**] <Insert dimension>.

Retain "Section Properties" Subparagraph below if not delegating design responsibility to Contractor. If retaining, indicate whether design is based on gross or effective section properties.

3. Section Properties: <Insert minimum allowable calculated section modulus, moment of inertia, and allowable moment>.

- D. Steel Single- or Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated, and as follows:

Steel-thickness sequence in "Minimum Base-Metal Thickness" Subparagraph below corresponds to common thickness designators 33, 43, 54, 68, and 97 and obsolete 20-, 18-, 16-, 14-, and 12-gage designations. If retaining different thicknesses for different locations, indicate locations here or in framing articles below.

1. Minimum Base-Metal Thickness: [**0.0329 inch**] [**0.0428 inch**] [**0.0538 inch**] [**0.0677 inch**] [**0.0966 inch**] <Insert dimension>.

First option in "Top Flange Width" Subparagraph below is minimum top flange width recognized by AISI S212. Coordinate with wall width.

2. Top Flange Width: [**1-1/2 inches**] [**1-5/8 inches**] [**2 inches**] [**2-1/2 inches**] <Insert dimension>.

Retain "Section Properties" Subparagraph below if not delegating design responsibility to Contractor. If retaining, indicate whether design is based on gross or effective section properties.

3. Section Properties: <Insert minimum allowable calculated section modulus,

moment of inertia, and allowable moment>.

2.5 FLOOR JOIST FRAMING

Retain this article if steel joists are required. If joist and joist-track depth are not indicated, revise paragraphs below and insert depth required.

- A. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, **[unpunched,] [punched with standard holes,] [punched with enlarged service holes,]** with stiffened flanges, and as follows:

Steel-thickness sequence in "Minimum Base-Metal Thickness" Subparagraph below corresponds to common thickness designators 33, 43, 54, 68, and 97 and obsolete 20-, 18-, 16-, 14-, and 12-gage designations.

1. Minimum Base-Metal Thickness: **[0.0329 inch] [0.0428 inch] [0.0538 inch] [0.0677 inch] [0.0966 inch] <Insert dimension>.**

Flange-width sequence in "Flange Width" Subparagraph below corresponds to common flange-width designators 162, 200, and 250. Flange widths may vary with application.

2. Flange Width: **[1-5/8 inches] [2 inches] [2-1/2 inches] <Insert dimension>**, minimum.

Retain "Section Properties" Subparagraph below if not delegating design responsibility to Contractor. If retaining, indicate whether design is based on gross or effective section properties.

3. Section Properties: **<Insert minimum allowable calculated section modulus, moment of inertia, and allowable moment>.**

Revise "Steel Joist Track" Paragraph below to include descriptions of other related components, such as headers or other built-up members, at openings or other terminations.

- B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

Steel-thickness sequence in "Minimum Base-Metal Thickness" Subparagraph below corresponds to common thickness designators 33, 43, 54, 68, and 97 and obsolete 20-, 18-, 16-, 14-, and 12-gage designations.

1. Minimum Base-Metal Thickness: **[0.0329 inch] [0.0428 inch] [0.0538 inch] [0.0677 inch] [0.0966 inch] [Matching steel joists] <Insert dimension>.**

Flange-width sequence in "Flange Width" Subparagraph below corresponds to common flange-width designators 125, 150, and 200. Flange widths may vary with application.

2. Flange Width: **[1-1/4 inches] [1-1/2 inches] [2 inches] <Insert dimension>**, minimum.

2.6 ROOF-RAFTER FRAMING

Retain this article if steel rafters are required. If rafter web depth is not indicated, revise "Steel Rafters" Paragraph below and insert depth required.

- A. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

Steel-thickness sequence in "Minimum Base-Metal Thickness" Subparagraph below corresponds to common thickness designators 33, 43, 54, 68, and 97 and obsolete 20-, 18-, 16-, 14-, and 12-gage designations.

1. Minimum Base-Metal Thickness: [0.0329 inch] [0.0428 inch] [0.0538 inch] [0.0677 inch] [0.0966 inch] <Insert dimension>.

Flange-width sequence in "Flange Width" Subparagraph below corresponds to common flange-width designators 162, 200, and 250. Flange widths may vary with application.

2. Flange Width: [1-5/8 inches] [2 inches] [2-1/2 inches] <Insert dimension>, minimum.

Retain "Section Properties" Subparagraph below if not delegating design responsibility to Contractor. If retaining, indicate whether design is based on gross or effective section properties.

3. Section Properties: <Insert minimum allowable calculated section modulus, moment of inertia, and allowable moment>.

2.7 CEILING JOIST FRAMING

Retain this article if steel joists are required. If joist and joist-track depth is not indicated, revise "Steel Ceiling Joists" Paragraph below and insert depth required.

- A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, [unpunched,] [punched with standard holes,] [punched with enlarged service holes,] with stiffened flanges, and as follows:

Steel-thickness sequence in "Minimum Base-Metal Thickness" Subparagraph below corresponds to common thickness designators 33, 43, 54, 68, and 97 and obsolete 20-, 18-, 16-, 14-, and 12-gage designations.

1. Minimum Base-Metal Thickness: [0.0329 inch] [0.0428 inch] [0.0538 inch] [0.0677 inch] [0.0966 inch] <Insert dimension>.

Flange-width sequence in "Flange Width" Subparagraph below corresponds to common flange-width designators 162, 200, and 250. Flange widths may vary with application.

2. Flange Width: [1-5/8 inches] [2 inches] [2-1/2 inches] <Insert dimension>, minimum.

Retain "Section Properties" Subparagraph below if not delegating design responsibility to Contractor. If retaining, indicate whether design is based on gross or effective section

properties.

3. Section Properties: <Insert minimum allowable calculated section modulus, moment of inertia, and allowable moment>.

2.8 SOFFIT FRAMING

Retain this article if soffit framing is required. If soffit frame web depth is not indicated, revise "Exterior Soffit Frame" Paragraph below and insert depth required.

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

Steel-thickness sequence in "Minimum Base-Metal Thickness" Subparagraph below corresponds to common thickness designators 33, 43, 54, 68, and 97 and obsolete 20-, 18-, 16-, 14-, and 12-gage designations.

1. Minimum Base-Metal Thickness: [0.0329 inch] [0.0428 inch] [0.0538 inch] [0.0677 inch] [0.0966 inch] <Insert dimension>.

Flange-width sequence in "Flange Width" Subparagraph below corresponds to common flange-width designators 162, 200, and 250. Flange widths may vary with application.

2. Flange Width: [1-5/8 inches] [2 inches] [2-1/2 inches] <Insert dimension>, minimum.

Retain "Section Properties" Subparagraph below if not delegating design responsibility to Contractor. If retaining, indicate whether design is based on gross or effective section properties.

3. Section Properties: <Insert minimum allowable calculated section modulus, moment of inertia, and allowable moment>.

2.9 FRAMING ACCESSORIES

Revise minimum yield strength of accessories as required.

- A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

Revise list below to suit Project.

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.

6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

2.10 ANCHORS, CLIPS, AND FASTENERS

Retain "Steel Shapes and Clips" Paragraph below if rolled steel shapes and clips are required and are not specified in another Section.

- A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

Retain grade of anchor bolt, head type, and type of protective coating from "Anchor Bolts" Paragraph below. Revise if using high-strength, low-alloy anchor bolts.

- B. Anchor Bolts: ASTM F1554, [**Grade 36**] [**Grade 55**], threaded carbon-steel [**hex-headed bolts,**] [**headless, hooked bolts,**] [**headless bolts, with encased end threaded,**] carbon-steel nuts, and flat, hardened-steel washers; zinc coated by [**hot-dip process according to ASTM A153/A153M, Class C**] [**mechanically deposition according to ASTM B695, Class 50**].

ICC-ES AC01 and ICC-ES AC193 are for expansion anchors in masonry and mechanical anchors in concrete respectively, and ICC-ES AC58 and ICC-ES AC308 are for adhesive anchors in masonry and concrete. Do not use expansion-type anchors where expansion can cause damage to the substrate material.

- C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on [**ICC-ES AC01**] [**ICC-ES AC193**] [**ICC-ES AC58**] [**or**] [**ICC-ES AC308**] as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.

Retain "Type" Subparagraph below to restrict type of anchor if required.

2. Type: [**Torque-controlled expansion anchor**] [**Torque-controlled adhesive anchor**] [**or**] [**adhesive anchor**].

Material in "Material for Interior Locations" Subparagraph below protects against corrosion in an indoor atmosphere.

3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or **ASTM F1941**, Class Fe/Zn 5, unless otherwise indicated.

Alloy Group 1 (A1) refers to Type 304 and similar alloys, and Alloy Group 2 (A4) refers to Type 316 and similar alloys.

4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated:

Alloy [Group 1] [Group 2] stainless steel bolts, ASTM F593, and nuts, ASTM F594.

Retain "Power-Actuated Anchors" Paragraph below if power-actuated fasteners are acceptable. Verify with Project's structural engineer.

- D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.11 FABRICATION

Retain this article for examples of shop or field fabrication, including panelized load-bearing and non-load-bearing walls.

- A. Fabricate cold-formed steel framing 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.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

Retain subparagraph below if fabricated assemblies include other materials; revise to suit Project.

- 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

Revise "Tolerances" Paragraph below to suit Project.

- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of **1/8 inch in 10 feet** and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus **1/8 inch** from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of **1/8 inch**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

Retain first two paragraphs below if sprayed fire-resistive materials are required.

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

Retain first paragraph below if bottom track of load-bearing walls requires a uniform-bearing surface on concrete or masonry construction.

- C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than **1/4 inch** to ensure a uniform bearing surface on supporting concrete or masonry construction.

Retain one of two paragraphs below if sealing the gap between framing and concrete or masonry construction.

- D. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

- E. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

Retain this article with each specific framing classification in installation articles below.

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

Retain first paragraph below for shop- or field-fabricated wall panels.

- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding **1/16 inch**.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

Include details on Drawings showing expansion-joint construction and locations.

- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

Retain first paragraph below if insulation within framing assemblies is required.

- H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 INSTALLATION OF LOAD-BEARING WALL FRAMING

If this article is required, retain with "Installation, General" Article.

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

Retain option in "Anchor Spacing" Subparagraph below to suit requirements and type of anchor.

- 1. Anchor Spacing: **[24 inches]** **[32 inches]** **[To match stud spacing]** **[As shown on Shop Drawings]** **<Insert dimension>**.
- B. Squarely seat studs against top and bottom tracks, with gap not exceeding **1/8 inch** between the end of wall-framing member and the web of track.
 - 1. Fasten both flanges of studs to top and bottom tracks.
 - 2. Space studs as follows:
 - a. Stud Spacing: **[12 inches]** **[16 inches]** **[19.2 inches]** **[24 inches]** **[As indicated on Drawings]** **<Insert dimension>**.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.

2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced vertically [**48 inches**] [**as indicated on Drawings**] [**as indicated on Shop Drawings**] <Insert dimension>. Fasten at each stud intersection with SmartFrame BridgeSmart Connectors

Retain type of bridging required from three subparagraphs below or revise to suit Project. Insert locations if more than one type of bridging is required. Insert minimum size of flat steel strap, such as 1-1/2 by 0.0329 inch (38 by 0.84 mm), if default size is required.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to **6 inches** deep.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

Retain first paragraph below if required. Description below usually applies to shear walls. Revise bracing type and reinforcement at terminations to suit Project. Insert track reinforcing or gusset plate requirements to Drawings if applicable, particularly for shear walls. If sheathing provides bracing to one or both stud flanges, revise to suit Project.

- J. Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INSTALLATION OF EXTERIOR NONLOADBEARING WALL FRAMING

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

Retain fastening of studs to top track only if required. Do not fasten studs to deflection track,

such as in infill wall framing.

- B. Fasten both flanges of studs to **[top and]** bottom track unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: **[12 inches] [16 inches] [19.2 inches] [24 inches] [As indicated on Drawings] <Insert dimension>**.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

Indicate isolation details on Drawings or insert detailed description here.

- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

Retain one of first two subparagraphs below if using deflection track with infill wall framing. Delete both subparagraphs and retain third if deflection clips are required for bypassing or infill wall framing. Vertical deflection clips are used if wall is stick built or panelized. Single deflection track is used if stud wall is stick built; double deflection track is used with wall panels. Drift clips may be used in seismic areas.

- 1. Install single deep-leg deflection tracks and anchor to building structure.
 - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 - 3. Connect vertical deflection clips to **[bypassing] [infill]** studs and anchor to building structure.
 - 4. Connect drift clips to cold-formed steel framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated **[on Shop Drawings]** but not more than **48 inches** apart. Fasten at each stud intersection with SmartFrame BridgeSmart Connectors.

Retain type of bridging required from three subparagraphs below or revise to suit Project. Insert locations if more than one type of bridging is required. Insert minimum size of flat steel strap, such as 1-1/2 by 0.0329 inch (38 by 0.84 mm), if default size is required.

- 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

Retain "Top Bridging for Single Deflection Track" Subparagraph below if required.

- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within **[12 inches] [18 inches]** of single deflection track. Install a combination of bridging and

stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at **[96-inch centers]** **[centers indicated]** **[centers indicated on Shop Drawings]**.

- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 INSTALLATION OF INTERIOR NONLOADBEARING WALL FRAMING

If this article is required for non-load-bearing wall framing that exceeds the height limitations of standard, nonstructural metal framing, retain with "Installation, General" Article.

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

Retain fastening of studs to top track only if required. Do not fasten studs to deflection track.

- B. Fasten both flanges of studs to **[top and]** bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: **[12 inches]** **[16 inches]** **[19.2 inches]** **[24 inches]** **[As indicated on Drawings]** <Insert dimension>.

- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

Indicate isolation details on Drawings or insert detailed description here.

- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

Retain one of first two subparagraphs below if using deflection track. Delete both subparagraphs and retain third if deflection clips are required. Vertical deflection clips are used if wall is stick built or panelized. Single deflection track is used if stud wall is stick built; double deflection track is used with wall panels. Drift clips may be used in seismic areas.

1. Install single deep-leg deflection tracks and anchor to building structure.
 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 3. Connect SmartFrame TopFlex or VertiFlex vertical deflection clips to studs and anchor to building structure.
 4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated **[on Shop Drawings]** but not more than **48 inches** apart. Fasten at each stud intersection with

SmartFrame BridgeSmart Connectors.

Retain type of bridging required from three subparagraphs below or revise to suit Project. Insert locations if more than one type of bridging is required. Insert minimum size of flat steel strap, such as 1-1/2 by 0.0329 inch (38 by 0.84 mm), if default size is required.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

Retain "Top Bridging for Single Deflection Track" Subparagraph below if required.

- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within [**12 inches**] [**18 inches**] of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
1. Install solid blocking at [**96-inch centers**] [**centers indicated**] [**centers indicated on Shop Drawings**].
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.7 INSTALLATION OF JOIST FRAMING

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated[**on Shop Drawings**].
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

Revise minimum end bearing in first subparagraph below if joists bearing on flange of joist track are acceptable. Web stiffeners will usually be required to reinforce the joist web.

1. Install joists over supporting frame with a minimum end bearing of **1-1/2 inches**.
 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.
- C. Space joists not more than **2 inches** from abutting walls, and as follows:
1. Joist Spacing: [**12 inches**] [**16 inches**] [**19.2 inches**] [**24 inches**] [**As indicated on Drawings**] <Insert dimension>.

- D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.

Retain first paragraph below if joist reinforcement is required.

- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.
 - 1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at intervals indicated[**on Shop Drawings**]. Fasten bridging at each joist intersection as follows:

Retain type of bridging required from two subparagraphs below or revise to suit Project. Insert locations if more than one type of bridging is required. Insert minimum size of flat steel strap, such as 1-1/2 by 0.0329 inch (38 by 0.84 mm), if default size is required. Revise if also fastening flat steel strap bridging to top flange of joists.

- 1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
 - 2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.8 INSTALLATION TOLERANCES

Revise paragraph below to suit Project. Coordinate with limitations of subsequent finish materials.

- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of **1/8 inch in 10 feet** and as follows:
 - 1. Space individual framing members no more than plus or minus **1/8 inch** from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.9 REPAIR

Retain "Galvanizing Repairs" Paragraph below if applicable.

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.10 FIELD QUALITY CONTROL

Retain this article if field testing and inspecting are required. Provisions below include shop and field testing and inspecting. Revise and insert a "Source Quality Control" Article to end of Part 2 if separate shop and field testing and inspecting are required. Revise "Testing" Paragraph below to include code-mandated special inspections or revise if Contractor engages testing agency.

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.

See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

- D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.11 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000