

The Steel Framing Industry Association (SFIA) is dedicated to expanding the market for cold-formed steel in construction through programs and initiatives that Promote the use of cold formed steel framing as a sustainable and cost-effective solution, Advocate the development and acceptance of favorable code provisions, Educate members with reliable data and other critical information that is essential to effective business planning, and create a positive environment for Innovation.

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. **Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Section, apply to this section**

1.2 SUMMARY

- A. Section Includes:

Note to Specifier delete items not used.

1. Load-bearing wall framing.
2. Floor joist framing.
3. Exterior non-load bearing wall framing.
4. Roof rafter framing.
5. Ceiling joist framing.
6. Soffit framing.

- B. Related Requirements:

1. Section 092216 "Non-Load-Bearing Steel Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 PRECONSTRUCTION MEETINGS

- A. Preconstruction Conference: Conduct conference at Project site.

1.4 SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory.

Note to Specifier delete following paragraph if Sustainable Design is not a part of project requirements.

- B. Sustainable Design Submittals:

Documentation for each individual CFS product of all applicable LEED® Version 4 credits in the SFIA document entitled **LEED®ing with COLD-FORMED STEEL**. Available at <https://www.cfsteel.org/leed-and-sustainability>.

- C. Shop Drawings:
 - 1. Provide Shop Drawings prepared by cold-formed metal framing manufacturer.
 - 2. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 3. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 - 4. Shop drawings shall be stamped by a professional engineer registered in the jurisdiction of the project.
- D. Delegated-Design Submittal: For cold-formed steel framing by Specialty Structural Engineer (SSE).

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Certificates: Code Compliance certificates for studs and tracks
- D. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by 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. Evaluation Reports: For cold-formed steel framing.
 - 1. Products to be certified under an independent third-party inspection program administered by an agency accredited by IAS to ICC-ES AC98 IAS Accreditation Criteria for Inspection Agencies.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Member in good standing of the Steel Framing Industry Association (SFIA).

1. Products to be certified under an independent third-party inspection program administered by an agency accredited by IAS to ICC-ES AC98 IAS Accreditation Criteria for Inspection Agencies.
- B. Provide certification of code compliance with the "Code Compliance Certification Program" implemented by the Steel Framing Industry Association (SFIA).
- C. Provide documentation on the qualifications of the contractor that will install the cold-formed steel framing. Documentation to include contractor's recognition in the Steel Framing Industry Association's (SFIA) "Contractor Certification Program."
- D. 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-steel thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- E. 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."
- F. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."
- G. Comply with the following AISI specifications and standards: *{Note to specifier Must comply with at least one}*
 1. AISI S100 "North American Specification for the Design of Cold-Formed Steel Structural Members."
 2. AISI S200 "North American Standard for Cold-Formed Steel Framing - General Provisions."
 3. AISI S201 "North American Standard for Cold-Formed Steel Framing - Product Standard."
 4. AISI S202 "Code of Standard Practice for Cold-Formed Steel Structural Framing."
- H. AISI S240 "North American Standard for Cold-Formed Steel Structural Framing." *{ Note to specifier Use only for IBC 2018. AISI S240 supersedes AISI S200, S210, S211, S212, S213, and S214.}*

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling, as required in AISI's "Code of Standard Practice."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide products by Steel Framing Industry Association Members in good standing (listing found at http://www.archtest.com/certification/SFIA_SteelFraming_Intertek.aspx).

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified Specialty Structural Engineer to design cold-formed steel framing as defined in Section 014000. The design professional, individual or organization having responsibility for the design of the specialty items. This responsibility shall be in accordance with the state's statues and regulations governing the professional registration and certification of architects or engineers.
- 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 horizontal and vertical deflections greater than the following:
 - 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. (239 Pa).
 - 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. (239 Pa).
 - e. Floor Joist Framing: Vertical deflection of [1/360] [1/480] for live loads and l/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 (67 deg C).
 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 (13 mm)] [3/4 inch (19 mm)] [1 inch (25 mm)] [1-1/2 inches (38 mm)].

5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- C. Cold-Formed Steel Framing Design Standards:
1. Floor and Roof Systems: AISI S210.
 2. Wall Studs: AISI S211.
 3. Headers: AISI S212.
 4. Lateral Design: AISI S213.
- D. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and **[ASTM C955]** **[AISI S200 and ASTM C955, Section 8]** **[AISI S240]**.*[NOTE to specifier: Use ASTM C955 for IBC 2009 and 2012, Use AISI S200 and ASTM C955, Section 8 for IBC 2015, Use AISI S240 for IBC 2018.]*
- E. Fire-Resistance Ratings: Comply with ASTM E 119; 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.

2.3 COLD-FORMED STEEL FRAMING, GENERAL

- A. Framing Members, General: Comply with **[ASTM C955]** **[AISI S200 and ASTM C955, Section 8]** **[AISI S240]** for conditions indicated. *[NOTE to specifier: Use ASTM C955 for IBC 2009 and 2012, Use AISI S200 and ASTM C955, Section 8 for IBC 2015, Use AISI S240 for IBC 2018.]*
- B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
1. Grade: **[ST33H (ST230H)] [ST50H (ST340H)]** [As required by structural performance][33 KSI for 18 gauge (0.0428) and lighter and 50 KSI for 16 gauge (0.0538) and heavier.].
 2. Coating: **[CP 60: G60 (Z180), A60 (ZF180), AZ50 (AZM150), or GF30 (ZGF90)] [CP 90: G90 (Z275), AZ50 (AZM150), or GF45 (ZGF135)]** <Insert coating designation>. [Note: For IBC 2012: Per ASTM C955, Paragraph 4.4 - Members shall have a protective coating in accordance with Table 1. CP-60 minimum. Table 1 of C955 lists G60, A60, AZ50 and GF30 as allowable coatings for use for coating designator CP60; and G90, AZ50 and GF45 for coating designator CP90. The coating designators indicate that each of these coatings meet the requirements of C955.
- C. Steel Sheet for **[Vertical Deflection]** **[Drift]** **[Rigid]** **[Foundation]** Clips: ASTM A1003/A1003M, ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
1. Grade: **[33 (230)] [50 (340), Class 1]** **[As required by structural performance]**.
 2. Coating: CP 90: G90 [recommended](Z275), AZ50 (AZM150), or GF45 (ZGF135)

2.4 LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, with minimum base metal thickness, flange width and section properties required to meet design requirements.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and matching properties of steel studs
- C. Steel Single- or Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths required, and with minimum base metal thickness, flange width and section properties required to meet design requirements.
- D. D.Steel Single- or Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated

2.5 FLOOR JOIST FRAMING

- A. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, [**unpunched,**] [**punched,**] [**punched, with enlarged service holes,**] with stiffened flanges, and with minimum base metal thickness, flange width and section properties required to meet design requirements.
- B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, of web depths required, unpunched, with unstiffened flanges, and with minimum base metal thickness, flange width and section properties required to meet design requirements.

2.6 ROOF-RAFTER FRAMING

- A. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows: with minimum base metal thickness, flange width and section properties required to meet design requirements.

2.7 CEILING JOIST FRAMING

- A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, [**unpunched,**] [**punched with enlarged service holes,**] [**punched with standard holes,**] with stiffened flanges, and with minimum base metal thickness, flange width and section properties required to meet design requirements.

2.8 SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and with minimum base metal thickness, flange width and section properties required to meet design requirements.

2.9 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, required by design requirements.

2.10 ANCHORS, CLIPS, AND FASTENERS

- A. SSE shall include the following anchors, clips and fasteners required by the design requirements:
 - 1. Steel Shapes and Clips.
 - 2. Anchor Bolts.
 - 3. Expansion Anchors.
 - 4. Power-Actuated Anchors if allowed by Structural Engineer of Record.
 - 5. Mechanical Fasteners, head type: low-profile head beneath sheathing, manufacturer's standard elsewhere.
 - 6. Welding Electrodes.

2.11 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A780.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.
- E. Sealer Gaskets: Closed-cell neoprene foam, ¼-inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.12 FABRICATION

- 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 screw penetrating joined members by no fewer than three exposed screw threads.
 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 to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance 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 shall not 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 supporting substrates 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

- 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 are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

- 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.
- D. Install sealer gaskets 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

- 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 ASTM C1007 and AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.
- 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 and install according to Shop Drawings, and complying 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 comparable in intensity 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.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

- H. Install insulation, specified in Section 07210 "Building Insulation," in built-up exterior framing 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.
- J. Erection Tolerances: 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 shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 LOAD-BEARING WALL INSTALLATION

- 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 indicated on shop drawings.
- B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as indicated on shop drawings.
- 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 as indicated.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. 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 as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
 - 2. Install runner 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 (1220 mm)**] [**as indicated on Drawings**] [**as indicated on Shop Drawings**] <Insert dimension>. Fasten at each stud intersection.
 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 (150 mm) 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.
- 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 JOIST INSTALLATION

- 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.
 1. Install joists over supporting frame with a minimum end bearing indicated on Shop Drawings.
 2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.
- C. Space joists not more than 2 inches from abutting walls, and as indicated on Shop Drawings.
- D. Frame openings with built-up joist headers consisting of joist and joist track, or another combination of connected joists if indicated.
- 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, or as indicated on Shop Drawings.

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 indicated on Shop Drawings.
- 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.

3.6 FIELD QUALITY CONTROL

- 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.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000