**SECTION 054000 - COLD-FORMED METAL FRAMING**

1. **GENERAL**
   * + 1. **SUMMARY**
          1. Section Includes:

*Note to Specifier retain items used.*

Load-bearing wall framing.

Floor joist framing.

Roof rafter and truss framing.

Ceiling joist framing.

Soffit framing.

* + - * 1. Related Requirements:

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

* + - 1. **PRECONSTRUCTION MEETINGS**

*Note to Specifier include following paragraph if Work of this Section is extensive or complex enough to justify a conference.*

* + - * 1. Preconstruction Conference: Conduct conference at Project site.
      1. **SUBMITTALS**
         1. Product Data: For each type of cold-formed steel framing product and accessory.

*Note to Specifier: Retain the following paragraph if Buy America Act is part of project requirements*

Provide certification that products were Manufactured in USA and meet the specifications of the Buy America Provision of the American Recovery and Investment Act of 2009 (ARRA)

*Note to Specifier retain the following paragraph when Sustainable Design is part of project requirements.*

* + - * 1. Sustainable Design Submittals:

Documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

Provide data indicating material was produced within 500 miles of the project location.

* + - * 1. Shop Drawings:

Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.

Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

Shop drawings shall be stamped by a professional engineer registered in the jurisdiction of the project.

*Note to Specifier retain the following paragraph if Building Information Modeling is part of project requirements.*

* + - * 1. Building Information Modeling:

Provide a [3D BIM model of the cold-formed steel framing](https://www.steelsmartsystem.com/steel-smart-framer-light-steel-framing-bim-software/) including all studs, tracks, joists, trusses, bridging, and connectors.

Provide panel drawings created from the BIM model including layout, spacing sizes, thicknesses, types, and quantities of cold-formed steel framing including all studs, tracks, joists, trusses, bridging, and connectors.

* + - * 1. Delegated-Design by Specialty Structural Engineer (SSE). 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.
      1. **QUALITY ASSURANCE**
         1. Qualification Data: For testing agency.
         2. Welding certificates.
         3. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.

Steel sheet.

Expansion anchors.

Power-actuated anchors.

Mechanical fasteners.

Vertical deflection clips.

Horizontal drift deflection clips

Miscellaneous structural clips and accessories.

* + - * 1. Research Reports: For non-standard cold-formed steel framing, submit evaluation reports 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.
        2. Provide certification of code compliance with the “Code Compliance Certification Program” implemented by the Steel Framing Industry Association (SFIA).

*Note to Specifier retain following paragraph if ISO 9001 Certification is part of project requirements.*

* + - * 1. Provide certification of ISO 9001 “Quality Management System” for manufacturing facility of cold-formed steel framing and connectors.

*Note to Specifier retain following paragraph if Made in USA is part of project requirements.*

* + - * 1. Provide certification that cold-formed steel framing and connectors were manufactured in the USA
        2. Welding Qualifications: Qualify procedures and personnel according to the following:

AWS D1.1/D1.1M, "Structural Welding Code - Steel."

AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

* + - * 1. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."
      1. **DELIVERY, STORAGE, AND HANDLING**
         1. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

1. **PRODUCTS**
   * + 1. **MANUFACTURERS**
          1. Provide cold-formed steel framing products by The Steel Network, Inc. (TSN) (<https://www.steelnetwork.com>); or comparable products by one of the Steel Framing Industry Association Members in good standing.
       2. **PERFORMANCE REQUIREMENTS**
          1. Delegated Design: Engage a qualified Specialty Structural Engineer to design cold-formed steel framing.
          2. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

Design Loads: As indicated.

Deflection Limits: Design framing systems to withstand design loads without horizontal and vertical deflections greater than those assigned to the indicated exterior wall systems, and including finish material.

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.

Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as determined by the exterior wall system.

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

* + - * 1. Cold-Formed Steel Framing Design Standards:

Floor and Roof Systems: AISI S210.

Wall Studs: AISI S211.

Headers: AISI S212.

Lateral Design: AISI S213.

Truss Design: AISI S214.

* + - * 1. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

*Note to Specifier ; retain 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.*

* + - * 1. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

* + - 1. **COLD-FORMED STEEL FRAMING, GENERAL**
         1. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
         2. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

Grade: As required by structural performance.

Coating: As determined by project location and climate conditions.

* + - 1. **LOAD-BEARING WALL FRAMING**
         1. Steel Studs: [SigmaStud®](https://www.steelnetwork.com/Product/SigmaStud) by The Steel Network, Inc., due to increased strength to weight ratio, of web depths indicated, punched, with stiffened flanges, with minimum base metal thickness, flange width and section properties required to meet design requirements.
         2. Steel Studs: Manufacturer's standard [C-shaped steel studs](https://www.steelnetwork.com/Product/StandardStud), of web depths indicated, punched, with stiffened flanges, with minimum base metal thickness, flange width and section properties required to meet design requirements.
         3. Steel Track: [SigmaTrak®](https://www.steelnetwork.com/Product/SigmaTrak) by The Steel Network, Inc., used to maintain full seating of loadbearing stud in track, of web depths indicated, unpunched, and matching properties of steel studs.
         4. Steel Track: Manufacturer's standard [U-shaped steel track](https://www.steelnetwork.com/Product/StandardTrack), of web depths indicated, unpunched, with straight flanges, and matching properties of steel studs.
         5. Steel Box or Back-to-Back Headers: [JamStud®](https://www.steelnetwork.com/Product/JamStud) by The Steel Network, Inc. used to form header beams, of web depths required, with double stiffened flanges, and with minimum base metal thickness, flange width and section properties required to meet design requirements.
         6. 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.
         7. Door and Window Jambs: [JamStud®](https://www.steelnetwork.com/Product/JamStud) by The Steel Network, Inc. used to frame single and multiple section jambs, of web depths required, with double stiffened flanges, and with minimum base metal thickness, flange width and section properties required to meet design requirements.
         8. Wall Bridging: used to support framing members in weak-axis direction:

[BridgeBar® BB150](https://www.steelnetwork.com/Product/BridgeBar) Bridging Channel by The Steel Network, Inc.

[BuckleBridge®](https://www.steelnetwork.com/Product/BuckleBridge) Solid Bridging by The Steel Network, Inc.

[NotchTrak®](https://www.steelnetwork.com/Product/NotchTrakNT) Solid Bridging by The Steel Network, Inc.

* + - * 1. Wall Bridging: Manufacturer's standard [U-shaped cold-rolled channel](https://www.steelnetwork.com/Product/PrimeWallCold-RolledChannel) 1.5 inch wide, 0.5 inch leg, unpunched, with thickness indicated.
        2. Clip Connectors: used to maintain continuous load path of framing members to foundation:

[StiffClip® CL](https://www.steelnetwork.com/Product/StiffClipCL) and [StiffClip® TD](https://www.steelnetwork.com/Product/StiffClipTD) Tie-Down Connectors by The Steel Network, Inc.

[MidWall™](https://www.steelnetwork.com/Product/MidWall) Partial Wall Framing Connector by The Steel Network, Inc.

[StiffClip® HE](https://www.steelnetwork.com/Product/StiffClipHE) and [StiffClip® HS](https://www.steelnetwork.com/Product/StiffClipHS) Header and Sill Connector by The Steel Network, Inc.

[StiffClip® AL](https://www.steelnetwork.com/Product/StiffClipAL) Multi-Use Connector by The Steel Network, Inc.

[StiffClip® FS](https://www.steelnetwork.com/Product/StiffClipFS) Floor Strap Connector by The Steel Network, Inc.

[BackIt®](https://www.steelnetwork.com/Product/BackIt) Solid Backing Connector by The Steel Network, Inc. to support handrails and wall-mounted shelving.

[BridgeClip®](https://www.steelnetwork.com/Product/BridgeClip) Securing Bridging Member by The Steel Network, Inc.

[SigmaStud® Web RFT](https://www.steelnetwork.com/Product/SigmaStudWebRFT) Hole Reinforcing for the [SigmaStud®](https://www.steelnetwork.com/Product/SigmaStud) by The Steel Network, Inc.

[StiffClip® PLC](https://www.steelnetwork.com/Product/StiffClipPLC) Panel Lifting Clip by The Steel Network, Inc.

* + - 1. **SHEAR WALL STRAP BRACING FRAMING**
         1. Steel Chords: [StiffWall® Columns](https://www.steelnetwork.com/Product/StiffWallColumnBootAssembly) by The Steel Network, Inc., engineered X-bracing shear wall system, of height, width, number of stud pieces, boot end connection, punched, with stiffened flanges, with minimum base metal thickness, flange width and section properties required to meet design requirements.
         2. Steel Straps: Manufacturer's standard [Steel straps](https://www.steelnetwork.com/Product/FlatStrap), of length, width and thickness indicated, with section properties required to meet design requirements.
         3. Steel Strap Tensioning: [TightStrap®](https://www.steelnetwork.com/Product/TightStrap) steel strap tensioning tool, by The Steel Network, Inc.
      2. **EXTERIOR NON-LOAD-BEARING WALL FRAMING**
         1. Steel Studs: [Curtain Wall Stud](https://www.steelnetwork.com/Product/curtainwallstud) designated by a “C” nomenclature by The Steel Network, Inc., of web depths indicated, punched, with double stiffened flanges, with minimum base metal thickness, flange width and section properties required to meet design requirements.
         2. Steel Studs: Manufacturer's standard [C-shaped steel studs](https://www.steelnetwork.com/Product/StandardStud), of web depths indicated, punched, with stiffened flanges, with minimum base metal thickness, flange width and section properties required to meet design requirements.
         3. Steel Track: Manufacturer's standard [U-shaped steel track](https://www.steelnetwork.com/Product/StandardTrack), of web depths indicated, unpunched, with straight flanges, and matching properties of steel studs.
         4. Steel Box or Back-to-Back Headers: [JamStud®](https://www.steelnetwork.com/Product/JamStud) by The Steel Network, Inc. used to form header beams, of web depths required, with double stiffened flanges, and with minimum base metal thickness, flange width and section properties required to meet design requirements.
         5. Single Section Headers: [JamStud®](https://www.steelnetwork.com/Product/JamStud) by The Steel Network, Inc. used to frame single section header, of web depths required, with double stiffened flanges, and with minimum base metal thickness, flange width and section properties required to meet design requirements.
         6. Door and Window Jambs: [JamStud®](https://www.steelnetwork.com/Product/JamStud) by The Steel Network, Inc. used to frame single and multiple section jambs, of web depths required, with double stiffened flanges, and with minimum base metal thickness, flange width and section properties required to meet design requirements.
         7. Wall Bridging: used to support framing members in weak-axis direction:

[BridgeBar® BB150](https://www.steelnetwork.com/Product/BridgeBar) Bridging Channel by The Steel Network, Inc.

[BuckleBridge®](https://www.steelnetwork.com/Product/BuckleBridge) Solid Bridging by The Steel Network, Inc.

[NotchTrak®](https://www.steelnetwork.com/Product/NotchTrakNT) Solid Bridging by The Steel Network, Inc.

* + - * 1. Wall Bridging: Manufacturer's standard [U-shaped cold-rolled channel](https://www.steelnetwork.com/Product/PrimeWallCold-RolledChannel) 1.5 inch wide, 0.5 inch leg, unpunched, with thickness indicated.
        2. Clip Connectors: used to maintain continuous load path of framing members to foundation:

[StiffClip® CL](https://www.steelnetwork.com/Product/StiffClipCL) and [StiffClip® TD](https://www.steelnetwork.com/Product/StiffClipTD) Tie-Down Connectors by The Steel Network, Inc.

[MidWall™](https://www.steelnetwork.com/Product/MidWall) Partial Wall Framing Connector by The Steel Network, Inc.

[MasterClip® VLB](https://www.steelnetwork.com/Product/MasterClipVLB) Hybrid Deflection/Rigid By-pass Structure at Floor Pour Stop by The Steel Network, Inc.

[StiffClip® LB](https://www.steelnetwork.com/Product/StiffClipLB) and [LB-HD](https://www.steelnetwork.com/Product/StiffClipLB-HD) By-pass Structure at Floor Pour Stop by The Steel Network, Inc.

[StiffClip® HE](https://www.steelnetwork.com/Product/StiffClipHE) and [StiffClip® HS](https://www.steelnetwork.com/Product/StiffClipHS) Header and Sill Connector by The Steel Network, Inc.

[StiffClip® AL](https://www.steelnetwork.com/Product/StiffClipAL) Multi-Use Connector by The Steel Network, Inc.

[BackIt®](https://www.steelnetwork.com/Product/BackIt) Solid Backing Connector by The Steel Network, Inc. to support handrails and wall-mounted shelving.

[BridgeClip®](https://www.steelnetwork.com/Product/BridgeClip) Securing Bridging Member by The Steel Network, Inc.

* + - * 1. Vertical Deflection Connectors: used to accommodate upward and downward vertical displacement of primary structure through positive mechanical attachment to structure and screw attachment to stud web using break-away bushings or step-bushings to permit frictionless vertical movement. Having a valid ICC ES Report complying with ICC Acceptance Criteria AC261, such as ICC-ESR-2049 or equivalent lab testing:

[MasterClip® VLB](https://www.steelnetwork.com/Product/MasterClipVLB) Hybrid Deflection/Rigid By-pass Structure at Floor Pour Stop by The Steel Network, Inc.

[VertiClip® SLB](https://www.steelnetwork.com/Product/VertiClipSLB) and [SLB-HD](https://www.steelnetwork.com/Product/VertiClipSLB-HD) By-pass Structure at Floor Pour Stop by The Steel Network, Inc.

[VertiClip® SLF](https://www.steelnetwork.com/Product/VertiClipSLF) By-pass Structure at Concrete Slab Stud Flange Attachment by The Steel Network, Inc.

[VertiClip® SLS](https://www.steelnetwork.com/Product/VertiClipSLS) By-pass Structure at Steel Beam by The Steel Network, Inc.

[VertiClip® SLT](https://www.steelnetwork.com/Product/VertiClipSLT) By-pass Structure at Concrete Slab by The Steel Network, Inc.

[VertiClip® Splice](https://www.steelnetwork.com/Product/VertiClipSplice) By-pass Structure at Floor Pour Stop with Stud Splice by The Steel Network, Inc.

[VertiClip® SL](https://www.steelnetwork.com/Product/VertiClipSL) Exterior Head of Wall by The Steel Network, Inc.

[VertiClip® SLD](https://www.steelnetwork.com/Product/VertiClipSLD) Interior/Exterior Head of Wall by The Steel Network, Inc.

[VertiTrak® VTX](https://www.steelnetwork.com/Product/VertiTrackVTX) Exterior Head of Wall Preassembled with Track by The Steel Network, Inc.

* + - * 1. Drift Connectors: used to accommodate upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to structure and screw attachment to stud web using step-bushings to permit frictionless vertical and horizontal movement. Having a valid ICC ES Report complying with ICC Acceptance Criteria AC261, such as ICC-ESR-2049 or equivalent lab testing:

[DriftClip® DSL](https://www.steelnetwork.com/Product/DriftClipDSL) Exterior Head of Wall by The Steel Network, Inc.

[DriftClip ® DSLB](https://www.steelnetwork.com/Product/DriftClipDSLB) By-pass Structure at Floor Pour Stop by The Steel Network, Inc.

[DriftClip® DSLS](https://www.steelnetwork.com/Product/DriftClipDSLS) By-pass Structure at Steel Beam by The Steel Network, Inc.

[DriftTrak® DTSL](https://www.steelnetwork.com/Product/DriftTrakDTSL) Exterior Head of Wall Free Lateral Movement Assembly by The Steel Network, Inc.

[DriftTrak® DTLB and DTLB-HD](https://www.steelnetwork.com/Product/DriftTrakDTLB) Exterior By-pass Structure at Floor Pour Stop Free Lateral Movement Assembly Rigid Attachment to Stud by The Steel Network, Inc.

[DriftTrak® DTSLB and DTSLB-HD](https://www.steelnetwork.com/Product/DriftTrakDTSLB) Exterior By-pass Structure at Floor Pour Stop Free Lateral Movement Assembly by The Steel Network, Inc.

[DriftTrak® Headed Stud](https://www.steelnetwork.com/Product/DriftTrakHeadedStud) Exterior By-pass Structure at Floor Pour Stop Free Lateral Movement Assembly with Headed Studs Concrete Embeds by The Steel Network, Inc.

[DriftTrak® Headed Stud - PTS](https://www.steelnetwork.com/Product/DriftTrakHeadedStudPTS) Exterior By-pass Structure at Floor Pour Stop Free Lateral Movement Assembly with Headed Studs Post-Tensioned Slab Concrete Embeds by The Steel Network, Inc.

[DriftCorner®](https://www.steelnetwork.com/Product/DriftCorner) Wall Corner By-pass or Infill by The Steel Network, Inc.

* + - 1. **FLOOR JOIST FRAMING**
         1. Steel Joists: [PrimeJoist®](https://www.steelnetwork.com/Product/PrimeJoist) by The Steel Network, Inc., of web depths indicated, [**unpunched,**] [**punched,**] with double stiffened flanges, and with minimum base metal thickness, flange width and section properties required to meet design requirements.
         2. Steel Joists: Manufacturer's standard [C-shaped steel joists](https://www.steelnetwork.com/Product/StandardStudhttps:/www.steelnetwork.com/Product/StandardStud), 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.
         3. Steel Joist Track: Manufacturer's standard [U-shaped steel joist track](https://www.steelnetwork.com/Product/StandardTrack), of web depths required, unpunched, with unstiffened flanges, and with minimum base metal thickness, flange width and section properties required to meet design requirements.
         4. Floor Bridging: used to support framing members in weak-axis direction:

[BuckleBridge®](https://www.steelnetwork.com/Product/BuckleBridge) Solid Bridging by The Steel Network, Inc.

* + - * 1. Clip Connectors: used to maintain continuous load path of framing members to foundation:

[StiffClip® JC](https://www.steelnetwork.com/Product/StiffClipJC) Joist Connector by The Steel Network, Inc.

[StiffClip® JH](https://www.steelnetwork.com/Product/StiffClipJH) Joist Hanger by The Steel Network, Inc.

[StiffClip® AL](https://www.steelnetwork.com/Product/StiffClipAL) Multi-Use Connector by The Steel Network, Inc.

* + - 1. **ROOF RAFTER AND TRUSS FRAMING**
         1. Steel Rafters and Trusses: [PrimeJoist®](https://www.steelnetwork.com/Product/PrimeJoist) by The Steel Network, Inc., of web depths indicated, with double stiffened flanges, and with minimum base metal thickness, flange width and section properties required to meet design requirements.
         2. Steel Rafters and Trusses: Manufacturer's standard [C-shaped steel sections](https://www.steelnetwork.com/Product/StandardStud), 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.
         3. Clip Connectors: used to maintain continuous load path of framing members to foundation:

[StiffClip® HC](https://www.steelnetwork.com/Product/StiffClipHC) Hip Connector by The Steel Network, Inc.

[StiffClip® RT](https://www.steelnetwork.com/Product/StiffClipRT) Roof Tie-Down by The Steel Network, Inc.

[StiffClip® AL](https://www.steelnetwork.com/Product/StiffClipAL) Multi-Use Connector by The Steel Network, Inc.

[StiffClip® PL](https://www.steelnetwork.com/Product/StiffClipPL) Truss Connector by The Steel Network, Inc.

[StiffClip® WC](https://www.steelnetwork.com/Product/StiffClipWC) Web Connector by The Steel Network, Inc.

* + - 1. **CEILING JOIST FRAMING**
         1. Steel Ceiling Joist: [PrimeJoist®](https://www.steelnetwork.com/Product/PrimeJoist) by The Steel Network, Inc., of web depths indicated, with double stiffened flanges, and with minimum base metal thickness, flange width and section properties required to meet design requirements.

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.

* + - * 1. Steel Ceiling Joists: Manufacturer's standard [C-shaped steel sections](https://www.steelnetwork.com/Product/StandardStud), 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. Clip Connectors: used to maintain continuous load path of framing members to foundation:

[StiffClip® JH](https://www.steelnetwork.com/Product/StiffClipJH) Joist Hanger by The Steel Network, Inc.

[StiffClip® AL](https://www.steelnetwork.com/Product/StiffClipAL) Multi-Use Connector by The Steel Network, Inc.

* + - 1. **SOFFIT FRAMING**
         1. Exterior Soffit Frame: Manufacturer's standard [C-shaped steel sections](https://www.steelnetwork.com/Product/StandardStud), of web depths indicated, with stiffened flanges, and with minimum base metal thickness, flange width and section properties required to meet design requirements.
      2. **FRAMING ACCESSORIES**
         1. 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.
         2. Provide accessories of manufacturer's standard thickness and configuration, required by design requirements.
      3. **ANCHORS, AND FASTENERS**

A. SSE shall include the following anchors and fasteners required by the design requirements:

1. Anchor Bolts.

2. Expansion Anchors.

3. Power-Actuated Anchors if allowed by Structural Engineer of Record.

4. Mechanical Fasteners, head type: low-profile head beneath sheathing, manufacturer's standard elsewhere.

5. Welding Electrodes.

* + - 1. **MISCELLANEOUS MATERIALS**
         1. Galvanizing Repair Paint: ASTM A780.
         2. 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.
         3. 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.
         4. 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.
         5. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.
      2. **FABRICATION**

*Note to Specifier retain the following paragraph when Building Information Modeling is part of project requirements.*

* + - * 1. Use panel drawings generated from 3D BIM model of the cold-formed steel framing to fabricate wall, floor and roof panels including all studs, tracks, joists, trusses, bridging, and connectors.
        2. 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.

Fabricate framing assemblies using jigs or templates.

Cut framing members by sawing or shearing; do not torch cut.

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.

Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.

Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

* + - * 1. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
        2. 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:

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.

Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

1. **EXECUTION**
   * + 1. **EXAMINATION**
          1. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
          2. Proceed with installation only after unsatisfactory conditions have been corrected.
       2. **PREPARATION**

*Note to Specifier delete following paragraph A. & B. if SFRM is not required*.

* + - * 1. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
        2. 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.
        3. 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.
        4. 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.
      1. **INSTALLATION, GENERAL**
         1. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
         2. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.
         3. Install shop- or field-fabricated, cold-formed framing wall panels and securely anchor to supporting structure.

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.

Use load rated lifting connector when lifting panels into place.

* + - * 1. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

Cut framing members by sawing or shearing; do not torch cut.

Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

* + - * 1. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
        2. 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.
        3. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

*Note to Specifier: Retain following if insulation for exterior framing is required.*

* + - * 1. 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.
        2. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
        3. 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:

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.

* + - 1. **LOAD-BEARING WALL INSTALLATION**
         1. 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.
         2. 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.
         3. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
         4. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
         5. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.
         6. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.
         7. 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 vertical load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

Frame wall openings at each jamb of frame as indicated on Shop Drawings. For multiple jamb members, fasten members together to uniformly distribute loads.

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.

* + - * 1. 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.

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.

* + - * 1. Install horizontal bridging in stud system, spaced vertically as indicated on Shop Drawings. Fasten at each stud intersection.
        2. 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.
        3. 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.
      1. **EXTERIOR NON-LOAD-BEARING WALL INSTALLATION**
         1. 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.
         2. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/4 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.
         3. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
         4. Isolate non-load-bearing steel framing from the building structure to prevent transfer of vertical loads and/or in-plane horizontal loads while providing lateral support.
         5. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of single or compound shapes indicated or required to transfer horizontal load to supporting studs, complete with clip-angle connectors.
         6. 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.

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.

* + - * 1. Install horizontal bridging in stud system, spaced vertically as indicated on Shop Drawings. Fasten at each stud intersection.
        2. 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.
        3. 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.
      1. **JOIST INSTALLATION**
         1. 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.
         2. 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.

Install joists over supporting frame with a minimum end bearing indicated on Shop Drawings.

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.

* + - * 1. Space joists not more than 2 inches from abutting walls, and indicated on Shop Drawings.
        2. Frame openings with built-up joist headers consisting of joist and joist track, or another combination of connected joists if indicated.
        3. 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.

Install web stiffeners to transfer axial loads of walls above.

* + - * 1. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection indicated on Shop Drawings.
        2. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
        3. 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.
      1. **FIELD QUALITY CONTROL**
         1. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
         2. Field and shop welds will be subject to testing and inspecting.
         3. Testing agency will report test results promptly and in writing to Contractor and Architect.
         4. Remove and replace work where test results indicate that it does not comply with specified requirements.
         5. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
      2. **REPAIRS AND PROTECTION**
         1. 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.
         2. 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**