SECTION 052100 - STEEL JOIST FRAMING

Revise this Section by deleting and inserting text to meet Project-specific requirements.

1. GENERAL
   * + 1. RELATED DOCUMENTS
          1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
       2. SUMMARY
          1. Section Includes:

K-series steel joists.

KCS-type K-series steel joists.

K-series steel joist substitutes.

LH-series long-span steel joists.

DLH-series long-span steel joists.

CJ-series composite steel joists.

Steel joist girders.

Steel joist accessories.

* + - 1. DEFINITIONS

Retain terms that remain after this Section has been edited for a project.

* + - * 1. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
        2. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."
      1. SUBMITTALS
         1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
         2. Manufacturer’s installation instructions shall be provided along with product data.
         3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
         4. Product Data: For each type of joist, accessory, and product.
         5. Indicate common joist load capacity diagram or provide calculations.

USE PARAGRAPH BELOW WITH EPD REQUIREMENT WHEN PROJECT ESTIMATE IS $1M OR MORE.

* + - * 1. Submit an Environmental Product Declaration (EPD) from the manufacturer for structural steel within this specification section, if available. A statement of the contractor’s good faith effort to obtain the EPD shall be provided if not available.

Manufacturer-provided EPDs must be Product Specific Type III (Third-Party Reviewed), in adherence with ISO 14025 *Environmental labels and declarations*, ISO 14044 *Environmental management – Life cycle assessment*, and ISO 21930 *Core rules for environmental product declarations of construction products and services.*

* + - * 1. Shop Drawings:

Include layout, designation, number, type, location, and spacing of joists.

Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.

Delete subparagraph below if bearing plates are specified in Section 055000 "Metal Fabrications."

Indicate locations and details of bearing plates to be embedded in other construction.

Retain "Qualification Data" Paragraph below with qualification requirements in "Quality Assurance" Article.

* + - * 1. Qualification Data: For **[manufacturer] [professional engineer in New York State]**.

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

* + - * 1. Welding certificates.

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

* + - * 1. Manufacturer certificates.
        2. Mill Certificates: For each type of bolt.

Retain paragraph below if retaining "Structural Performance" Paragraph in "Performance Requirements" Article for special joists. Delete or revise below if Architect assumes or is required by law to assume design responsibility.

* + - * 1. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer in New York State responsible for its preparation.

Retain "Source quality-control reports" Paragraph below if Contractor is responsible for source quality-control testing and inspecting.

* + - * 1. Source quality-control reports.

Use subparagraph below for projects over $100,000. See Article 1.6. below.

Documentation to confirm compliance with General Conditions Article 25.4 Domestic Steel.

Retain "Field quality-control reports" Paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
      1. QUALITY ASSURANCE
         1. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications[."]**[" and "Standard Specification for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice."]**

Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

Retain "Welding Qualifications" Paragraph below if field welding is required. If retaining, also retain "Welding certificates" Paragraph in "Informational Submittals" Article. AWS states that welding qualifications remain in effect indefinitely unless welding personnel have not welded for more than six months or there is a specific reason to question their ability. Shop welding does not follow AWS requirements; SJI has its own requirements for welding procedures.

* + - * 1. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

Use paragraph below for projects over $100,000. Paragraph is taken from Article 25.4 of the General Conditions.

* + - * 1. If the value of the contract exceeds $100,000 all structural steel, reinforcing steel and other major steel items to be incorporated in the Work of this Contract shall be produced and made in whole or substantial part in the United States, its territories or possessions.
      1. DELIVERY, STORAGE, AND HANDLING
         1. Deliver, store, and handle joists as recommended in SJI's "Specifications[."]**[" and "Standard Specification for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice."]**
         2. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.
      2. SEQUENCING

Retain this article if steel bearing plates are specified in this Section for installation in Section 033000 "Cast-in-Place Concrete" or Section 042000 "Unit Masonry."

* + - * 1. Deliver steel bearing plates to be built into **[cast-in-place concrete] [and] [masonry]** construction.

1. PRODUCTS

Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications.

* + - 1. MANUFACTURERS
         1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Canam Steel Corporation; Canam Group, Inc.

New Millennium Building Systems, LLC.

Vulcraft; Nucor Corporation, Verco Group.

Approved equivalent.

* + - 1. PERFORMANCE REQUIREMENTS

Revise "Structural Performance" Paragraph below as necessary if nonuniform, unequal, or special loading conditions invalidate SJI load or weight tables and if joist manufacturer is required to design special joists. Indicate locations of special joists on Drawings and identify them as "special." SJI's "Specifications" usually calls for loading diagrams, net uplift loads, and end moments, as applicable, to allow joist manufacturer to design special joists. Structural engineer of record should determine whether to follow ASD or LRFD design method and should indicate the method used on Drawings.

* + - * 1. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated on Drawings.

Use **[ASD; data are given at service-load level] [LRFD; data are given at factored-load level]**.

Design special joists to withstand design loads with live-load deflections no greater than the following:

Deflection limits in "Floor Joists" and "Roof Joists" subparagraphs below are examples only. Retain options or insert other limits as appropriate for floor, roof, and ceiling materials.

Floor Joists: Vertical deflection of **[1/360] [1/240]** of the span.

Roof Joists: Vertical deflection of **[1/360] [1/240]** of the span.

Insert other performance and design criteria that apply to special joists. Examples may include stress-level reduction for special joists that are part of a fire-resistance-rated assembly, joist extensions with nonuniformly distributed loads, or special joists with rigid end connections.

* + - * 1. **<Insert requirements>**.
      1. STEEL JOISTS

Retain this article if Project uses open-web K-series steel joists.

* + - * 1. K-Series Steel Joist: Manufactured steel joists of type indicated according to "Standard Specification for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

Joist Type: **[K-series steel joists] [and] [KCS-type K-series steel joists]**.

Retain "K-Series Steel Joist Substitutes" Subparagraph below if K-series joist substitutes of 2-1/2-inch- deep sections are required for spans less than 96 inches.

K-Series Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

For each reduction in chord area, SJI advises proportionately reducing carrying capacity.

Provide holes in chord members for connecting and securing other construction to joists.

Retain "Top-Chord Extensions" or "Extended Ends" Subparagraph below if required. SJI distinguishes between Type S and Type R joist extensions to K-series joists. See the Evaluations and SJI's "Specifications."

Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated on Drawings, complying with SJI's "Specifications."

Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated on Drawings, complying with SJI's "Specifications."

Retain one of first two subparagraphs below. SJI's "Specifications" states that camber is optional with K-series steel joist manufacturers, and it lists camber that varies according to top-chord length. Coordinate with roof-slope requirements.

Do not camber joists.

Camber joists **[according to SJI's "Specifications."] [as indicated on Drawings.]**

Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

Retain "Long-Span Steel Joist" Paragraph below if Project uses either LH- or DLH-series steel joists. LH-series joists may be used in floor or roof decks; DLH-series joists are limited to use in roof decks.

* + - * 1. Long-Span Steel Joist: Manufactured steel joists according to "Standard Specification for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements**[ as follows:][ as indicated on Drawings.]**

Delete "Joist Type," "End Arrangement," and "Top-Chord Arrangement" subparagraphs below if joist type and end and top-chord arrangements are indicated on Drawings.

Joist Type: **[LH-series long-span steel joists] [and] [DLH-series long-span steel joists]**.

Retain one option in "End Arrangement" Subparagraph below for either LH- or DLH-series steel joists.

End Arrangement: **[Underslung] [Square]**.

LH- and DLH-series joists are available parallel, pitched one way, or pitched two ways. SJI's load tables are based on a standard pitch of 1/8 inch per 12 inches (1:96). Coordinate with roof-slope requirements.

Top-Chord Arrangement: **[Parallel] [Pitched 1/8 inch per 12 inches, one way] [Pitched 1/8 inch per 12 inches, two ways]**.

For each reduction in chord area, SJI advises proportionately reducing carrying capacity.

Provide holes in chord members for connecting and securing other construction to joists.

SJI's "Specifications" lists long-span joist manufacturer's standard camber that varies according to top-chord length.

Camber long-span steel joists **[according to SJI's "Specifications."] [as indicated on Drawings.]**.

Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

Retain "Composite Steel Joist" Paragraph below if Project uses composite steel joists.

* + - * 1. Composite Steel Joist: Manufactured steel joists according to "Standard Specifications for Composite Steel Joists, CJ-Series" in SJI's "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice," with steel-angle top- and bottom-chord members and parallel top chord, and with **[underslung] [square]** ends.

"Standard Specifications for Composite Steel Joists, CJ-Series" in SJI's "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice" requires composite joists to be cambered.

Camber composite steel joists **[as indicated on Drawings]**.

* + - 1. STEEL JOIST GIRDERS

Retain this article if Project uses steel joist girders.

* + - * 1. Manufactured joist girders according to "Standard Specification for Joist Girders" in SJI's "Specifications," with steel-angle top- and bottom-chord members; with end and top-chord arrangements**[ as follows:][ as indicated on Drawings.]**

Delete "End Arrangement" and "Top-Chord Arrangement" subparagraphs below if end and top-chord arrangements are indicated on Drawings.

Retain one option in "End Arrangement" Subparagraph below. Bottom-chord extensions provided for lateral bracing of bottom chords of joist girders are manufacturer's standard unless design of this connection is detailed by the design professional.

End Arrangement: **[Underslung] [Underslung with bottom-chord extensions] [Square]**.

Joist girders are available parallel, pitched one way, or pitched two ways. SJI's load tables are based on a standard pitch of 1/8 inch per 12 inches (1:96). Coordinate with roof-slope requirements.

Top-Chord Arrangement: **[Parallel] [Pitched 1/8 inch per 12 inches, one way] [Pitched 1/8 inch per 12 inches, two ways]**.

For each reduction in chord area, SJI advises proportionately reducing carrying capacity. Predrilled holes in chord members are needed if bolting wood nailers to top chords.

Provide holes in chord members for connecting and securing other construction to joist girders.

SJI's "Specifications" lists joist girder manufacturer's standard camber, which varies according to top-chord length.

Camber joist girders **[according to SJI's "Specifications."] [as indicated on Drawings.]**

Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

* + - 1. PRIMERS

Retain this article if shop priming is required. See the Evaluations for discussion of sprayed fire-resistive materials and primers.

* + - * 1. Primer:

Retain one of two subparagraphs below unless joists are required to be unprimed. Usually, retain first subparagraph. SJI's "Specifications" recognizes SSPC-Paint 15 and other types of primers complying with its performance requirements. Retain second subparagraph if requiring a special primer to be shop-applied. Coordinate with Section 099123 "Interior Painting."

SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.

Provide shop primer that complies with **Section 099123 "Interior Painting."] [Section 099600 "High-Performance Coatings."]**

* + - 1. STEEL JOIST ACCESSORIES
         1. Bridging:

Retain one of three subparagraphs below. Bridging refers to permanent bridging.

Provide bridging anchors and number of rows of **[horizontal] [or] [diagonal]** bridging of material, size, and type required by SJI's "Specifications"**[ and "Standard Specification for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice"]** for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

Schematically indicated. Detail and fabricate according to SJI's "Specifications[."]**[" and "Standard Specification for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice."]** Furnish additional erection bridging if required for stability.

Fabricate as indicated on Drawings and according to SJI's "Specifications[."]**[" and "Standard Specification for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice."]** Furnish additional erection bridging if required for stability.

Retain one of first two paragraphs below if joists bear on masonry or concrete construction. Retain first paragraph if steel bearing plates are specified in this Section; retain second if steel bearing plates are specified in Section 055000 "Metal Fabrications."

* + - * 1. Fabricate steel bearing plates from ASTM A36 steel with integral anchorages of sizes and thicknesses indicated on Drawings. **[Shop prime paint] [Hot-dip zinc coat according to ASTM A123]**.
        2. Steel bearing plates with integral anchorages are specified in Section 055000 "Metal Fabrications."

Retain first paragraph below if ceiling is attached to bottom of joists.

* + - * 1. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction.

Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated on Drawings.

Retain one option in "Finish" Subparagraph below.

Finish: **[Plain, uncoated] [Hot-dip zinc coating, ASTM A153, Class C] [Mechanically deposited zinc coating, ASTM B695, Class 50]**.

Retain "High-Strength Bolts, Nuts, and Washers" Paragraph below if splicing of long-span joists or if permanent bolted connections of joist ends using high-strength bolts is required.

* + - * 1. High-Strength Bolts, Nuts, and Washers: ASTM F3125, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers.

Retain one option in "Finish" Subparagraph below.

Finish: **[Plain] [Hot-dip zinc coating, ASTM A153, Class C] [Mechanically deposited zinc coating, ASTM B695, Class 50]**.

Retain "Welding Electrodes" Paragraph below if field welding is required.

* + - * 1. Welding Electrodes: Comply with AWS standards.

Retain "Galvanizing Repair Paint" Paragraph below if galvanized bolts or bearing plates are included in this Section.

* + - * 1. Galvanizing Repair Paint: **[MPI#18, MPI#19, or SSPC-Paint 20] [ASTM A780]**.
        2. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.
      1. CLEANING AND SHOP PAINTING

Retain this article if shop cleaning is required with or without shop priming.

* + - * 1. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by **[hand-tool cleaning, SSPC-SP 2] [or] [power-tool cleaning, SSPC-SP 3]**.

Retain first paragraph below if priming is not permitted or is not permitted in selected locations. Standard fabrication practice is to prime paint joists except for CJ type.

* + - * 1. Do not prime paint joists and accessories**[ to receive sprayed fire-resistive materials]**.

Retain first paragraph below if shop priming is specified in this Section. SSPC-Paint 15 requires the minimum paint film thickness in first paragraph below. Verify that joist manufacturer complies with this minimum.

* + - * 1. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

Retain paragraph below if shop priming is specified in Section 099123 "Interior Painting" or in Section 099600 "High-Performance Coatings."

* + - * 1. Shop priming of joists and joist accessories is specified in **[Section 099123 "Interior Painting."] [Section 099600 "High-Performance Coatings."]**

1. EXECUTION
   * + 1. EXAMINATION
          1. Examine supporting substrates, embedded bearing plates, 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. INSTALLATION
          1. Do not install joists until supporting construction is in place and secured.
          2. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications[,"]**[" and "Standard Specification for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice,"]** joist manufacturer's written instructions, and requirements in this Section.

Before installation, splice joists delivered to Project site in more than one piece.

Space, adjust, and align joists accurately in location before permanently fastening.

Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.

SJI cautions that a rigid connection of bottom chord to column be made only after application of dead loads. Revise subparagraph below to suit Project. Insert other limitations as required.

Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.

Retain first paragraph below if field welding joists to steel bearing plates or steel framework.

* + - * 1. Field weld joists to supporting steel **[bearing plates] [and] [framework]**. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

Retain one of first two paragraphs below for bolting joists to steel framework. Retain first paragraph if mild-strength carbon-steel bolts are required; retain second if high-strength structural bolts are required. Mild-strength bolts are standard with SJI.

* + - * 1. Bolt joists to supporting steel framework using carbon-steel bolts.
        2. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for high-strength structural bolt installation and tightening requirements.
        3. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.
      1. REPAIRS

Retain first paragraph below if repairs to galvanized bolts or bearing plates are required.

* + - * 1. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.
        2. Touchup Painting:

Retain first subparagraph below if on-site paint repair is included in this Section. Touchup painting may be unnecessary if building is closed in immediately and in-service conditions require no permanent paint protection. Standard shop paint should not be considered a prime coat for a coating system and is not typically touched up.

Immediately after installation, clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists**[, bearing plates,] [abutting structural steel,]** and accessories.

Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

Apply a compatible primer of same type as primer used on adjacent surfaces.

Retain subparagraph below if touchup painting is required for Project but is not part of the Work of this Section.

Cleaning and touchup painting are specified in **[Section 099123 "Interior Painting."] [Section 099600 "High-Performance Coatings."]**

* + - 1. FIELD QUALITY CONTROL
         1. Special Inspections: Director’s Representative will engage a special inspector and a qualified testing agency to perform tests and inspections in accordance with the requirements of BDC 406 Summary of Special Inspections and BDC 406.1 Statement of Special Inspections and as directed by the Code Compliance Manager.

END OF SECTION 052100