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USACE / NAVFAC / AFCEC / NASA	**UFGS-05 21 00 (May 2015)** **Change 1 - 08/18**
Preparing Activity: USACE	**Superseding** **UFGS-05 21 13 (August 2009)** **UFGS-05 21 16 (August 2009)** **UFGS-05 21 19 (July 2007)** **UFGS-05 21 23 (July 2007)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021

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05/15, CHG 1: 08/18

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SECTION 05 21 00

STEEL JOIST FRAMING
05/15, CHG 1: 08/18

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NOTE: This guide specification covers the requirements for steel joist framing and accessories and includes the following components: Open Web Steel Joists (K-Series and KCS), Longspan Steel Joists (LH-Series), Deep Longspan Steel Joists (DLH-Series), Joist Girders, Composite Steel Joists (CJ-Series), and Nonstandard Joists and Joist Girders.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).
****

PART 1 GENERAL

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NOTE: Show the following information on the project drawings:

1. Joist series and size, joist spacing, and kN (kip) load on each panel point, span, and slope.

2. Design loads, including net uplift and lateral forces in addition to gravity (dead and live) loads.

3. Method of anchoring, framing at openings, spacing and type of bridging.

4. Accessory details as applicable.

Mechanical and Electrical layout drawings and specifications for ceiling suspensions must contain notes indicating that hangar loads between panel points in excess of 445 N 100 pounds must have the excess hangar loads suspended from panel points.

When joists or girders are to be designed to resist net uplift and/or lateral forces, such joists and girders and the forces they must resist must be indicated on the drawings. Also, indicate all proper anchorages and bracing designed to resist those forces, as required.

The standard joist tables cannot be used verbatim when the depth of the joist is reduced near the ends to accommodate two-way top chord slopes in excess of 10 mm per meter 1/8 inch per foot. Before using standard designations for these joists, the designer must verify the adequacy of the joist members.

For additional information on the use of joists and joist girders see SJI Technical Digests covering ponding loading, vibrations, uplift, welding, fire resistant assemblies, lateral load resisting frames using steel joists and joist girders and evaluation and modification of open web steel joists and joist girders.

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1.1 REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2020) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2018) International Building Code

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PA 1	(2016) Shop, Field, and Maintenance Coating of Metals
SSPC Paint 15	(1999; E 2004) Steel Joist Shop Primer/Metal Building Primer
SSPC SP 2	(2018) Hand Tool Cleaning

STEEL JOIST INSTITUTE (SJI)

SJI COMPOSITE JOISTS	(2007; Supplement 1 2010) Standard Specifications for Composite Steel Joist Catalog
SJI LOAD TABLES	(2010; Errata 1 2011; Errata 2 2012) 42nd Edition Catalog of Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders
SJI MANUAL	(2009) 80 Years of Open Web Steel Joist Construction

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.756	Steel Erection; Beams and Columns
29 CFR 1926.757	Steel Erection; Open Web Steel Joists

1.2 SUBMITTALS

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NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification

technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Welder Qualification

SD-02 Shop Drawings

Steel Joist Framing; G

SD-03 Product Data

Recycled Content Of Steel Products; S

SD-05 Design Data

Design Calculations; G

SD-06 Test Reports

Erection Inspection
Welding Inspections

SD-07 Certificates

Certification of Compliance

1.3 QUALITY ASSURANCE

Perform all work in compliance with the requirements set forth in 29 CFR 1926.

1.3.1 Drawing Requirements

Submit drawings of steel joist framing including fabrication, specifications for shop painting, and identification markings of joists [and joist girders]. Show joist type and size, layout in plan, all applicable loads, deflection criteria, and erection details including methods of anchoring, framing at openings, type, size, and location and connections for and spacing of bridging, requirements for field welding, and details of accessories as applicable. [Show profiles for nonstandard joist configurations.][Show steel joist field splice locations and details.]

1.3.2 Certification of Compliance

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NOTE: Use the SJI MANUAL reference for projects involving existing joist girder and joist systems.
****

Prior to construction commencement, submit certification for welder qualification, in compliance with AWS D1.1/D1.1M, welding operation, and tacker, stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. Submit certification of compliance for the following:

[a. SJI MANUAL

] [a][b]. Steel Joist Institute Member Fabricator

[b][c]. 29 CFR 1926

[c][d]. 29 CFR 1926.757

[d][e]. Statement from steel joist manufacturer, that work was performed in accordance with approved construction documents and with SJI standard specifications, in accordance with ICC IBC Section 1704.2.5.2.

1.4 DELIVERY, STORAGE, AND HANDLING

Handle, transport, and store joists [and joist girders] in a manner to prevent damage affecting their structural integrity. Verify piece count of all joist products upon delivery and inspect all joists products for damage. Report any damage to the joist supplier. Store all items off the ground in a well drained location protected from the weather and easily accessible for inspection and handling. Store joists with top chord down and with joists in a vertical position. Store deep joists horizontally if they were shipped on their sides.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

****

NOTE: The structural steel design must meet the requirements of OSHA Steel Erection Standard, 29 CFR Part 1926, Subpart R-Steel Erection and 29 CFR 1926.757.

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Designate steel joists [and joist girders] on the drawings in accordance with the standard designations of the Steel Joist Institute. Joists of other standard designations or joists with properties other than those shown may be substituted for the joists designated provided the structural properties are equal to or greater than those of the joists shown and provided all other specified requirements are met.

2.2 STEEL JOISTS [AND JOIST GIRDERS]

Provide steel joists [and joist girders] conforming to SJI LOAD TABLES. Design joists designated K, KCS, LH and DLH to support the loads given in the applicable standard load tables of SJI LOAD TABLES. Submit design calculations for [joist girders,][special steel joists,][composite steel joists,] net uplift loads, non-SJI standard details, and field splices. Include cover letter signed and sealed by the joist manufacturer's registered design professional.

2.2.1 Steel Joist Camber

Camber joists [according to SJI LOAD TABLES][as indicated]. [Do not camber joists.]

2.2.2 Special Steel Joists

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NOTE: Provide load diagrams on structural drawings for all loading conditions including net wind uplift on special joists.

For roof joists, specify live-load deflection criteria of L/360 for conditions where plaster ceiling is attached or suspended. Specify L/240 for all other cases.

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Provide special joists and connections capable of withstanding the design loads indicated with a live-load deflection less than [L/360][L/240] for roof joists and L/360 for floor joists.

2.2.3 Steel Joist Substitutes and Outriggers

Provide joist substitutes and outriggers conforming to SJI LOAD TABLES with steel angle or channel members.

2.2.4 Composite Steel Joists

Provide composite steel joists conforming to SJI COMPOSITE JOISTS.

2.2.5 Joist Girders

Provide joist girders capable of withstanding the design loads indicated with a live-load deflection less than [L/360][L/240] for roof girders and L/360 for floor girders. [Where joist girders are part of the lateral load resisting system, design girder for the end moments indicated for wind [and seismic].]

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NOTE: Include this paragraph when joists will be bolted to the joist girder as the holes require special consideration in the design of the joist girder.

****

[Provide holes in top chord members for connecting and securing other construction to the joist girders.]

Camber joist girders [according to SJI LOAD TABLES][as indicated]. [Do not camber joist girders.]

2.3 RECYCLED CONTENT

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NOTE: Coordinate the level of recycled content with sustainability requirements for the project.

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Provide products with an average recycled content of steel products of postconsumer recycled content plus one half of preconsumer recycled content not less than [25] [_____] percent.

2.4 ACCESSORIES AND FITTINGS

2.4.1 Bridging

Provide bridging of material, size, and type required by SJI LOAD TABLES for type of joist, chord size, spacing and span. Furnish additional erection bridging if required for stability.

2.4.2 Bearing Plates

Fabricate steel bearing plats from ASTM A36/A36M steel of size and thickness indicated.

2.4.3 Ceiling Extensions

Furnish ceiling extensions, either bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 13 mm 1/2 inch of finished wall surface unless otherwise indicated.

2.5 SHOP PAINTING

****

NOTE: The requirements of this paragraph will be coordinated with the requirements of Section 09 90 00 PAINTS AND COATINGS. In crawl spaces and other

high humidity areas where greater protection than that provided by a primer paint is required and the joists or girders will not be finish painted, the paragraph will be revised to require that the joists or girders be shop painted with a corrosion resistant type paint as recommended by SSPC.
****

SSPC Paint 15. Shop prime joists, except as modified herein, in accordance with SSPC PA 1. Clean joists in accordance with SSPC SP 2 before priming. [Do not prime joists to receive sprayed-on fireproofing.] If flash rusting occurs, re-clean the surface prior to application of primer. For joists [and joist girders] which require finish painting under Section 09 90 00 PAINTS AND COATINGS, the primer paint must be compatible with the finish paint.

PART 3 EXECUTION

3.1 ERECTION

****
NOTE: Use 29 CFR 1926.756 when joist lengths exceed 43,900 mm 144 feet.

****

Install joists [and joist girders] in conformance with SJI LOAD TABLES for the joist series indicated, and the requirements of 29 CFR 1926 and 29 CFR 1926.757[and 29 CFR 1926.756]. Handle and set joists [and joist girders] avoiding damage to the members. Place the "tag end" of joists as shown on the joists placement plans. Ensure that square-end joists are erected right side up. [Place joists on joist girders in accordance with the joist placement plan, noting that in many instances joist may not need to be placed at a joist girder panel point.] Distribute temporary loads so that joist capacity is not exceeded. Remove damaged joists [and joist girders] from the site, except when field repair is approved and such repairs are satisfactorily made in accordance with the manufacturer's recommendations. Do not repair, field modify, or alter any joists [or joist girder] without specific written instructions from the Designer of Record and/or joist manufacturer.

Install and connect bridging concurrently with joist erection, before construction loads are applied. Do not apply loads to bridging. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams. Do not cut away vertical leg of bridging where bridging makes an elevation transition; weld a separate piece of bridging at the transition. Perform all welding in accordance with AWS D1.1/D1.1M.

[3.2 BEARING PLATES

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NOTE: Use this paragraph for masonry or cast-in-place concrete applications only.
****

Provide bearing plates to accept full bearing after the supporting members have been plumbed and properly positioned, but prior to placing superimposed loads. The area under the plate must be damp-packed solidly with bedding mortar, except where nonshrink grout is indicated on the

drawings. Provide bedding mortar and grout as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

]3.3 PAINTING

3.3.1 Touch-Up Painting

After erection of joists [and joist girders], touch-up connections and areas of abraded shop coat with paint of the same type used for the shop coat.

[3.3.2 Field Painting

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NOTE: Omit bracketed text when field painting is not required.
****

Paint joists [and joist girders] requiring a finish coat in conformance with the requirements of Section 09 90 00 PAINTS AND COATINGS.

]3.4 VISUAL INSPECTIONS

Perform the following visual inspections:

a. Verify that all joists are spaced properly.

b. Verify that there is sufficient joist bearing on steel beams, concrete, and masonry.

c. Verify all bridging lines are properly spaced and anchored.

d. Verify that damage has not occurred to the joists [and joist girder] during erection.

e. Verify the joists are aligned vertically and there is no lateral sweep in the joists.

f. Where concentrated loads are present on the joists verify that they are located in accordance with the joists placement plan.

g. Verify welding of bridging and joist seats in accordance with AWS D1.1/D1.1M, Section 6. Perform erection inspection and field welding inspections with AWS certified welding inspectors.

h. Verify proper bolting of diagonal bridging and joist seats where the bolts are snug-tight.

-- End of Section --