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Preparing Activity: NASA Superseding
NASA-05210S (December 2005)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are NOT in agreement with UMRL dated 01 April 2006

Revised throughout - changes not indicated by CHG tags

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SECTION 05 21 00.00 40

STEEL JOISTS 04/06

NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This section covers open web, long-span, and deep long-span steel joists, conforming to Steel Joists Institute specifications for floor or roof construction.

Drawings must include the following:

A complete design indicating the character of the work to be performed, showing the walls, structural framing, and other supports; steel joist sizes expressed by steel joist institute markings; details of accessories; details of openings; bridging; and sufficient dimensions to convey adequately the quantity and nature of the required steel joist work

Assumed loads and other design data as required for the proper preparation of shop drawings

Roof slope and direction

For high-strength bolted construction, the type of connection, namely, friction or bearing

Location of welds requiring inspection and the type of weld inspection, if required

Fire-resistance-rated floor or roof and ceiling constructions using steel joists are described in Underwriters Laboratories Inc., (BXUV) "Fire Resistance Ratings" (included in UL FRD) and the "fire resistance ratings" contained in the National Building Code recommended by the American Insurance Association AIA CO-1. Fire-resistance-rated construction limits type, size, and spacing of steel joists; method of fastening steel joists to

supporting members; type of bridging; type of floor or roof construction; and type of ceiling construction.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

PART 1 GENERAL

1.1 REFERENCES

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 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.

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.

ACI INTERNATIONAL (ACI)

ACI/MCP 505

(2005) Manual of Concrete Practice Part 5:
357R-84 to 503.6-97

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC S329

(2004) Specification for Structural Joints
Using ASTM A 325 or ASTM A 490 Bolts

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISC/AISI 121 (2004) Standard Definitions for Use in the Design of Steel Structures

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B18.22.1 (1975; R 2003) Plain Washers

ANSI B18.22M (1981; R 2000) Metric Plain Washers

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4 (1998; R 2001) Standard Symbols for Welding, Brazing and Nondestructive Examination

AWS A5.1/A5.1M (2004) Carbon Steel Electrodes for Shielded Metal Arc Welding

AWS D1.1/D1.1M (2004) Structural Welding Code-Steel

ASTM INTERNATIONAL (ASTM)

ASTM A 1011/A 1011M (2005) Standard Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

ASTM A 194/A 194M (2005) Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both

ASTM A 242/A 242M (2004) Standard Specification for High-Strength Low-Alloy Structural Steel

ASTM A 307 (2004) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

ASTM A 325 (2004b) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

ASTM A 325M (2004b) Standard Specification for Structural Steel Bolts, Steel, Heat Treated 830 Mpa Minimum Tensile Strength (Metric)

ASTM A 36/A 36M (2005) Standard Specification for Carbon Structural Steel

ASTM A 370 (2005) Standard Test Methods and Definitions for Mechanical Testing of Steel Products

ASTM A 490 (2004) Standard Specification for

	Structural Bolts, Alloy Steel, Heat Treated, 150 psi Minimum Tensile Strength
ASTM A 490M	(2004) Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints [Metric]
ASTM A 563	(2004) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A 563M	(2004) Standard Specification for Carbon and Alloy Steel Nuts [Metric]
ASTM A 568/A 568M	(2005) Standard Specifications for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for
ASTM A 572/A 572M	(2004) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A 6/A 6M	(2005) Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A 606	(2004) Standard Specification for Steel Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
ASTM C 1107	(2005) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C 150	(2005) Standard Specification for Portland Cement
ASTM C 404	(2004) Standard Specification for Aggregates for Masonry Grout
ASTM E 165	(2002) Standard Test Method for Liquid Penetrant Examination
ASTM E 709	(2001) Standard Guide for Magnetic Particle Examination
ASTM F 436	(2004) Standard Specification for Hardened Steel Washers
ASTM F 436M	(2004) Standard Specification for Hardened Steel Washers (Metric)
ASTM F 568M	(2004) Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners

STEEL JOIST INSTITUTE (SJI)

SJI 279167 (2002e41) Standard Specifications and Load
Tables

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PS 14.01 (2000) Steel Joist Shop Painting System

SSPC Paint 15 (1999) Steel Joist Shop Primer

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD 410 (Rev E; 1991) Nondestructive Testing
Personnel Qualification and Certification
(Eddy Current, Liquid Penetrant, Magnetic
Particle, Radiographic and Ultrasonic)

1.2 DESIGN REQUIREMENTS

1.2.1 Allowable Design Stress

Design stress for tension in steel joist chord and web members shall conform to the requirements of the SJI 279167 specifications for steel joists.

1.2.2 Deflection

NOTE: Deflection due to design load must not exceed
1/360 of the span for roofs where a ceiling of any
construction (not only plaster ceilings as specified
in the SJI 279167 specifications), piping, ductwork,
conduit, or equipment is suspended or attached to
the steel joists.

Deflection shall not exceed 1/360 of the clear span under the indicated uniform live load.

1.2.3 Allowable Loads

Total uniform dead and live load, uniform live load, and concentrated dead loads for design purposes shall be as indicated.

1.2.4 Bridging

NOTE: Where open web steel joists are used in floor
construction, cross-bracing-type bridging may be
required.

Bridging for open web steel joists shall be [horizontal] [cross bracing] type as specified in the SJI 279167 specification and as indicated on the approved shop drawings.

Bridging for longspan and deep longspan steel joists shall be cross-bracing type as specified in the SJI 279167 specification and as indicated on the

approved shop drawings.

1.3 SUBMITTALS

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation 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.

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

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

SD-02 Shop Drawings

Fabrication and [Installation Drawings](#) for [Steel Joists](#) shall be in accordance with paragraph entitled, "Fabrication," of this section.

SD-03 Product Data

Manufacturer's catalog data shall include type, voltage and amperage for [Welding Equipment](#).

SD-05 Design Data

[Design Analysis and Calculations](#) shall be submitted in accordance with paragraph entitled, "Fabrication," of this section.

Mix designs shall be submitted for [Portland Cement](#).

[SD-07 Certificates](#)

[Welding Procedures](#) shall be in accordance with [AWS D1.1/D1.1M](#).

[Factory Test Reports](#) for the following shall be in accordance with paragraph entitled, "Manufacturer's Information," of this section.

[Ladle Analysis of Steel](#)
[Tensile Properties and Bend Tests](#)
[Mechanical Tests](#)
[Chemical Composition and Mechanical Usability](#)
[Soundness Tests](#)

Certificates for [Steel Joists](#) shall show conformance to [SJI 279167](#).

[Welders Certificates](#)

[SD-08 Manufacturer's Instructions](#)

Installation instructions shall indicate the manufacturer's recommended method and sequence of installation for the following items:

[Steel Joists](#)
[Epoxy-Resin Grout](#)

1.4 QUALIFICATIONS FOR WELDING WORK

Manufacturer's catalog data for [Welding Equipment](#) shall include type, voltage and amperage.

[Section [41 36 19.00 40](#) WELDING, STRUCTURAL applies to work specified in this section.]

[[Welding Procedures](#) shall be in accordance with [AWS D1.1/D1.1M](#).]

[Welder's Certificates](#) shall be submitted to verify welders qualifications.

1.5 DELIVERY, STORAGE, AND HANDLING

Joists stored at the site before erection shall be stored off the ground on platforms or other supports and covered to provide an enclosure, while affording proper air circulation.

Packaged materials shall be stored in their original, unbroken packages in a dry area until ready for installation.

[Epoxy-Resin Grout](#) shall be delivered to the project site in a manner to avoid damage or loss. Storage areas shall be windowless and weatherproof but ventilated, insulated, noncombustible buildings with provisions nearby for conditioning the material at [21 to 30 degrees C](#) [70 to 85 degrees F](#) for a period of 48 hours before use. Ambient temperature in the storage area of the epoxy materials shall at no time be higher than [38 degrees C](#) [100 degrees F](#).

1.6 MANUFACTURER'S INFORMATION

Factory test reports shall be submitted indicating all specification requirements with reference to the contract design.

1.6.1 Ladle Analysis of Steel

NEED Text HERE

1.6.2 Tensile Properties and Bend Tests

Tensile properties and bend test as specified in the particular referenced specification for the material and in **ASTM A 6/A 6M** for rolled steel plates, shapes and bars.

Tensile properties and bend test as specified in the particular referenced specification for the material in **ASTM A 568/A 568M** for rolled steel sheets and strip.

1.6.3 Mechanical Tests

Mechanical tests as specified in the referenced specifications for the material and in **ASTM A 370** for high strength bolts.

1.6.4 Chemical Composition and Mechanical Usability

Chemical composition and mechanical usability as specified in **AWS A5.1/A5.1M** for electrodes for manual shielded arc welding.

1.6.5 Soundness Tests

Soundness tests as specified in **AWS A5.1/A5.1M** for electrodes for manual shielded arc welding.

PART 2 PRODUCTS

2.1 ROLLED STEEL PLATES, SHAPES, AND BARS

Plates, shapes, and bars are defined in **ASTM A 6/A 6M** and shall conform to the following:

[Structural quality carbon steel conforming to **ASTM A 36/A 36M**.]

[High-strength structural steel conforming to **ASTM A 572/A 572M** or **ASTM A 242/A 242M** with properties suitable for welding.]

2.2 STEEL SHEETS AND STRIP

[Sheets and strip shall be carbon steel of structural quality having minimum yield point of **275 Megapascal** **40,000 pounds per square inch (psi)** conforming to **ASTM A 1011/A 1011M**.]

[Sheets and strip shall be high-strength, low-alloy steel having minimum yield point of **345 Megapascal** **50,000 psi** conforming to **ASTM A 606**, Type 2.]

2.3 ELECTRODES FOR MANUAL SHIELDED METAL ARC WELDING

NOTE: Delete paragraph heading and following

paragraphs when field bolted connections only are required.

Electrodes shall meet the requirements of AWS D1.1/D1.1M and shall be covered, mild-steel electrodes conforming to AWS A5.1/A5.1M and as follows:

[Electrodes shall be [E60] [E70] series for connected members, both members having a minimum yield point of 248 Megapascal 36,000 psi.]

Electrodes having low-hydrogen-type coverings shall be dried for at least 2 hours between 232 and 260 degrees C 450 and 500 degrees F before they are used. Electrodes may be stored immediately after drying in storage ovens held at a temperature of at least 120 degrees C 250 degrees F. Electrodes that are not used within 4 hours after removal from a drying oven shall be redried before use. Wet electrodes shall not be used.

2.4 UNFINISHED THREADED FASTENERS

Unfinished bolts and nuts shall be regular hexagon type conforming to ASTM F 568M, Class 4.8 or lower ASTM A 307, Grade A.

Washers shall conform to ANSI B18.22M ANSI B18.22.1, Type B.

2.5 HIGH-STRENGTH THREADED FASTENERS

NOTE: Delete following paragraphs when field connections of steel joists to the structural steel framing members are welded or when high-strength bolted connections are not required, or both. High-strength bolted connections, if used, must be indicated on the drawings.

Fasteners shall consist of heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers.

[High-strength bolts, including nuts and hardened washers, shall conform to ASTM A 325M.ASTM A 325.]

[High-strength bolts shall conform to ASTM A 490M. ASTM A 490. Nuts shall conform to ASTM A 194/A 194M, Grade 2H or ASTM A 563M ASTM A 563, Grade DH. Washers shall conform to ASTM F 436M ASTM F 436.]

2.6 BEDDING MORTAR MATERIALS

[Shrinkage-resistant grout shall be a premixed and packaged ferrous-aggregate-mortar grouting compound conforming to ASTM C 1107, expansive cement type.]

[Portland Cement shall conform to ASTM C 150, Type I.

Aggregate for cement grout shall be clean, sharp, uniformly graded natural sand conforming to ASTM C 404, Size No. 2.]

NOTE: Epoxy-resin grout may be used instead of shrinkage-resistant, grout-type bedding mortar.

[Epoxy-Resin Grout shall conform to applicable chapters of the ACI/MCP 505, Part 3, Products and Processes.]

Mixing water for bedding mortar shall be potable.

2.7 FABRICATION

Design Analysis and Calculations shall be submitted to establish conformance with joist strength requirements of SJI 279167 specifications for Steel Joists. Certificates to verify this compliance shall be submitted by the Contractor.

Installation Drawings for steel joists shall include details and layouts indicating wall, structural framing, and other supports; location, lengths, and marking of steel joists corresponding to sequence and procedure to be followed in placing and fastening, location and type of fasteners, and sequence of welded connections. Welds shall be indicated in accordance with AWS A2.4. Drawings shall also indicate accessories and methods of installation, details of longspan and deep longspan steel joists with sloped top chords, if required.

2.7.1 Open-Web Steel Joists

Open-web steel joists shall be shop fabricated of the specified rolled steel plates, shapes, and bars, or the specified steel sheets and strip, or a combination thereof, in accordance with the SJI 279167 specifications.

2.7.2 Long-Span Steel Joists

Long-span steel joists shall be shop fabricated of the specified rolled steel plates, shapes, and bars or of the specified steel sheets and strip, or of a combination thereof in accordance with the SJI 279167 specifications.

2.7.3 Holes in Chords

NOTE: Size and spacing of holes in chords for securing wood nailers and other work to the steel joists must be indicated.

Holes shall be provided in chords for securing other work to steel joists; the area of a hole shall be deducted from the area of a chord when computing strength of member.

Holes shall not be made or enlarged by burning, nor will the burning of unfair holes in the shop or field be acceptable.

2.7.4 Loose Bearing Plates

Plates shall be provided for steel joists bearing on masonry or concrete construction. Plates shall be flat, free from warps or twists, of the proper thickness and bearing area, and drilled to receive anchor bolts.

2.7.5 Joist Extended Ends

Extended ends shall conform to the manufacturer's standard for steel joists

indicated on the approved shop drawings and descriptive data and shall conform to requirements of the applicable **SJI 279167** specification.

2.7.6 Ceiling Extensions

Ceiling extensions shall be provided for steel joists to support ceilings that are to be attached to the bottom of the joists. Extensions shall be either an extended bottom chord element or a loose unit, whichever is the standard with the steel joist manufacturer. Extensions shall be of sufficient strength to support ceiling construction and shall extend within **13 millimeter 1/2 inch** of wall surface.

2.7.7 Header Members

NOTE: When openings in the floor or roof surfaces require header members exceeding the joist spacing, such openings must be framed with steel supporting members that are provided as a part of the structural steel framing system.

Rolled steel header members shall be provided for support of steel joists at openings where indicated. Headers shall be in accordance with the manufacturer's standard for steel joists indicated on the approved shop drawings and descriptive data.

2.7.8 Shop Painting

Steel joists and accessories shall be given one coat of the specified paint in accordance with **SSPC PS 14.01**.

Paint shall be shop paint primer conforming to **SSPC Paint 15**, Type I, (red oxide).

PART 3 EXECUTION

3.1 GENERAL

Steel joists and accessories shall be installed in accordance with the approved shop drawings and descriptive data, and as specified.

Care shall be exercised in handling and placing joists. Joists shall be fastened in place and bridging installed prior to receiving construction loads. Contractor shall coordinate joist location with access space and fixture-placing requirements of other trades.

Special fittings for openings, overhangs, and ceiling extenders shall be furnished where required and not otherwise detailed or specified.

3.2 WELDING

Welding and weldments shall conform to the applicable requirements of **AWS D1.1/D1.1M**.

3.3 ANCHORS

Anchor bolts and other anchors required for connection of steel joists supported on, attached to, or built into masonry or concrete construction

shall be correctly located. Anchors shall be set by use of templates or other methods required to locate the anchors accurately.

3.4 SETTING LOOSE BEARING PLATES

3.4.1 Cement and Shrink-Resistant Grout

Plates for steel joists supported on masonry or concrete construction shall be fully bedded on wedges or shims and damp-pack bedding mortar. Installation of plates shall be as follows:

Masonry and concrete bearing surfaces shall be clean. Concrete surfaces shall be roughened. Bottom surface of plates shall be clean.

Space between top of bearing surface and bottom of plate shall be approximately 1/24 of the width of plate but not less than 13 millimeter 1/2 inch for plates that are less than 300 millimeter 12-inches wide. Bearing plate shall be supported and aligned on steel wedges or shims.

[Bedding mortar shall be a mix composed of the specified shrinkage-resistant grout and enough water to provide a flowable mixture without segregation or bleeding, with a water/cement ratio of 0.50 to 1.00 by weight.]

[Bedding mortar shall be a mix composed of 1 part portland cement, 2-1/2 parts of aggregate for cement grout, and not more than 17 liter 4-1/2 gallons of water per 43-kilogram 94-pound bag of portland cement.]

Forms shall be provided to retain mortar until it is sufficiently hard to be self-supporting.

After supporting members have been positioned and the anchor bolts tightened, space between top of bearing surface and bottom of bearing plate shall be packed with mortar mix by tamping or ramming with a bar or rod until voids are filled.

Wedges or shims shall not be removed, but, when protruding, shall be cut off flush with the edge of the bearing plate prior to packing with mortar.

Mortar, after receiving its initial set, shall be kept damp for a minimum of 24 hours.

3.4.2 Epoxy-Resin Grout

Epoxy-resin grout components shall be mixed in the proportions recommended by the manufacturer. Components shall be conditioned to 21 to 30 degrees C 70 to 85 degrees F for 48 hours prior to mixing. Two epoxy-resin grout components shall be mixed with a power-driven, explosion-proof stirring device in a metal or polyethylene container having a hemispherical bottom. Polysulfide curing agent component shall be added gradually to the epoxy-resin component with constant stirring until a uniform mixture is obtained. Rate of stirring shall be such that entrained air is minimum.

Protective clothing, gloves, and eye-protective devices shall be provided for workmen engaged in epoxy-resin grout mixing and placing.

Adequate ventilation and fire protection precautions shall be maintained during mixing and placing.

Installation requirements not specified shall be in accordance with the epoxy-resin grout manufacturer's printed installation instructions and as approved.

3.5 PLACING STEEL JOISTS

Supporting members shall be in place before placing of joists is started. Joists shall be placed on the supporting framework and adjusted and aligned accurately, with ends bearing on supporting members, before being permanently fastened. End supports shall be as specified. Placing and aligning joists shall be done to attain the number and spacing indicated on the approved shop drawings.

End support for [short-span] [long-span] steel joists shall be as specified in accordance with the [SJI 279167](#) specifications.

3.6 BRIDGING

NOTE: When fire-resistance-rated construction is required, consult fire-rating agency's design and material requirements for the applicable roof or floor construction.

As soon as steel joists are placed, bridging shall be completely installed. Size of bridging members shall be as indicated on the approved shop drawings.

Bridging shall conform to requirements of the [SJI 279167](#) specification. Each line of bridging shall be securely anchored to walls or supports at the ends of the line and to each joist by welding or bolting.

3.7 FASTENING STEEL JOISTS

NOTE: When fire-resistance-rated construction is required, consult fire-rating agency's design and material requirements for the applicable roof, floor, or ceiling construction.

[Steel joists resting on steel supporting members shall be connected by welding. Welds shall be as specified in the [SJI 279167](#) specification for type of joists used and as indicated on the approved shop drawings. Welding sequence shall be coordinated with placing of joists.]

[Steel joists resting on steel supporting members shall be connected by bolting. Bolting shall be as specified in the [SJI 279167](#) specifications for the type of joist used, as indicated on the approved shop drawings, and as specified. Bolting sequence shall be coordinated with placing of joists. Bolted connections shall be as follows:

[Unfinished threaded fasteners shall be used for bolted connections.]

[Unfinished threaded fasteners shall be used for bolted connections of joists to purlins, bearing plates on supporting walls, wall anchors, and elsewhere except where high-strength bolted connections are

indicated.]

[High-strength threaded fasteners shall be used for bolted connections of joists to steel columns and elsewhere as indicated. High-strength bolted connections shall be installed in accordance with [AISC S329](#).]

NOTE: Delete following paragraph when steel joists supported on masonry or concrete construction are resting on steel bearing plates specified in the paragraph, "Setting Loose Bearing Plates."

[Joists resting on masonry or concrete bearing surfaces shall be bedded in mortar and anchored to masonry or concrete construction as specified in the [SJI 279167](#) specification.]

3.8 TOUCHUP PAINTING

After joist installation, field welds, bolt heads and nuts, and scarred surfaces on joists and steel supporting members shall be touchup painted. Before touchup painting, weld scars, bruises, abrasions, and rust spots shall be wire-brushed and solvent-cleaned. Paint for touchup painting shall be the same as that used for shop painting.

3.9 INSPECTION AND ACCEPTANCE PROVISIONS

3.9.1 Inspection and Tests

Inspection by the Contracting Officer will include proper preparation, size, gaging location, and acceptability of welds; identification marking; operation and current characteristics of welding sets in use; and calibration of wrenches for high-strength bolts.

Repair of damaged joists will be allowed only if approved. Method of repairs shall be in accordance with the manufacturer's recommendation.

3.9.2 Inspection of Welds

NOTE: Location of welds requiring inspection and type of inspection must be indicated on the drawings.

If weld inspection is desired, the liquid penetration method is the most economical and commonly used.

Inspection of welded joints shall be performed in accordance with [AWS D1.1/D1.1M](#), and as follows:

[Liquid penetrant inspection of welds shall conform to [ASTM E 165](#).]

[Magnetic particle inspection of welds shall conform to [ASTM E 709](#).]

[Welding inspectors shall be certified in accordance with [MIL-STD 410](#).]

3.9.3 Inspection of High-Strength Bolt Connections

Inspection of connections shall be performed in accordance with
AISC/AISI 121.

-- End of Section --