AISC 313-21

# Code of Standard Practice for Structural Stainless Steel Buildings

June 3, 2021
Approved by the Committee on Structural Stainless Steel


Smarter.
Stronger.
Steel.

AISC 313-21

# Code of Standard Practice for Structural Stainless Steel Buildings

June 3, 2021
Approved by the Committee on Structural Stainless Steel

Smarter.
Stronger.
Steel.

# PREFACE

(This Preface is not part of *Code of Standard Practice for Structural Stainless Steel Buildings*, AISC 313-21, but is included for informational purposes only.)

As in any industry, trade practices have developed among those that are involved in the design, purchase, fabrication, and erection of structural stainless steel. This Code provides a useful framework for a common understanding of the acceptable standards when contracting for structural stainless steel. As such, it is useful for owners, architects, engineers, general contractors, construction managers, fabricators, steel detailers, erectors, and others associated with construction in structural stainless steel. Unless specific provisions to the contrary are contained in the contract documents, the existing trade practices contained herein are considered to be the standard custom and usage of the industry and are thereby incorporated into the relationships between the parties to a contract.

There are significant differences in design requirements between carbon steel or alloy steel and stainless steel when used as structural components in buildings. In addition, there are a number of finishing, material protection, and erection requirements that are unique to stainless steel. *The Specification for Structural Steel Buildings*, ANSI/AISC 360-16, and *Code of Standard Practice for Steel Buildings and Bridges*, ANSI/AISC 303-16, establish the design requirements for buildings and building-like structures in other steel alloys. The *Specification for Structural Stainless Steel Buildings*, ANSI/AISC 370-21, and this Code set complementary commercial and technical requirements for structural stainless steel. The first edition of AISC Design Guide 27, *Structural Stainless Steel*, provided some guidance on the design and fabrication of structural stainless steel buildings; that design guide is being updated and the 2nd Edition will serve as a companion to AISC 313-21 and ANSI/AISC 370-21.

The Symbols and Glossary are an integral part of this Code. In many sections of this Code, a nonmandatory Commentary has been prepared to provide background and further explanation for the corresponding Code provisions. The user is encouraged to consult it.

This Code is written—and intended to be utilized in practice—as a unified document. Contract documents may supersede individual provisions of the Code as provided in Section 1.1, except when doing so would violate a requirement of the applicable building code.

This code has been developed to recognize the differences between structural stainless steel and structural steel. The language throughout the entire Code has been generalized to address contracts that utilize drawings, models, or drawings and models in combination.

This Specification was approved by the AISC Committee on Structural Stainless Steel:

Mark V. Holland, Chair
Benjamin W. Schafer, Vice Chair
Benjamin Baer
Richard Beldyk
Hannah B. Blum
Ted Bush
Martin Denault
Daniel Fitzwilliam
Richard C. Garvin
John Grubb
Catherine Houska
Kristofer Lark
Nate Lindell
Patrick S. McCafferty
Michael Mulhern
Patrick Olechno
Andrew Personett
Jason T. Provines
Mark Remsen
Cynthia J. Duncan, Secretary

The Committee gratefully acknowledges the following task group members and staff for their contribution to this document.

Michael Mulhern, Chair
Benjamin Baer
Richard Beldyk
Mark V. Holland
Catherine Houska
Lawrence F. Kruth
Kristofer Lark
Eric Bolin, Secretary

The Committee also gratefully acknowledges AISC Board Oversight, Matt Smith; the advisory members, Javier Avila Mendoza, Nancy Baddoo, Leroy Gardner, and Ben Young; as well as Francisco Meza, for their contributions and involvement in the development of this document.

# TABLE OF CONTENTS

# GLOSSARY

The following abbreviations and terms are used in this Code. Where used, terms are italicized to alert the user that the term is defined in this Glossary.

*Adjustable items.* See Section 7.13.1.3.

*AESSS.* See *architecturally exposed structural stainless steel.*

*AISC.* American Institute of Steel Construction.

*Allowance.* A monetary amount included in a contract as a placeholder for work that is anticipated but not defined at the time the contract is executed.

*Alloy steel.* A steel, other than a *stainless steel*, that conforms to the specification for *alloy steel* given in ASTM A941.

*Anchor rod.* A mechanical device that is either cast or drilled and chemically adhered, grouted, or wedged into concrete and/or masonry for the purpose of the subsequent attachment of *structural stainless steel*.

*Approval documents.* The *structural stainless steel shop drawings, erection drawings, embedment drawings*, and the *fabrication* and *erection models*. A combination of drawings and digital models also may be provided.

*Architect.* The entity that is professionally qualified and duly licensed to perform architectural services.

*Architecturally exposed structural stainless steel.* See Section 10.

*ASME.* American Society of Mechanical Engineers.

*ASTM.* ASTM International; formerly the American Society for Testing and Materials.

*AWS.* American Welding Society.

*Bearing devices.* Shop plates, loose base and bearing plates, and leveling devices, such as leveling plates, leveling nuts and washers, and leveling screws.

*Bimetallic interface.* Any location where *structural stainless steel* has a direct electrical contact to a dissimilar metal.

*Built-up member.* Member fabricated from *structural stainless steel* components, which may include rolled or extruded sections, *built-up sections*, and/or plates, using intermittent welds or fasteners.

*Built-up section (or shape).* Section fabricated from *structural stainless steel* elements welded together with a continuous weld along the entire length of the member.

*Carbon steel.* A steel, other than *stainless steel*, that conforms to the specification of *carbon steel* given in ASTM A941.

*CASE.* Council of American Structural Engineers.

*Clarification.* An interpretation of the *design documents* or *specifications* that have been *released for construction*, made in response to an *RFI* or a note on an approval document. A *clarification* provides an explanation that neither revises the information that has been *released for construction* nor alters the cost or schedule of performance of the work.

*The Code, This Code.* This document, the AISC *Code of Standard Practice for Structural Stainless Steel Buildings*, as adopted by the American Institute of Steel Construction.

*Column line.* The grid line of column centers set in the field based on the dimensions shown on the structural *design documents* and using the building layout provided by the *owner's designated representative for construction*. Column offsets are taken from the *column line*. The *column line* may be straight or curved as shown in the structural *design documents*.

*Connection.* An assembly of one or more joints that is used to transmit forces between two or more members and/or *connection* elements.

*Contract documents.* The documents that define the responsibilities of the parties that are involved in bidding, fabricating, and erecting *structural stainless steel*. These documents normally include the *design documents*, the *specifications*, and the contract.

*Design documents.* The *design drawings* or the *design model*. A combination of drawings and digital models also may be provided.

*Design drawings.* The graphic and pictorial portions of the *contract documents* showing the design, location, and dimensions of the work. These documents generally include, but are not necessarily limited to, *plans*, elevations, sections, details, schedules, diagrams, and notes.

*Design model.* A 3D digital model of the structure that conveys the *structural stainless steel* requirements given in Section 3.1 for the building.

*Detailer.* See *steel detailer*.

*Embedment drawings.* Drawings that show the location and placement of items that are installed to receive *structural stainless steel*.

*EOR, engineer, engineer of record.* See *structural engineer of record*.

*Erection bracing drawings.* Drawings that are prepared by the *erector* to illustrate the sequence of erection, any requirements for temporary supports, and the requirements for raising, bolting, and/or welding. These drawings are in addition to the *erection drawings*.

*Erection documents.* The *erection drawings* or the *erection model*. A combination of drawings and digital models also may be provided.

*Erection drawings.* Field-installation or member-placement drawings that are prepared by the *fabricator* to show the location and attachment of the individual *structural stainless steel* shipping pieces.

*Erection model.* A 3D digital model produced to convey the information necessary to erect the *structural stainless steel*. This may be the same digital model as the *fabrication model*, but it is not required to be.

*Erector.* The entity that is responsible for the erection of the *structural stainless steel*.

*Established column line.* The actual field line that is most representative of the erected column centers along a line of columns placed using the dimensions shown in the structural *design drawings* or *design model* and the lines and benchmarks established by the *owner's designated representative for construction*, to be used in applying the erection tolerances given in this Code for column shipping pieces.

*Fabrication documents.* The *shop drawings* or the *fabrication model*. A combination of drawings and digital models also may be provided.

*Fabrication model.* A 3D digital model produced to convey the information necessary to fabricate the *structural stainless steel*. This may be the same digital model as the *erection model*, but it is not required to be.

*Fabricator.* The entity that is responsible for detailing (except in Section 4.5) and fabricating the *structural stainless steel*.

*Free iron.* Oxidizable deposit from contact with iron, *other steel alloys*, or substances containing the element iron.

*Hazardous materials.* Components, compounds, or devices that are either encountered during the performance of the contract work or incorporated into it containing substances that, notwithstanding the application of reasonable care, present a threat of harm to persons and/or the environment.

*Inspector.* The *owner's* testing and inspection agency.

*Levels of development (LOD).* The levels of completeness of the digital model(s) or digital model elements.

*MBMA.* Metal Building Manufacturers Association.

*Mill material.* Steel mill products that are ordered expressly for the requirements of a specific project.

*Other steel alloys.* Any steel alloy other than those listed in ANSI/AISC 370, Section A3.1b, including *carbon steel* and *alloy steel*.

*Owner.* The entity that is identified as such in the *contract documents*.

*Owner's designated representative for construction.* The *owner* or the entity that is responsible to the *owner* for the overall construction of the project, including its planning, quality, and completion. This is usually the general contractor, the construction manager, or similar authority at the job site.

*Owner's designated representative for design.* The *owner* or the entity that is responsible to the *owner* for the overall structural design of the project, including the *structural stainless steel* frame. This is usually the *structural engineer of record*.

*Plans.* See *design drawings*.

*Released for construction.* The term that describes the status of *contract documents* that are in such a condition that the *fabricator* and the *erector* can rely upon them for the performance of their work, including the ordering of material and the preparation of *shop* and *erection drawings* or *fabrication* and *erection models*.

*Revision.* An instruction or directive providing information that differs from information that has been *released for construction*. A *revision* may, but does not always, impact the cost or schedule of performance of the work.

*RFI.* A written request for information or *clarification* generated during the construction phase of the project.

*Shop drawings.* Drawings of the individual *structural stainless steel* shipping pieces that are to be produced in the fabrication shop.

*SJI.* Steel Joist Institute.

*Specifications.* The portion of the *contract documents* that consists of the written requirements for materials, standards, and workmanship.

*SSPC.* The Society for Protective Coatings, which was formerly known as the Steel Structures Painting Council.

*Stainless steel.* A steel that conforms to a specification that requires, by mass percent, a minimum chromium content of 10.5% or more, and a maximum carbon content of less than 1.20%.

*Steel detailer.* The entity that produces the *approval documents*.

*Strength grade. Stainless steel* designation for a specific set of minimal mechanical property requirements for one or more alloys.

*Structural engineer of record.* The licensed professional who is responsible for sealing the *contract documents*, which indicates that he or she has performed or supervised the analysis, design, and document preparation for the structure and has knowledge of the load-carrying structural system.

*Structural stainless steel.* The elements of the *stainless steel* structural frame as given in Section 2.1.

*Structural steel.* Elements of the structural frame produced from *other steel alloys*.

*Substantiating connection information.* Information submitted by the *fabricator*, if requested by the *owner's designated representative for design* in the *contract documents*, when Option 2 or Option 3 is designated for *connections* per Section 3.1.1.

*Tier.* The *structural stainless steel* framing defined by a column shipping piece.

*UNS (unified numbering system) number.* Identification system for specific metals and alloys adopted by ASTM and in compliance with SAE J1086.

*Weld show-through.* In *architecturally exposed structural stainless steel*, visual indication of the presence of a weld or welds on the side of the member opposite the weld.

# CODE OF STANDARD PRACTICE FOR STRUCTURAL STAINLESS STEEL BUILDINGS

## SECTION 1. GENERAL PROVISIONS

### 1.1. Scope

This Code sets forth criteria for the trade practices involved in *structural stainless steel* buildings and other structures, where other structures are defined as those structures designed, fabricated, and erected in a manner similar to buildings, with building-like vertical and lateral force-resisting elements. In the absence of specific instructions to the contrary in the *contract documents*, the trade practices that are defined in this Code shall govern the fabrication and erection of *structural stainless steel* and any *bimetallic interfaces* that may be integral to the *structural stainless steel*.

There are five *stainless steel* alloy families. Alloys from three of those families are included in this Code. All structural shapes manufactured from the austenitic and duplex *stainless steel* alloy families are included in this Code. The precipitation hardening *stainless steel* alloy family applications are limited to tension members, fittings, and fasteners.

**Commentary:**
The practices defined in this Code are the commonly accepted standards of custom and usage for *structural stainless steel* fabrication and erection, which generally represent the most efficient approach.

This Code is not intended to define a professional standard of care for the *owner's designated representative for design*; change the duties and responsibilities of the *owner*, contractor, *architect,* or *structural engineer of record* from those set forth in the *contract documents*; nor assign to the *owner*, *architect,* or *structural engineer of record* any duty or authority to undertake responsibility inconsistent with the provisions of the *contract documents*.

This Code is not applicable to steel joists or metal building systems, which are addressed by *SJI* and *MBMA*, respectively.

### 1.2. Dates of Referenced Specifications, Codes, and Standards

The following dated versions of documents are referenced in this Code:

ANSI/AISC 370-21 *Specification for Structural Stainless Steel Buildings*
ASME B46.1-2019 *Surface Texture (Surface Roughness, Waviness, and Lay)*
ASTM A380/A380M-17 *Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems*
ASTM A484/A484M-19 *Standard Specification for General Requirements for Stainless Steel Bars, Billets, and Forgings*
ASTM A941-18 *Standard Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys*

ASTM A967/A967M-17 *Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts*
ASTM A1069/A1069M-19 *Standard Specification for Laser and Laser Hybrid Welded Stainless Steel Bars, Plates, and Shapes*
AWS D1.6/D1.6M:2017 *Structural Welding Code—Stainless Steel*
SAE J1086-12 *Practice for Numbering Metals and Alloys (UNS)*
SEI/ASCE 8-21 *Specification for the Design of Cold-Formed Stainless Steel Structural Members*
SSPC SP1 *Surface Preparation Specification No. 1, Solvent Cleaning*, 2015
SSPC SP2 *Surface Preparation Specification No. 2, Hand Tool Cleanin*g, 2004
SSPC SP6 *Surface Preparation Specification No. 6, Commercial Blast Cleaning*, 2007

**Commentary:**
Additionally, the following dated versions of documents are referenced in the Commentary on this Code:
AIA Document E202-2008 *Building Information Modeling Protocol Exhibit*
AIA Document E203-2013 *Building Information Modeling and Digital Data Exhibit*
AIA Document G201-2013 *Project Digital Data Protocol Form*
AIA Document G202-2013 *Project Building Information Modeling Protocol Form*
BIMFORUM-2019 *Level of Development Specification*
CASE Document 962-2012 *National Practice Guidelines for the Structural Engineer of Record*
Consensus Docs 301-2013 *BIM Addendum*

## 1.3. Units

In this Code, the values stated in either U.S. customary units or S.I. units shall be used. Each system shall be used independently of the other.

**Commentary:**
In this Code, dimensions, weights, and other measures are given in U.S. customary units with rounded or rationalized S.I.-unit equivalents in parentheses. Because the values stated in each system are rounded equivalents, the selective combination of values from each of the two systems is not permitted.

## 1.4 Responsibility for Identifying Contract Documents

The *owner's designated representative for construction* shall identify all *contract documents*. When the *design drawings* and a *design model* are both provided, the *owner's designated representative for design* shall specify which document is the controlling *contract document*. The *contract documents* shall establish the procedures for communicating changes to the *contract documents*, permitted use of design and other digital models, and restrictions on the release of these digital models to other parties.

**Commentary:**
There can be many combinations of drawings and digital models used as part of the *contract documents* and to transfer information between the many entities in the design and construction processes. The communication of design information to the *fabricator* through the *design model* is permitted in this Code. This Code does not designate which of these possible documents takes precedence because of the variation in current practice. The document hierarchy is left to the *owner's designated representative for design* and communicated through the *owner's designated representative for construction*. The *owner's designated representative for construction* must provide guidance as to which information is to be considered to have precedence if conflicts exist.

## 1.5. Design Criteria

For *structural stainless steel* buildings and other *structural stainless steel* structures, in the absence of other design criteria, the provisions in ANSI/AISC 370 shall govern the design of the *structural stainless steel*.

## 1.6. Responsibility for Design

1.6.1. When the *owner's designated representative for design* provides the design, *design documents*, and *specifications*, the *fabricator* and the *erector* are not responsible for the suitability, adequacy, or building-code conformance of the design.

1.6.2. When the *owner* enters into a direct contract with the *fabricator* to both design and fabricate an entire, completed *structural stainless steel* structure, the *fabricator* shall be responsible for the suitability, adequacy, conformance with *owner*-established performance criteria, and building-code conformance of the *structural stainless steel* design. The *owner* shall be responsible for the suitability, adequacy, and building-code conformance of the non-*structural stainless steel* elements and shall establish the performance criteria for the *structural stainless steel* frame.

## 1.7. Patents and Copyrights

The entity or entities that are responsible for the specification and/or selection of proprietary structural designs shall secure all intellectual property rights necessary for the use of those designs.

## 1.8. Existing Structures

1.8.1. Demolition and shoring of any part of an existing structure are not within the scope of work that is provided by either the *fabricator* or the *erector*. Such demolition and shoring shall be performed in a timely manner so as not to interfere with or delay the work of the *fabricator* or the *erector*.

1.8.2. Protection of an existing structure and its contents and equipment, so as to prevent damage from normal erection processes, is not within the scope of work that is provided by either the *fabricator* or the *erector*. Such protection shall be performed in a timely manner so as not to interfere with or delay the work of the *fabricator* or the *erector*.

1.8.3. Surveying or field dimensioning of an existing structure is not within the scope of work that is provided by either the *fabricator* or the *erector*. Such surveying or field dimensioning, which is necessary for the completion of the *approval documents* and fabrication, shall be performed and furnished to the *fabricator* in a timely manner so as not to interfere with or delay the work of the *fabricator* or the *erector*.

1.8.4. Abatement or removal of *hazardous materials* is not within the scope of work that is provided by either the *fabricator* or the *erector*. Such abatement or removal shall be performed in a timely manner so as not to interfere with or delay the work of the *fabricator* or the *erector*.

## 1.9. Means, Methods, and Safety of Erection

1.9.1. The *erector* shall be responsible for the means, methods, and safety of erection of the *structural stainless steel* frame.

1.9.2. The *structural engineer of record* shall be responsible for the structural adequacy of the design of the structure in the completed project. The *structural engineer of record* shall not be responsible for the means, methods, and safety of erection of the *structural stainless steel* frame. See also Section 7.10.

## 1.10. Tolerances

Tolerances for materials, fabrication, and erection shall be as stipulated in Sections 5, 6, 7, and 10. Tolerances absent from this Code or the *contract documents* shall not be considered zero by default.

**Commentary:**
Tolerances are not necessarily specified in this Code for every possible variation that could be encountered. For most projects, where a tolerance is not specified or covered in this Code, it is not needed to ensure that the fabricated and erected *structural stainless steel* complies with the requirements in Sections 6 and 7. If a special design concept or system component requires a tolerance that is not specified in this Code, the necessary tolerance should be specified in the *contract documents*. If a tolerance is not shown and is deemed by the *fabricator* and/or *erector* to be important to the successful fabrication and erection of the *structural stainless steel*, it should be requested from the *owner's designated representative for design*. The absence of a tolerance in this Code for a particular condition does not mean that the tolerance is zero; rather, it means that no tolerance has been established.

## SECTION 2. CLASSIFICATION OF MATERIALS

### 2.1. Definition of Structural Stainless Steel

*Structural stainless steel* shall consist of the elements of the structural frame, fabricated from *stainless steel*, that are shown and sized in the structural *design documents*, essential to support the design loads, and described as:

*Anchor rods* that will receive *structural stainless steel*
Base plates, if part of the *structural stainless steel* frame
Beams, including those from *built-up members*
Bearing plates, if part of the *structural stainless steel* frame
Bearings of steel for girders or trusses
Bracing, if permanent
Canopy framing
Columns, including those from *built-up members*
*Connection* materials for framing *structural stainless steel* to *structural stainless steel*
Crane stops
Door frames, if part of the *structural stainless steel* frame
Edge angles and plates, if attached to the *structural stainless steel* frame or steel (open-web) joists
Embedded *structural stainless steel* parts, other than bearing plates, that will receive *structural stainless steel*
Expansion joints, if attached to the *structural stainless steel* frame
Fasteners for connecting *structural stainless steel* items: permanent shop bolts, nuts, and washers; shop bolts, nuts, and washers for shipment; field bolts, nuts, and washers for permanent *connections*; and permanent pins
Floor-opening frames, if attached to the *structural stainless steel* frame or steel (open-web) joists
Floor plates (checkered or plain), if attached to the *structural stainless steel* frame
Girders, including those from *built-up members*
Girts
Grillage beams and girders
Hangers, if framing *structural stainless steel* to *structural stainless steel* or to *structural steel*
Leveling nuts and washers
Leveling plates
Leveling screws
Lintels, if attached to the *structural stainless steel* frame
Marquee framing
Machinery supports, if attached to the *structural stainless steel* or *structural steel* frame
Monorail elements, if attached to the *structural stainless steel* or *structural steel* frame
Posts, if part of the *structural stainless steel* or *structural steel* frame

Purlins
Relieving angles, if attached to the *structural stainless steel* or *structural steel* frame
Roof-opening frames, if attached to the *structural stainless steel* frame or open-web joists
Roof-screen support frames
Sag rods, if part of the *structural stainless steel* frame and connecting *structural stainless steel* to *structural stainless steel* or *structural steel*
Shear stud connectors, if specified to be shop attached
Shims, if permanent
Struts, if permanent and part of the *structural stainless steel* or *structural steel* frame
Tie rods, if part of the *structural stainless steel* or *structural steel* frame
Trusses
Wall-opening frames, if attached to the *structural stainless steel* or *structural steel* frame
Wedges, if permanent

**Commentary:**
The *fabricator* normally fabricates the items listed in Section 2.1. Such items must be shown, sized, and described in the structural *design documents*. Bracing includes vertical bracing for resistance to wind load and structural stability, horizontal bracing for floor and roof systems, and permanent stability bracing for components of the *structural stainless steel* frame.

## 2.2. Other Steel, Iron, or Metal Items

*Structural stainless steel* shall not include items that are not generally described in Section 2.1, even where such items are shown in the structural *design documents* or are attached to the *structural stainless steel* frame. Items include but are not limited to:

Any elements covered by SEI/ASCE 8
Base plates, if not part of the *structural stainless steel* frame
Bearing plates, if not part of the *structural stainless steel* frame
Bearings, if non-steel
Cables for permanent bracing or suspension systems
Castings
Catwalks
Chutes
Cold-formed steel products
Cold-rolled steel products, except those that are specifically covered in ANSI/AISC 370
Corner guards
Crane rails, splices, bolts, and clamps
Door guards

Embedded steel parts, other than bearing plates, that do not receive *structural stainless steel* or that are embedded in precast concrete
Expansion joints, if not attached to the *structural stainless steel* frame
Flagpole support steel
Floor plates (checkered or plain), if not attached to the *structural stainless steel* frame
Forgings
Gage-metal products
Grating
Handrail and guards
Hangers, if not framing *structural stainless steel* to *structural stainless steel* or *structural steel*
Hoppers
Items that are required for the assembly or erection of materials that are furnished by trades other than the *fabricator* or *erector*
Ladders
Lintels, if not attached to the *structural stainless steel* or *structural steel* frame
Masonry anchors
Ornamental metal framing
Other miscellaneous metal not already listed
Pressure vessels
Reinforcing steel for concrete or masonry
Relieving angles, if not attached to the *structural stainless steel* or *structural steel* frame
Safety cages
Shear stud connectors, if specified to be field installed
Stacks
Stairs
Steel deck
Steel (open-web) joists
Steel joist girders
Tanks
Toe plates
Trench or pit covers

**Commentary:**
Section 2.2 includes many items that may be furnished by the *fabricator* if contracted to do so by specific notation and detail in the *contract documents*. When such items are contracted to be provided by the *fabricator*, coordination will normally be required between the *fabricator* and other material suppliers and trades. The provisions in this Code are not intended to apply to items in Section 2.2.

# SECTION 3. DESIGN DOCUMENTS AND SPECIFICATIONS

## 3.1. Structural Design Documents and Specifications

Unless otherwise indicated in the *contract documents*, the structural *design documents* shall be based upon consideration of both the corrosion resistance and the design loads and forces to be resisted by the *structural stainless steel* frame in the completed project.

The structural *design documents* shall clearly show or note the work that is to be performed and shall give the following information with sufficient dimensions to accurately convey the quantity and complexity of the *structural stainless steel* to be fabricated:

(a) The size, section, and location of all members. Unless the structural product used to make a member is known to exist in *stainless steel*, the cross section of the structural member shall be clearly defined, including by its overall dimensions and by the plate thicknesses of its constituent components.

> **Commentary:**
> Many of the steel structural shapes or structural products found in ASTM A6/A6M and the AISC *Steel Construction Manual* are not commonly available as rolled or extruded shapes in *stainless steel*. Many *structural stainless steel* shapes can be produced in accordance with ASTM A1069/A1069M. *Built-up sections,* whether laser welded per ASTM A1069/A1069M or fabricated as otherwise allowed in ANSI/AISC 370, Table A3.1, should be completely specified in the *contract documents*.

(b) The required *stainless steel* alloy, designated by *UNS number*, *strength grade*, if applicable, and surface finish requirements of the *structural stainless steel* shall be incorporated in the *contract documents*.
(c) Any paint, coatings, gaskets, bushings, or other means necessary to mitigate galvanic corrosion at all *bimetallic interfaces* on the *structural stainless steel*.
(d) All geometry and working points necessary for layout.
(e) Floor elevations.
(f) Column centers and offsets.
(g) The camber requirements for members.
(h) Preset elevation requirements, if any, at free ends of cantilevered members relative to their fixed-end elevations.
(i) Joining requirements between elements of *built-up sections* and between elements of *built-up members*.
(j) The information required in Sections 3.1.1 through 3.1.6.
(k) The alloy's *UNS number* or ASTM standard designation and *strength grade* of all fasteners used to join *structural stainless steel* elements to themselves and to join *structural stainless steel* elements to members manufactured from *other steel alloys*.

The *structural stainless steel specifications* shall include any special requirements for the fabrication and erection of the *structural stainless steel*.

The *structural stainless steel specifications* shall indicate that the fasteners must be at least as corrosion resistant as the most corrosion resistant of the materials joined to prevent galvanic corrosion failures. Galvanized steel fasteners are not permitted.

The structural *design documents*, *specifications*, and addenda shall be numbered and dated for the purposes of identification. 3D digital models shall contain a unique identifier.

**Commentary:**

*Contract documents* vary greatly in complexity and completeness. Nonetheless, the *fabricator* and the *erector* must be able to rely upon the accuracy and completeness of the *contract documents*. This allows the *fabricator* and the *erector* to provide the *owner* with bids that are adequate and complete. It also enables the preparation of the *approval documents*, the ordering of materials, and the timely fabrication and erection of shipping pieces.

In some cases, the *owner* can benefit when reasonable latitude is allowed in the *contract documents* for alternatives that can reduce cost without compromising quality. However, critical requirements that are necessary to protect the *owner's* interest, that affect the integrity of the structure, or that are necessary for the *fabricator* and the *erector* to proceed with their work must be included in the *contract documents*. Some examples of critical requirements may include, when applicable:

Standard *specifications* and codes that govern *structural stainless steel* design and construction, including bolting and welding.
Material *specifications*, including fasteners. (See both ANSI/AISC 370 and AISC Design Guide 27 for discussion of the special care required when specifying fasteners for s*tructural stainless steel* elements.)
Special material requirements to be reported on the material test reports.
Welded-joint configuration.
Weld procedure qualification.
Special requirements for work of other trades.
Final disposition of backing and runoff tabs.
Lateral bracing.
Stability bracing.
*Connections* or data for *connection* selection and/or completion.
Restrictions on *connection* types.
Column stiffeners (also known as continuity plates).
Column web doubler plates.
Bearing stiffeners on beams and girders.
Web reinforcement.
Openings for other trades.
Surface preparation and shop painting requirements.
Shop and field inspection requirements.
Nondestructive testing requirements, including acceptance criteria.
Special requirements on delivery.
Special erection limitations.

Identification of non-*structural stainless steel* elements that interact with the *structural stainless steel* frame to provide for the lateral stability of the *structural stainless steel* frame (see Section 3.1.4).
Column differential shortening information (see Commentary to Section 7.13).
Anticipated deflections and the associated loading conditions for major structural elements, such as transfer girders and trusses, supporting columns, and hangers.
Special fabrication and erection tolerances for *AESSS*.
Special pay-weight provisions.

It may be necessary to specify a relative elevation to which the free end of a cantilever must be erected (preset) prior to load application, with the fixed end stabilized before the member is released from the crane or temporary support and any other load is applied to it. This is needed so that the cantilevered member can be detailed and fabricated to allow for any required preset. This does not apply to a beam that is continuous over a support, which is controlled by camber, not preset.

When *stainless steel* is in direct electrical contact with a dissimilar metal (typically *other steel alloys* or aluminum) and there is an electrolyte present, there is the possibility of galvanic corrosion. Any processes or elements necessary to mitigate the chances of this corrosion must be part of the *design documents* and/or *specifications*. It is outside of the fabricator's, or the erector's, scope to understand the project environment or the risk of galvanic corrosion and the means to minimize said risk.

3.1.1. The *owner's designated representative for design* shall indicate one of the following options for each *connection*:

(1) Option 1: the complete *connection* design shall be shown in the structural *design documents*.
(2) Option 2: in the structural *design documents* or *specifications*, the *connection* shall be designated to be selected or completed by an experienced *steel detailer*.
(3) Option 3: in the structural *design documents* or *specifications*, the *connection* shall be designated to be designed by a licensed engineer working for the *fabricator*.

In all of the above options,

(a) The requirements of Section 3.1.2 shall apply.
(b) The approval process in Section 4.4 shall be followed.

When Option 2 is specified, the experienced *steel detailer* shall utilize information provided in the structural *design documents* in the selection or completion of the *connections*. When such information is not provided in the structural *design documents* other sources such as journal papers, textbooks, or other reference information as approved by *the owner's designated representative for design* shall be used.

When Option 2 or 3 is specified, the *owner's designated representative for design* shall provide the following *connection* design criteria in the structural *design documents* and *specifications*:

(a) Any restrictions on the types of *connections* that are permitted
(b) Data concerning the loads, including shears, moments, axial forces, and transfer forces, that are to be resisted by the individual members and their *connections*, sufficient to allow the selection, completion, or design of the *connection* details while preparing the *approval documents*
(c) Whether the data required in (b) is given at the service-load level or the factored-load level
(d) Whether LRFD or ASD is to be used in the selection, completion, or design of *connection* details
(e) What *substantiating connection information*, if any, is to be provided with the *approval documents* to the *owner's designated representative for design*

When Option 3 is specified:

(a) The *fabricator* shall submit in a timely manner representative samples of the required *substantiating connection information* to *the owner's designated representatives for design* and *construction*. The *owner's designated representative for design* shall confirm in writing in a timely manner that these representative samples are consistent with the requirements in the *contract documents*, or shall advise what modifications are required to bring the representative samples into compliance with the requirements in the *contract documents*. This initial submittal and review is in addition to the requirements in Section 4.4.
(b) The licensed engineer in responsible charge of the *connection* design shall review and confirm in writing as part of the *substantiating connection information*, that the *approval documents* properly incorporate the *connection* designs. However, this review by the licensed engineer in responsible charge of the *connection* design does not replace the approval process of the *approval documents* by the *owner's designated representative for design* in Section 4.4.
(c) The *fabricator* shall provide a means by which the *substantiating connection information* is referenced to the related *connections* on the *approval documents* for the purpose of review.

**Commentary:**
There are three options covered in this Section:

(1) In Option 1, the *owner's designated representative for design* shows the complete design of the *connections* in the structural *design documents*. The following information is included:

   (a) All weld types, sizes, lengths, and strengths
   (b) All bolt alloys, sizes, locations, quantities, and *strength grades*
   (c) All plate and angle sizes, thicknesses, dimensions, alloys, and *strength grades* (where required)
   (d) All work point locations and related information

The intent of this approach is that complete design information necessary for detailing the *connection* is shown in the structural *design documents*. Typical details are shown for each *connection* type, set of geometric parameters, and adjacent framing conditions. The *steel detailer* will then be able to transfer this information to the *approval documents*, applying it to the individual pieces being detailed.

(2) In Option 2, the *owner's designated representative for design* allows an experienced *steel detailer* to select or complete the *connections*. This is commonly done by referring to loads embedded in the digital model, tables, or schematic information in the structural *design documents*, or other reference information approved by the *owner's designated representative for design*, such as journal papers and recognized software output. Tables and schematic information in the structural *design documents* should provide such information as weld types and sizes, plate thicknesses, and quantities of bolts. However, there may be some geometry and dimensional information that the *steel detailer* must develop. The *steel detailer* will then configure the *connections* based upon the design loads and other information given in the structural *design documents* and *specifications*.

The intent of this method is that the *steel detailer* will select the *connection* materials and configuration from the referenced tables or complete the specific *connection* configuration (e.g., dimensions, edge distances, and bolt spacing) based upon the *connection* details that are shown in the structural *design documents*.

The *steel detailer* must be experienced and familiar with AISC requirements for *connection* configurations, the calculation of dimensions, and adaptation of typical *connection* details to similar situations. Notations of loadings in the structural *design documents* are only to facilitate selection of the *connections* from the referenced documents. It is not the intent that this method be used when the practice of engineering is required.

(3) Option 3 reflects a practice in some areas of the U.S. to have a licensed engineer working for or retained by the *fabricator* design the *connections*, and recognizes the information required by the *fabricator* to do this work. The *owner's designated representative for design*, who has the knowledge of the structure as a whole, must review and approve the *approval documents*, and take such action on *substantiating connection information* as the *owner's designated representative for design* deems appropriate. See Section 4.4 for the approval process.

When, under Section 3.1.1, the *owner's designated representative for design* designates that *connections* are to be designed by a licensed engineer employed or retained by the *fabricator*, this work is incidental to, and part of, the overall means and methods of fabricating and constructing the *structural stainless steel* frame. The licensed engineer performing the *connection* design is not providing a peer review of the *contract documents.*

The *owner's designated representative for design* reviews the *approval documents* during the approvals process as specified in Section 4.4 for conformance with the specified criteria and compatibility with the design of the primary structure.

One of these options should be indicated for each *connection* in a project. It is acceptable to group *connection* types and utilize a combination of these options for the various *connection* types involved in a project. Option 3 is not normally specified for *connections* that can be selected or completed as noted in Option 2 without practicing engineering.

If there are any restrictions as to the types of *connections* to be used, it is required that these limitations be set forth in the structural *design documents* and *specifications*. There are a variety of *connections* available for a given situation. Preference for a particular type will vary between *fabricators* and *erectors*. Stating these limitations, if any, in the structural *design documents* and *specifications* will help to avoid repeated changes to the *approval documents* due to the selection of a *connection* that is not acceptable to the *owner's designated representative for design*, thereby avoiding additional cost and/or delay for revising the *approval documents*.

The structural *design documents* must indicate the method of design used as LRFD or ASD. In order to conform to the spirit of ANSI/AISC 370, the *connections* must be selected using the same method and the corresponding references.

*Substantiating connection information*, when required, can take many forms. When Option 2 is designated, the *approval documents* may suffice with no additional *substantiating connection information* required. When Option 3 is designated, the *substantiating connection information* may take the form of hand calculations and/or software output.

When *substantiating connection information* is required, it is recommended that representative samples of that information be agreed upon prior to preparation of the *approval documents*, in order to avoid additional cost and/or delay for the *connection* redesign and/or revising that might otherwise result.

The *owner's designated representative for design* may require that the *substantiating connection information* be signed and sealed for Option 3. The signing and sealing of the cover letter transmitting the *approval documents* and *substantiating connection information* may suffice. This signing and sealing indicates that a licensed engineer performed the work but does not replace the approval process provided in Section 4.4.

A requirement to sign and seal each sheet of the *shop* and *erection drawings* is discouraged as it may serve to confuse the design responsibility between the *owner's designated representative for design* and the licensed engineer's work in performing the *connection* design. Such a requirement may not be possible when submitting *fabrication* and *erection models*.

3.1.2. Permanent bracing, openings in *structural stainless steel* for other trades, and other special details, where required, shall be designed by the *owner's designated representative for design* and shown in sufficient detail in the structural *design documents* issued for bidding so that the quantity, detailing, and fabrication requirements for these items can be readily understood.

At locations away from *connections*, stiffeners, web doubler plates, bearing stiffeners, and other member reinforcement, where required, shall be designed by the *owner's designated representative for design* and shown in sufficient detail in the structural *design documents* issued for bidding so that the quantity, detailing, and fabrication requirements for these items can be readily understood.

At locations of *connections*, the following requirements shall apply to column stiffeners, web doubler plates, beam bearing stiffeners, and all other member reinforcement required to satisfy strength and equilibrium of forces through the *connection*:

(1) When Option 1 or 2 in Section 3.1.1 is specified for a *connection*, these items shall be designed by the *owner's designated representative for design* and shown in the structural *design documents* issued for bidding so that the quantity, detailing, and fabrication requirements for member reinforcement at *connections* can be readily understood.

(2) When Option 3 in Section 3.1.1 is specified for a *connection*, two subsidiary options are available to the *owner's designated representative for design*; either:

(a) Option 3A: member reinforcement at *connections* shall be designed by the *owner's designated representative for design* and shown in the structural *design documents* issued for bidding so that the quantity, detailing, and fabrication requirements for member reinforcement at *connections* can be readily understood, or;

(b) Option 3B: the *owner's designated representative for design* shall provide a bidding quantity of items required for member reinforcement at *connections* with corresponding project-specific details that show the conceptual configuration of reinforcement appropriate for the order of magnitude of forces to be transferred. These quantities and project-specific conceptual configurations will be relied upon for bidding purposes. If no quantities or conceptual configurations are shown, member reinforcement at *connections* will not be included in the bid.

Subsequently, member reinforcement at *connections*, where required, shall be designed in its final configuration by the licensed engineer in responsible charge of the *connection* design.

When the actual quantity and/or details of any of the foregoing items differ from the bidding quantity and/or details, the contract price and schedule shall be adjusted equitably in accordance with Sections 9.4 and 9.5.

Any limitations regarding type and connection of reinforcing shall be clearly provided.

**Commentary:**
Option 3A is most useful when the *owner's designated representative for design* delegates *connection* design work but has selected member sizes to eliminate or minimize the need for member reinforcement at *connections*. Option 3A should not be used if the intent is to delegate the determination and design of member reinforcement at *connections* to the licensed engineer in responsible charge of the *connection* design.

Option 3B is necessary if the intent is to delegate the determination and design of member reinforcement at *connections* to the licensed engineer in responsible charge of the *connection* design. Because these requirements will not be known until *connections* are designed after award of the contract, bids prepared by multiple *fabricators* will not be comparable unless all bidders use the same assumptions in preparing their bids. The approach provided here allows for all bids to be comparable. The *owner's* final cost for the actual member reinforcement requirements at *connections* will be determined through equitable contract price adjustment.

When no quantities and details are shown for column stiffeners, web doubler plates, beam bearing stiffeners, and/or other member reinforcement required to satisfy strength and equilibrium of forces through *connections*, the *fabricator's* bid reflects no *allowance* for these items. Should it subsequently be determined that member reinforcement at *connections* is required, the provisions of Sections 9.4 and 9.5 then apply.

3.1.3. When leveling plates are to be furnished as part of the contract requirements, their locations and required thickness and sizes shall be specified in the *contract documents*.

3.1.4. When the *structural stainless steel* frame, in the completely erected and fully connected state, requires interaction with non-*structural stainless steel* elements (see Section 2) for strength and/or stability, those non-*structural stainless steel* elements shall be identified in the *contract documents* as required in Section 7.10.

**Commentary:**
Examples of non-*structural stainless steel* elements include all elements made from *other steel alloys*, diaphragms made of steel deck, diaphragms made of concrete on steel deck, and masonry and/or concrete shear walls.

3.1.5. When camber is required, the magnitude, direction, and location of camber shall be specified in the structural *design documents*.

**Commentary:**
For cantilevers, the specified camber may be up or down, depending upon the framing and loading.

3.1.6. Specific members, or portions thereof, that are to be painted shall be identified in the *contract documents*. When shop painting is required, the painting requirements shall be specified in the *contract documents*, including the following information:

(a) The identification of specific members or portions thereof to be painted.
(b) The surface preparation that is required for these members.
(c) The paint *specifications* and manufacturer's product identification, including color requirements, if any, that are required for these members.
(d) The minimum dry-film shop-coat thickness that is required for these members.

**Commentary:**
Other than the joining of dissimilar metals, *structural stainless steel* is generally not painted.

At *bimetallic interfaces, structural stainless steel* joined by welding to dissimilar metals should be painted in the region abutting the other steel in order to prevent galvanic corrosion. Unless otherwise specified there should be a minimum of 2 in. (50 mm) of painted *structural stainless steel* adjacent to the steel.

The combination of the formulation of the paint system and surface preparation are key factors in meeting the objective of sufficient durability to meet the requirements of the service environment and its associated operating conditions. In general, the passive film on *stainless steel* hinders good paint adherence. Since the passive film completely reforms within 24 hours, mechanical or chemical removal shortly before primer application or the use of an appropriate etchant primer is critical. Micro-porosity, coating damage, deterioration, or improper surface preparation can create the conditions necessary for highly localized crevice corrosion, which may cause more severe pitting corrosion than that experienced with uncoated surfaces.

## 3.2. Architectural, Electrical, and Mechanical Design Documents and Specifications

All requirements for the quantities, sizes, and locations of *structural stainless steel* shall be shown or noted in the structural *design documents*. The structural *design documents* are permitted to reference the architectural, electrical, and/or mechanical *design documents* as a supplement to the structural *design documents* for the purposes of defining detail configurations and construction information.

When the referenced information is not available at the time of structural design, bidding, detailing, or fabrication, subsequent *revisions* shall be the responsibility of the *owner* and shall be made in accordance with Sections 3.5 and 9.3.

## 3.3. Discrepancies

When discrepancies exist between the *design documents* and *specifications*, the *design documents* shall govern. When discrepancies exist between scale dimensions in the *design documents* and the figures written in them, the figures shall govern. When discrepancies exist between the structural *design documents* and the architectural, electrical, or mechanical *design documents*, or the *design documents* for other trades, the structural *design documents* shall govern. When discrepancies exist between the *design drawings* and the *design model*, the governing document shall be as identified per Section 1.4.

When a discrepancy is discovered in the *contract documents* in the course of the *fabricator's* work, the *fabricator* shall promptly notify the *owner's designated representative for construction* so that the discrepancy can be resolved. Such resolution shall be timely so as not to delay the *fabricator's* work. See Sections 3.5 and 9.3.

It is not the *fabricator's* responsibility to discover discrepancies, including those that are associated with the coordination of the various design disciplines.

## 3.4. Legibility of Design Drawings

*Design drawings* shall be clearly legible and drawn to an identified scale that is appropriate to clearly convey the information.

**Commentary:**
Historically, the most commonly accepted scale for *structural steel* drawings has been ⅛ in. per ft (10 mm per 1 000 mm). There are, however, situations where a smaller or larger scale is appropriate. Ultimately, consideration must be given to the clarity of the drawing.

The scaling of the *design drawings* to determine dimensions is not an accepted practice for detailing the *approval documents*. However, it should be remembered when preparing *design drawings* that scaling may be the only method available when early-submission drawings are used to determine dimensions for estimating and bidding purposes.

## 3.5. Revisions to the Design Documents and Specifications

*Revisions* to the *design documents* and *specifications* shall be made either by issuing new *design documents* and *specifications* or by reissuing the existing *design documents* and *specifications*. In either case, all *revisions*, including *revisions* that are communicated through responses to *RFIs* or the annotation of the *approval documents* (see Section 4.4.2), shall be clearly and individually indicated in the *contract documents*. The *contract documents* shall be dated and identified by *revision* number. When the *design documents* are communicated using *design drawings*, each *design drawing* shall be identified by the same drawing number throughout the duration of the project, regardless of the *revision*. See also Section 9.3.

When *revisions* are communicated using *design models*, *revisions* shall be made evident in the revised *design model* submitted by identifying within the *design model* which items are changed. Alternatively, the changes shall be submitted with a written document describing in explicit detail the items that are changed. A historic tracking of changes must either be present in the revised *design model* or maintained in the written record of changes.

The party or entity that is contractually assigned responsibility for managing the *design model* shall maintain accurate accounting and tracking records of the most current *design model*, as well as previously superseded *design models*, and shall facilitate a tracking mechanism so that all contracted parties are aware of, and have access to, the most current *design model*.

**Commentary:**
*Revisions* to the *design documents* and *specifications* can be made by issuing sketches and supplemental information separate from the *design documents* and *specifications*. These sketches and supplemental information become amendments to the *design documents* and *specifications* and are considered new *contract documents*. All sketches and supplemental information must be uniquely identified with a number and date as the latest instructions until such time as they may be superseded by new information.

When *revisions* are made by revising and reissuing the existing structural *design documents* and/or *specifications*, a unique *revision* number and date must be added to those documents to identify that information as the latest instructions until such time as they may be superseded by new information. When the *design documents* are communicated using *design drawings*, the same unique drawing number must identify each *design drawing* throughout the duration of the project so that revisions can be properly tracked, thus avoiding confusion and miscommunication among the various entities involved in the project.

When *revisions* are communicated through the annotation of the *approval documents* or contractor submissions, such changes must be confirmed in writing by one of the aforementioned methods. This written confirmation is imperative to maintain control of the cost and schedule of a project and to avoid potential errors in fabrication.

When *design models* are used, a similar unique method of identifying each *revision* must be used. This method can vary in various digital modeling software, but the same level of notation of changes must be present in the revised *design model* as would be used on *design drawings*.

## 3.6. Fast-Track Project Delivery

When the fast-track project delivery system is selected, release of the structural *design documents* and *specifications* shall constitute a *release for construction*, regardless of the status of the architectural, electrical, mechanical, and other interfacing designs and *contract documents*. Subsequent *revisions*, if any, shall be the responsibility of the *owner* and shall be made in accordance with Sections 3.5 and 9.3.

**Commentary:**
The fast-track project delivery system generally provides for a condensed schedule for the design and construction of a project. Under this delivery system, the *owner* elects to release for construction the structural *design documents* and *specifications*, which may be partially complete, at a time that may precede the completion of and coordination with architectural, mechanical, electrical, and other design work and *contract documents*. The release of the structural *design documents* and *specifications* may also precede the release of the General Conditions and Division 1 Specifications.

Release of the structural *design documents* and *specifications* to the *fabricator* for ordering of material constitutes a *release for construction*. Accordingly, the *fabricator* and the *erector* may begin their work based upon those partially complete documents. As the architectural, mechanical, electrical, and other design elements of the project are completed, *revisions* may be required in design and/or construction. Thus, when considering the fast-track project delivery system, the *owner* should balance the potential benefits to the project schedule with the project cost contingency that may be required to allow for these subsequent *revisions*.

## 3.7 Intellectual Property

Any copyright or other property or proprietary rights owned by the *owner's designated representative for design* in any content included within the *contract documents*, whether created specifically for an individual project or otherwise made available for use on an individual project, shall remain the exclusive property of the *owner's designated representative for design*.

## SECTION 4. APPROVAL DOCUMENTS

### 4.1. Owner Responsibility

The *owner* shall furnish, in a timely manner and in accordance with the *contract documents*, the complete structural *design documents* and *specifications* that have been *released for construction*. Unless otherwise noted, *design documents* and *specifications* that are provided as part of the contract bid documents shall constitute authorization by the *owner* that the *design documents* and *specifications* are *released for construction*.

**Commentary:**
When the *owner* issues *design documents* and *specifications* that are *released for construction*, the *fabricator* and the *erector* rely on the fact that these are the *owner's* requirements for the project. This release is required by the *fabricator* prior to the ordering of material and the preparation and completion of the *approval documents*.

To ensure the orderly flow of material procurement, detailing, fabrication, and erection activities, on phased construction projects, it is essential that designs are not continuously revised after they have been *released for construction*. In essence, once a portion of a design is *released for construction*, the essential elements of that design should be "frozen" to ensure adherence to the contract price and construction schedule. Alternatively, all parties should reach a common understanding of the effects of future changes, if any, as they affect scheduled deliveries and added costs.

A pre-detailing conference, held after the *structural stainless steel* fabrication contract is awarded, can benefit the project. Typical attendees may include the *owner's designated representative for construction*, the *owner's designated representative for design*, the *fabricator*, the *steel detailer*, and the *erector*. Topics of the meeting should relate to the specifics of the project and might include:

- Contract document review and general project overview, including *clarifications* of scope of work, tolerances, layouts and sequences, and special considerations.
- Detailing and coordination needs, such as bolting, welding, and *connection* considerations, constructability considerations, OSHA requirements, coordination with other trades, and the advanced bill of materials.
- The project communication system, including distribution of contact information for relevant parties to the contract, identification of the primary and alternate contacts in the general contractor's office, and the *RFI* system to be used on the project.
- The submittal schedule, including the method of submitting (electronic or hard copy); for hard copy, how many copies of documents are required; *connection* submittals; and identification of schedule-critical areas of the project, if any.

- If digital models will be used as part of the delivery method for the *design documents*, the parties should determine and convey the *levels of development (LOD)*, the digital model types that will be furnished, the authorized uses of such digital models, the transmission of digital models to prevent the loss or alteration of data, interoperability, and methods of review and approval. The term *levels of development* refers to the level of completeness of elements within the digital model (see the BIMFORUM *Level of Development Specification*). The term "authorized uses" refers to the permitted uses of the digital model(s) and the digital data associated with the digital model(s). Such authorized uses may include the right to (1) store and view the digital model(s) for informational purposes only, (2) rely upon, store, and view the digital model(s) to carry out the work on the project, (3) reproduce and distribute the digital model(s) for informational purposes only, (4) rely upon, reproduce, and distribute the digital model(s) to carry out the work, (5) incorporate additional digital data into the digital model(s) without modifying the data received to carry out the work on the project, (6) modify the digital model(s) as required to carry out the work on the project, (7) produce the digital model(s) in an archival format for the *owner* to use as a reference for as-built construction data and/or for the operation of the project after completion, and/or (8) other authorized uses specified in the *contract documents*.
- Review of quality and inspection requirements, including the approvals process for corrective work.

A record of the meeting should be written and distributed to all parties. Subsequent meetings to discuss progress and issues that arise during construction also can be helpful, particularly when they are held on a regular schedule.

## 4.2. Fabricator Responsibility

4.2.1. Except as provided in Section 4.5, the *fabricator* shall produce the *approval documents* for the fabrication and erection of the *structural stainless steel* and is responsible for the following:

(a) The transfer of information from the *contract documents* into accurate and complete *approval documents*
(b) The development of accurate, detailed dimensional information to provide for the fit-up of parts in the field

**Commentary:**
The *fabricator* is permitted to use the services of independent *steel detailers* to produce *approval documents* and to perform other support services, such as producing advanced bills of material and bolt summaries.

As the *fabricator* develops the detailed dimensional information for production of the *approval documents*, there may be discrepancies, missing information, or conflicts discovered in the *contract documents*. See Section 3.3.

4.2.2. Any copyright or other property or proprietary rights owned by the *fabricator* in any content included within the *approval documents*, whether created specifically for an individual project or otherwise made available for use on an individual project, shall remain the exclusive property of the *fabricator*.

4.2.3. When the *approval documents* are *shop* and *erection drawings*, each *shop* and *erection drawing* shall be identified by the same drawing number throughout the duration of the project and shall be identified by *revision* number and date, with each specific *revision* clearly identified. When the *approval documents* are *fabrication* and *erection models*, each submittal shall be uniquely identified.

When the *fabricator* submits a request to change *connection* details that are described in the *contract documents*, the *fabricator* shall notify *the owner's designated representatives for design* and *construction* in writing in advance of the submission of the *approval documents*. The *owner's designated representative for design* shall review and approve or reject the request in a timely manner.

When requested to do so by the *owner's designated representative for design*, the *fabricator* shall provide to the *owner's designated representatives for design* and *construction* its schedule for the submittal of *approval documents* to facilitate the timely flow of information between all parties.

**Commentary:**
When the *fabricator* intends to make a submission of alternative *connection* details to those shown in the *contract documents*, the *fabricator* must notify the *owner's designated representatives for design* and *construction* in advance. This will allow the parties involved to plan for the increased effort that may be required to review the alternative *connection* details. In addition, the *owner* will be able to evaluate the potential for cost savings and/or schedule improvements against the additional design cost for review of the alternative *connection* details by the *owner's designated representative for design*. This evaluation by the *owner* may result in the rejection of the alternative *connection* details or acceptance of the submission for review based upon cost savings, schedule improvements, and/or job efficiencies.

The *owner's designated representative for design* may request the *fabricator's* schedule for the submittal of the *approval documents*. This process is intended to allow the parties to plan for the staffing demands of the submission schedule. The *contract documents* may address this issue in more detail. In the absence of the requirement to provide this schedule, none need be provided.

When the *fabricator* provides a schedule for the submission of the *approval documents*, it must be recognized that this schedule may be affected by *revisions* and the response time to requests for missing information or the resolution of discrepancies.

## 4.3. Use of Digital Files or Copies of the Design Documents

The *fabricator* shall neither use nor reproduce any part of the *design documents* as part of the *approval documents* without the written permission of the *owner's designated representative for design*. When digital files or copies of the *design documents* are made available for the *fabricator's* use as part of the *approval documents*, the *fabricator* shall accept this information under the following conditions:

(a) All information contained in the digital files or copies of the *design documents* shall be considered instruments of service of the *owner's designated representative for design* and shall not be used for other projects, additions to the project, or the completion of the project by others. Digital files or copies of the *design documents* shall remain the property of the *owner's designated representative for design* and in no case shall the transfer of these copies of the *design documents* be considered a sale or unrestricted license.
(b) CAD files or copies of the *design drawings* shall not be considered to be *contract documents*. In the event of a conflict between the *design drawings* and the CAD files or copies thereof, the *design drawings* shall govern.
(c) When a *design model* is made available for use by the *fabricator*, the *owner's designated representative for construction* shall designate whether the *design model* and/or other documents are to be considered the *contract documents*. See Section 1.4.
(d) Any party or entity that creates a copy of the *design model* does so at their own risk.
(e) The use of copies of the *design documents* shall not in any way obviate the *fabricator's* responsibility for proper checking and coordination of dimensions, details, member sizes, and fit-up, and quantities of materials as required to facilitate the preparation of *approval documents* that are complete and accurate as required in Section 4.2.
(f) If copies of *design drawings* are used by the *fabricator*, the *fabricator* shall remove information that is not required for the fabrication or erection of the *structural stainless steel* from the copies of the *design drawings*.

**Commentary:**
Copies of the *design documents* often are readily available to the *fabricator*. As a result, the *owner's designated representative for design* may have reduced control over the unauthorized use of the *design documents*. There are many copyright and other legal issues to be considered.

The *owner's designated representative for design* may choose to make copies of the *design documents* available to the *fabricator* and may charge a service or licensing fee for this convenience. In doing so, a carefully negotiated agreement should be established to set out the specific responsibilities of both parties in view of the liabilities involved for both parties. For sample contracts, see Consensus Docs 301 *BIM Addendum*, AIA Document E202 *Building Information Modeling Protocol Exhibit*, AIA Document E203 *Building Information*

*Modeling and Digital Data Exhibit*, AIA Document G201 *Project Digital Data Protocol Form*, and AIA Document G202 *Project Building Information Modeling Protocol Form*.

Once the *design model* has been accessed and/or modified by any entity other than the *owner's designated representative for design*, the resulting model is considered a copy of the *design model* and is no longer part of the *contract documents*.

The copies of the *design documents* are provided to the *fabricator* for convenience only. The information therein should be adapted for use only in reference to the placement of *structural stainless steel* members during erection. The *fabricator* should treat this information as if it were fully produced by the *fabricator* and undertake the same level of checking and quality assurance. When amendments or *revisions* are made to the *contract documents*, the *fabricator* must update this reference material.

When copies of the *design drawings* are provided to the *fabricator*, they often contain other information, such as architectural backgrounds or references to other *contract documents*. This additional material should be removed when producing the *approval documents* to avoid the potential for confusion.

Just like the transmission of the *design documents* created by the *owner's designated representative for design* does not convey ownership rights in the *design documents*, the transmission of the *approval documents* created by the *fabricator* does not convey ownership rights in the *approval documents*.

## 4.4. Approval

Except as provided in Section 4.5, the *approval documents* shall be submitted to the *owner's designated representatives for design* and *construction* for review and approval. The *approval documents* shall be returned to the *fabricator* within 14 calendar days.

Final *substantiating connection information*, if any, shall also be submitted with the *approval documents*. The *owner's designated representative for design* is the final authority in the event of a disagreement between parties regarding the design of *connections* to be incorporated into the overall *structural stainless steel* frame. The *fabricator* and licensed engineer in responsible charge of *connection* design are entitled to rely upon the *connection* design criteria provided in accordance with Section 3.1.1. *Revisions* to these criteria shall be addressed in accordance with Sections 9.3 and 9.4.

Approved *approval documents* shall be individually annotated by the *owner's designated representatives for design* and *construction* as either approved or approved subject to corrections noted. When so required, the *fabricator* shall subsequently make the corrections noted and furnish corrected *fabrication* and *erection documents* to the *owner's designated representatives for design* and *construction*.

**Commentary:**
As used in this Code, the 14-day allotment for the return of *approval documents* is intended to represent the *fabricator's* portal-to-portal time. The intent in this Code is that, in the absence of information to the contrary in the *contract documents*, 14 days may be assumed for the purposes of bidding, contracting, and scheduling. When additional time is desired, such as when *substantiating connection information* is part of the submittals, the modified allotment should be specified in the *contract documents*. A submittal schedule is commonly used to facilitate the approval process.

If the *approval documents* are approved subject to corrections noted, the *owner's designated representative for design* may or may not require that it be resubmitted for record purposes following correction. If the *approval documents* are not approved, *revisions* must be incorporated and the documents resubmitted until approval is achieved.

4.4.1. Approval, approval subject to corrections noted, and similar approvals of the *approval documents* shall constitute the following:

(a) Confirmation that the *fabricator* has correctly interpreted the *contract documents* in the preparation of those submittals
(b) Confirmation that the *owner's designated representative for design* has reviewed and approved the *connection* details shown in the *approval documents* and submitted in accordance with Section 3.1.1, if applicable
(c) Release by the *owner's designated representatives for design* and *construction* for the *fabricator* to begin fabrication using the approved submittals

Such approval shall not relieve the *fabricator* of the responsibility for either the accuracy of the detailed dimensions in the *approval documents* or the general fit-up of parts that are to be assembled in the field.

The *fabricator* shall determine the fabrication schedule that is necessary to meet the requirements of the contract.

**Commentary:**
When considering the current language in this Section, the Committee sought language that would parallel the practices of CASE. In CASE Document 962, CASE indicates that when the design of some element of the primary structural system is left to someone other than the *structural engineer of record*, "…such elements, including *connections* designed by others, should be reviewed by the *structural engineer of record*. He [or she] should review such designs and details, accept or reject them, and be responsible for their effects on the primary structural system."

From the inception of *Code of Standard Practice for Steel Buildings and Bridges*, ANSI/AISC 303, AISC, and the industry in general, have recognized that only the *owner's designated representative for design* has all the information necessary to evaluate the total impact of *connection* details on the overall structural design of the project. This authority traditionally has been exercised during the approval process for the *approval documents*. The *owner's*

*designated representative for design* has thus retained responsibility for the adequacy and safety of the entire structure since at least the 1927 edition of ANSI/AISC 303.

The *fabricator*, the *erector*, the *owner*, and the general public rely on the *owner's designated representative for design* to assume this responsibility. When no *revisions* or corrections to the *approval documents* are required, the use of language other than "approved" in the required annotation of the *approval documents* does not alter that relationship.

4.4.2. Unless otherwise noted, any additions, deletions, or *revisions* that are indicated in responses to *RFIs* or on the approved *approval documents* shall constitute authorization by the *owner* that the additions, deletions, or *revisions* are *released for construction*. The *fabricator* and the *erector* shall promptly notify the *owner's designated representative for construction* when any direction or notation in responses to *RFIs* or on the *approval documents* or other information will result in an additional cost and/or a delay. See Sections 3.5 and 9.3.

**Commentary:**
When the *fabricator* notifies the *owner's designated representative for construction* that a direction or notation in response to *RFIs* or on the *approval documents* will result in an additional cost or a delay, it is then normally the responsibility of the *owner's designated representative for construction* to subsequently notify the *owner's designated representative for design*.

## 4.5. Fabrication and/or Erection Documents Not Furnished by the Fabricator

When the *fabrication* and *erection documents* are not prepared by the *fabricator*, but are furnished by others, they shall be delivered to the *fabricator* in a timely manner, or as agreed upon in the *contract documents*. These *fabrication* and *erection documents* shall be prepared, insofar as is practical, in accordance with the shop fabrication and detailing standards of the *fabricator*. The *fabricator* shall not be responsible for the completeness, coordination, or accuracy of *fabrication* and *erection documents* so furnished, nor for the general fit-up of the members that are fabricated from them.

**Commentary:**
This delivery system of *fabrication* and *erection documents* is discouraged. The preparation of the fabrication and *erection documents* is very specific to the needs of the *fabricator* performing the work, and an integral part of the constructability and coordination assurance of the project. If the project team chooses to use this delivery method, the *contract documents* should be very clear as to the managing of this process, including, but not limited to, who and how the following will be handled:

- Standards, format, and contents of the *fabrication* and *erection documents*, or representative documents that will be part of the *contract documents* for the mill order and for fabrication, including field bolts
- Provisions for proper risk management (errors and omissions or product liability, as applicable)
- Normal "pre-detailing" sequencing, OSHA erection aids, and other Sub Part R requirements incorporated
- Schedule updates for documents, and impact to overall project schedule and contract, as these dates are impacted
- *Revision* of *fabrication* and *erection documents* and control of the documents during the process, in order to maintain the integrity of all parts of the *fabrication* and *erection documents*
- Late released items
- Shop question support, including those that arise on night shifts and weekends
- Joist, deck, and other commodity item coordination and support
- Field question support

## 4.6. The RFI Process

When requests for information (*RFIs*) are issued, the process shall include the maintenance of a written record of inquiries and responses related to interpretation and implementation of the *contract documents*, including the *clarifications* and/or *revisions* to the *contract documents* that result, if any. *RFIs* shall not be used for the incremental release for construction of the *design documents*. When *RFIs* involve discrepancies or *revisions*, see Sections 3.3, 3.5, and 4.4.2.

When a *design model* is used as the *design documents*, the changes and/or *clarifications* made in response to *RFIs* shall be incorporated into the *design model*.

**Commentary:**
The *RFI* process is most commonly used during the detailing process, but can also be used to forward inquiries by the *erector* or to inform the *owner's designated representative for design* in the event of a *fabricator* or *erector* error and to develop corrective measures to resolve such errors.

The *RFI* process is intended to provide a written record of inquiries and associated responses but not to replace all verbal communication between the parties on the project. *RFIs* should be prepared and responded to in a timely fashion so as not to delay the work of the *steel detailer*, *fabricator,* and *erector*. Discussion of the *RFI* issues and possible solutions between the *fabricator*, *erector,* and *owner's designated representatives for design* and *construction* often can facilitate timely and practical resolution. Unlike submittals in Section 4.4, *RFI* response time can vary depending on the urgency of the issue, the amount of work required by the *owner's designated representatives for design* and *construction* to develop a complete response, and other circumstances, such as building official approval.

*RFIs* should be prepared in a standardized format, including *RFI* number and date, identity of the author, reference to a specific location(s) in the *design documents* or specification section, the needed response date, a description of a suggested solution (graphic depictions are recommended for more complex issues), and an indication of possible schedule and cost impacts. *RFIs* should be limited to one question each (unless multiple questions are interrelated to the same issue) to facilitate the resolution and minimize response time. Questions and proposed solutions presented in *RFIs* should be clear and complete. *RFI* responses should be equally clear and complete in the depictions of the solutions, and signed and dated by the responding party.

Unless otherwise noted, the *fabricator* and *erector* can assume that a response to an *RFI* constitutes a release for construction. However, if the response will result in an increase in cost or a delay in schedule, Section 4.4.2 requires that the *fabricator* and/or *erector* promptly inform the *owner's designated representatives for design* and *construction*.

## 4.7. Erection Documents

The *erection documents* shall be provided to the *erector* in a timely manner so as to allow the *erector* to properly plan and perform the work.

**Commentary:**
For planning purposes, this may include release of preliminary *erection documents*, if requested by the *erector*.

## SECTION 5. MATERIALS

### 5.1. Mill Materials

Unless otherwise noted in the *contract documents*, the *fabricator* is permitted to order the materials that are necessary for fabrication when the *fabricator* receives *contract documents* that have been *released for construction*.

**Commentary:**
The *fabricator* may purchase materials in stock lengths, exact lengths, or multiples of exact lengths to suit the dimensions shown in the structural *design documents*. Such purchases will normally be job-specific in nature and may not be suitable for use on other projects or returned for full credit if subsequent design changes make these materials unsuitable for their originally intended use. The *fabricator* should be paid for these materials upon delivery from the mill, subject to appropriate additional payment or credit if subsequent unanticipated modification or reorder is required. Purchasing materials to exact lengths is not considered fabrication.

5.1.1. Unless otherwise specified by means of special testing requirements in the *contract documents*, mill testing shall be limited to those tests that are required for the material in the ASTM standards indicated in the *contract documents*. Materials ordered to special material requirements shall be marked by the supplier as specified in the ASTM standard to which the product is ordered prior to delivery to the *fabricator's* shop or other point of use. Such material not so marked by the supplier, shall not be used until:

(a) Its identification is established by means of testing in accordance with the applicable ASTM standards, and
(b) A *fabricator's* identification mark, as described in Section 6.1.2 and 6.1.3, has been applied.

5.1.2. When *mill material* or built-up material does not satisfy the tolerances of the ASTM standards or AWS standards for the product form for camber, profile, flatness, or sweep, the *fabricator* shall be permitted to perform corrective procedures, including the use of controlled heating and/or mechanical straightening, subject to the limitations found in ANSI/AISC 370.

**Commentary:**
Dimensional tolerances for mill or built up *structural stainless steel* are set forth in the ASTM standards for each product. Normal variations in the cross-sectional geometry of *structural stainless steel* shapes must be recognized by the designer, the *fabricator*, the *steel detailer*, and the *erector*. Geometric perfection of the cross section is not necessary for either structural or architectural reasons, if the tolerances are recognized and provided for.

The product or general requirements for each ASTM standard also stipulate tolerances for straightness that are adequate for typical construction. However, these characteristics may be controlled or corrected to closer tolerances during the fabrication process when the added cost is justified by the special requirements for an atypical project.

The *fabricator* should be in close communication with the mill in the case where out of tolerance material is discovered. The remediation methods may vary greatly depending upon the processes used to make the section.

5.1.3. When the surface of the *structural stainless steel* has variations that exceed the tolerances found in the ASTM or AWS standards for the product form and these variations are discovered or occur after the receipt of *mill material* or *built-up material*, the *fabricator* shall, at the *fabricator's* option, be permitted to perform the corrective procedures prescribed in the applicable ASTM standard. Should the applicable ASTM standard not include corrective procedures for mill reconditioning, the *fabricator* may propose remediation procedures to the *owner's designated representative for design* for review and approval.

5.1.4. When special tolerances that are more restrictive than those in the ASTM standards are required for *mill materials*, such special tolerances shall be specified in the *contract documents*. The *fabricator* shall, at the *fabricator's* option, be permitted to order material to ASTM standard tolerances and subsequently perform the corrective procedures described in Sections 5.1.2 and 5.1.3.

## 5.2. Stock Materials

5.2.1. Stock material that does not have mill certifications or material test reports from an independent lab shall not be used.

5.2.2. Stock materials that are purchased under no particular specification or under a specification that is less rigorous than the applicable ASTM standards shall not be used without the approval of the *owner's designated representative for design*.

5.2.3. Mill certifications or material test reports from an independent certified lab shall be accepted as sufficient record of the quality of materials taken from stock by the *fabricator*. The *fabricator* shall review and retain the mill certifications or material test reports that cover such stock materials. However, the *fabricator* need not maintain records that identify individual pieces of stock material against individual material test reports, provided that the *fabricator* purchases stock materials that meet the requirements for material grade and quality in the applicable ASTM standards.

# SECTION 6. SHOP FABRICATION AND DELIVERY

## 6.1. Identification of Material

6.1.1. The *fabricator* shall be able to demonstrate by written procedure and actual practice a method of material identification, visible up to the point of assembling members as follows:

(a) For all material, identification capability shall include shape designation, *stainless steel* alloy, and, where appropriate, *strength grade* and condition or heat treatment. Representative mill certifications and material test reports shall be furnished by the *fabricator* if requested by the *owner's designated representative for design*, either in the *contract documents* or in separate written instructions given to the *fabricator* prior to ordering *mill materials*.

(b) For material ordered in accordance with an ASTM supplementary or other special material requirements in the *contract documents*, identification capability shall include *stainless steel* alloy, and, where appropriate, *strength grade*, condition or heat treatment, and independent laboratory test reports (if required) or mill certification documenting compliance with supplementary requirements with heat number. The corresponding material test reports shall be furnished by the *fabricator* if requested by the *owner's designated representative for design*, either in the *contract documents* or in separate written instructions given to the *fabricator* prior to ordering *mill materials*.

6.1.2. During fabrication, up to the point of assembling members, each piece of material that is ordered to special material requirements shall carry a *fabricator's* identification mark or an original supplier's identification mark. The *fabricator's* identification mark shall be in accordance with the *fabricator's* established material identification system, which shall be on record and available, prior to the start of fabrication, to the *owner's designated representative for construction*, the building code authority, and the *inspector*.

**Commentary:**
In many applications, *fabricator's* identification marks may adversely affect either the appearance or corrosion resistance of the *structural stainless steel* elements. The *fabricator's* identification marks shall be of a size and location that does not cause unacceptable blemishing of the surface after erection.

6.1.3. Members that are made of material that is ordered to special material requirements shall not be given the same assembling or erection mark as members made of other material, even if they are of identical dimensions and detail.

## 6.2. Preparation of Material

6.2.1. Plasma or laser cutting of *structural stainless steel* by hand-guided or mechanically guided means is permitted.

6.2.2. Surfaces of cut edges that are specified as "finished," with no further definition in the *contract documents*, shall have a roughness height value measured in accordance with ASME B46.1 that is less than or equal to 500 μin. (13 μm) $R_a$. The use of any fabricating technique that produces such a finish is permitted.

**Commentary:**
Most cutting processes, including friction sawing and cold sawing, and milling processes meet a surface roughness limitation of 500 μin. (13 μm) $R_a$ per ASME B46.1. Note that a 500 μin. (13 μm) $R_a$ roughness height is very rough and may increase the accumulation of corrosive deposits. There is a direct correlation between rougher surfaces and the increased potential for corrosion of *stainless steel* in an aggressive environment.

## 6.3. Fitting and Fastening

6.3.1. Projecting elements of *connection* materials need not be straightened in the connecting plane, subject to the limitations in ANSI/AISC 370.

6.3.2. Backing and runoff tabs shall be used in accordance with AWS D1.6/D1.6M as required to produce sound welds. The *fabricator* or *erector* need not remove backing or runoff tabs unless such removal is specified in the *contract documents*. When the removal of backing is specified in the *contract documents*, such removal shall meet the requirements in AWS D1.6/D1.6M. When the removal of runoff tabs is specified in the *contract documents*, hand plasma or laser cutting close to the edge of the finished member with no further finishing is permitted, unless other finishing is specified in the *contract documents*.

6.3.3. Unless otherwise noted in the *fabrication documents*, high-strength bolts for shop-attached *connection* material shall be installed in the shop in accordance with the requirements in ANSI/AISC 370.

## 6.4. Fabrication Tolerances

The tolerances on *structural stainless steel* fabrication shall be in accordance with the requirements in Section 6.4.1 through 6.4.6.

**Commentary:**
Fabrication tolerances are stipulated in several *specifications* and codes, each applicable to a specialized area of construction. Basic fabrication tolerances are stipulated in this Section. For *architecturally exposed structural stainless steel (AESSS)*, see Section 10. Other *specifications* and codes are also commonly incorporated by reference in the *contract documents*, such as ANSI/AISC 370 and AWS D1.6/D1.6M.

6.4.1. For members that have both ends finished (see Section 6.2.2) for contact bearing, the variation in the overall length shall be less than or equal to 1/32 in. (1 mm). For other members that frame to other *structural stainless steel* elements, the variation in the detailed length shall be as follows:

(a) For members that are less than or equal to 30 ft (9 m) in length, the variation shall be less than or equal to 1/16 in. (2 mm).
(b) For members that are greater than 30 ft (9 m) in length, the variation shall be less than or equal to 1/8 in. (3 mm).

**Commentary:**
Care should be taken in the measurement of precision elements, including a consideration of thermal expansion.

6.4.2. For straight and curved structural members, the permitted variation in specified straightness or curvature shall be as listed below. In all cases, completed members shall be free of twists (except as allowed by ASTM standards), bends, and open joints. Sharp kinks or sharp bends shall be cause for rejection.

(a) For straight structural members other than compression members, the variation in straightness shall be less than or equal to that specified for structural shapes in the applicable ASTM standards except when a smaller variation is specified in the *contract documents*. In the absence of applicable ASTM standards for *structural stainless steel* shapes, the straightness tolerance found in ASTM A484/A484M, Table 12, shall apply to *structural stainless steel* shapes.

For straight compression members, the variation in straightness shall be less than or equal to 1/1000 of the axial length between points that are to be laterally supported.

**Commentary:**
Straightness, camber, and twist tolerances may need to be part of the ordering information in order to achieve the tolerances found in ASTM A484/A484M, Table 12.

(b) For curved structural members, the variation in the chord length shall be as defined in Section 6.4.1. Unless otherwise specified in the *design documents*, the maximum variation in curvature measured at the middle ordinate shall be plus or minus 1/8 in. (3 mm) times one-fifth the total arc length in ft (times two-thirds the total arc length in m) for members 10 ft (3 m) or greater in length. For members less than 10 ft (3 m) in length, the permissible variation in curvature measured at the middle ordinate shall be plus or minus 1/8 in. (3 mm). The middle ordinate is located between work points (W.P.) as shown in Figure C-6.1.

**Commentary:**
Curved structural members, as referred to in this section, are defined as those members intended to maintain a specified curvature while in use. This section does not apply to members specified for camber. The location of the arc length is defined by the *design documents* and may be either at the member's inside radius, the outside radius, or the radius between work points.

6.4.3. For beams that are detailed without specified camber, the member shall be fabricated so that, after erection, any incidental camber due to rolling or shop fabrication is upward. For trusses that are detailed without specified camber, the components shall be fabricated so that, after erection, any incidental camber in the truss due to rolling or shop fabrication is upward.

6.4.4. For beams that are specified in the *contract documents* with camber, beams received by the *fabricator* with 75% of the specified camber shall require no further cambering. Otherwise, the variation in camber shall be as follows:

(a) For beams that are less than or equal to 50 ft (15 m) in length, the variation shall be less than or equal to minus zero/plus ½ in. (13 mm).
(b) For beams that are greater than 50 ft (15 m) in length, the variation shall be less than or equal to minus zero/plus ½ in. plus ⅛ in. for each 10 ft or fraction thereof (13 mm plus 3 mm for each 3 m or fraction thereof) in excess of 50 ft (15 m) in length.

For the purpose of inspection, camber shall be measured in the *fabricator's* shop in the unstressed condition.

**Commentary:**
There is no known way to inspect beam camber after the beam is received in the field because of factors that include:

(a) The release of stresses in members over time and in varying applications
(b) The effects of the dead weight of the member
(c) The restraint caused by the end *connections* in the erected state
(d) The effects of additional dead load that may ultimately be intended to be applied, if any

Therefore, inspection of the *fabricator's* work on beam camber must be done in the fabrication shop in the unstressed condition.

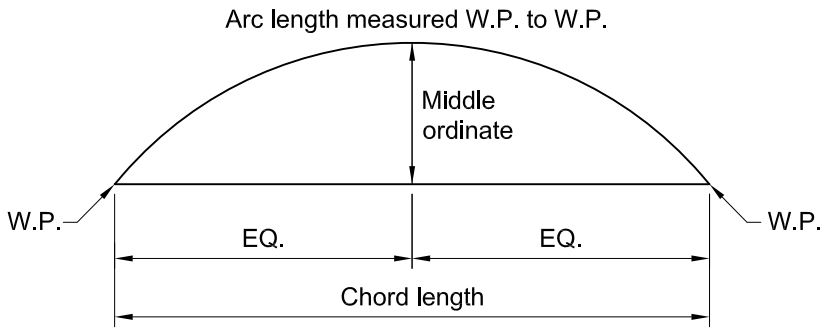


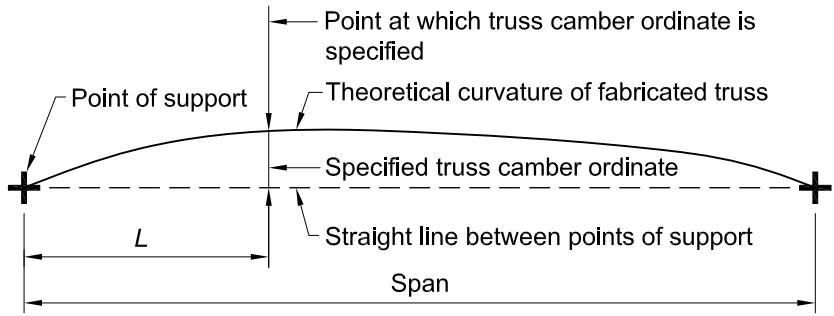

*Fig. C-6.1. Illustration of the tolerance on curved structural steel member.*

6.4.5. For fabricated trusses that are specified in the *contract documents* with camber, the variation in camber at each specified camber point shall be less than or equal to plus or minus 1/800 of the distance to that point from the nearest point of support. For the purpose of inspection, camber shall be measured in the *fabricator's* shop in the unstressed condition. For fabricated trusses that are specified in the *contract documents* without indication of camber, the foregoing requirements shall be applied at each panel point of the truss with a zero camber ordinate.

**Commentary:**
There is no known way to inspect truss camber after the truss is received in the field because of factors that include:

(a) The effects of the dead weight of the member
(b) The restraint caused by the truss *connections* in the erected state
(c) The effects of additional dead load that may ultimately be intended to be applied, if any

Therefore, inspection of the *fabricator's* work on truss camber must be done in the fabrication shop in the unstressed condition. See Figure C-6.2.




Taking $L$ as the distance from the point at which truss camber is specified to the closer point of support, in. (mm), the tolerance on truss camber at that point is calculated as $L/800$. $L$ must be equal to or less than one-half the span.

*Fig. C-6.2. Illustration of the tolerance on camber for fabricated trusses with specified camber.*

6.4.6. When permissible variations in the depths of beams and girders result in abrupt changes in depth at splices, such deviations shall be accounted for as follows:

(a) For splices with bolted joints, the variations in depth shall be taken up with filler plates.
(b) For splices with welded joints, the weld profile shall be adjusted to conform to the variations in depth, the required cross section of weld shall be provided and the slope of the weld surface shall meet the requirements in AWS D1.6/D1.6M or, if a laser or laser hybrid welded section is specified, ASTM A1069/A1069M.

## 6.5. Shop Cleaning and Finishing (see also Section 3.1.6)

The finish required on *structural stainless steel* shall be specified in the *contract documents*. *Structural stainless steel* that has no special finish requirements shall be supplied with no coatings and it shall be cleaned of oil and grease with solvent cleaners, and of dirt, *free iron*, and other foreign material by sweeping with a fiber brush or other suitable means in accordance with ASTM A967/A967M. Deeply embedded contamination from *free iron* or other metals shall be removed in compliance with ASTM A380/A380M.

**Commentary:**
There are a wide variety of finishes and surface treatments available. The type of surface finish may have implications for the long-term performance of the *structural stainless steel* elements, with smoother finishes providing better corrosion performance.

If the *contract documents* specify that the *structural stainless steel* is to have a finish other than as ordered from the mill, the *fabricator* shall perform such operations as required with clean media and appropriate tools that impart no foreign matter on the surface of the *structural stainless steel*. The work shall be performed in an area that is free of airborne steel and other contaminants.

**Commentary:**
The use of recycled blast media, recycled abrasives, and steel wire brushes may all leave *stainless steel* with *free iron* embedded or on its surface. This will stain under normal atmospheric conditions. Proper tooling and a shop environment that is free of airborne steel is required to produce *structural stainless steel* that will not stain under normal atmospheric conditions.

## 6.6. Marking and Shipping of Materials

6.6.1. Unless otherwise specified in the *contract documents*, erection marks shall be applied to the *structural stainless steel* members by painting or other suitable means in accordance with ANSI/AISC 370, Section M2.

6.6.2. Bolt assemblies and loose bolts, nuts, and washers shall be shipped in separate closed containers according to length and diameter, as applicable. Pins and other small parts and packages of bolts, nuts, and washers shall be shipped in boxes, crates, kegs, or barrels. A list and description of the material shall appear on the outside of each closed container.

## 6.7. Delivery of Materials

6.7.1. Fabricated *structural stainless steel* shall be delivered in a sequence that will permit efficient and economical fabrication and erection, and that is consistent with requirements in the *contract documents*. If the *owner* or *owner's designated representative for construction* wishes to prescribe or control the sequence of delivery of materials, that entity shall specify the required sequence in the *contract documents*. If the *owner's designated representative for construction* contracts separately for delivery and for erection, the *owner's designated representative for construction* shall coordinate planning between contractors.

6.7.2. *Anchor rods*, washers, nuts, and other anchorage or grillage materials that are to be built into concrete or masonry shall be shipped so that they will be available when needed. The *owner's designated representative for construction* shall allow the *fabricator* sufficient time to fabricate and ship such materials before they are needed.

6.7.3. If any shortage is claimed relative to the quantities of materials that are shown in the shipping statements, the *owner's designated representative for construction* or the *erector* shall promptly notify the *fabricator* so that the claim can be investigated.

**Commentary:**
The quantities of material that are shown in the shipping statement are customarily accepted as correct by the *owner's designated representative for construction*, the *fabricator*, and the *erector*.

6.7.4. Unless otherwise specified in the *contract documents*, and subject to the approved *approval documents*, the *fabricator* shall limit the number of field splices to that consistent with minimum project cost.

**Commentary:**
This Section recognizes that the size and weight of *structural stainless steel* assemblies may be limited by shop capabilities, the permissible weight and clearance dimensions of available transportation, or job-site conditions.

6.7.5. If material arrives at its destination in damaged condition, the receiving entity shall promptly notify the *fabricator* and carrier prior to unloading the material, or promptly upon discovery prior to erection.

## SECTION 7. ERECTION

### 7.1. Method of Erection

Fabricated *structural stainless steel* shall be erected using methods and a sequence that will permit efficient and economical performance of erection, and that is consistent with the requirements in the *contract documents*. If the *owner* or *owner's designated representative for construction* wishes to prescribe or control the method and/or sequence of erection, or specifies that certain members cannot be erected in their normal sequence, that entity shall specify the required method and sequence in the *contract documents*. If the o*wner's designated representative for construction* contracts separately for fabrication services and for erection services, the *owner's designated representative for construction* shall coordinate planning between contractors.

**Commentary:**
Design modifications are sometimes requested by the *erector* to allow or facilitate the erection of the *structural stainless steel* frame. When this is the case, the *erector* should notify the *fabricator* prior to the preparation of the *approval documents* so that the *fabricator* may refer the *erector's* request to the *owner's designated representatives for design* and *construction* for resolution.

### 7.2. Job-Site Conditions

The *owner's designated representative for construction* shall provide and maintain the following for the *fabricator* and the *erector*:

(a) Adequate access roads into and through the job site for the safe delivery and movement of the material to be erected and of derricks, cranes, trucks, and other necessary equipment under their own power.
(b) A firm, properly graded, drained, convenient, and adequate space at the job site for the operation of the *erector's* equipment, free from overhead obstructions such as power lines, telephone lines, or similar conditions.
(c) Adequate storage space, when the structure does not occupy the full available job site, to enable the *fabricator* and the *erector* to operate at maximum practical speed. The storage space shall allow for the separation of *structural stainless steel* and *other steel alloys*.

Otherwise, the *owner's designated representative for construction* shall inform the *fabricator* and the *erector* of the actual job-site conditions and/or special delivery requirements prior to bidding.

### 7.3. Foundations, Piers, and Abutments

The accurate location, strength, suitability of, and access to all foundations, piers, and abutments shall be the responsibility of the *owner's designated representative for construction*.

## 7.4. Lines and Benchmarks

The *owner's designated representative for construction* shall be responsible for the accurate location of lines and benchmarks at the job site and shall furnish the *erector* with a plan that contains all such information. The *owner's designated representative for construction* shall establish offset lines and reference elevations at each level for the *erector's* use in the positioning of *adjustable items* (see Section 7.13.1.3), if any.

## 7.5. Installation of Anchor Rods, Foundation Bolts, and Other Embedded Items

7.5.1. *Anchor rods*, foundation bolts, and other embedded items shall be set by the *owner's designated representative for construction* in accordance with *embedment drawings* that have been approved by the *owner's designated representatives for design* and *construction*. The variation in location of these items from the dimensions shown in the approved *embedment drawings* shall be as follows:

(a) The vertical variation in location from the specified top of *anchor rod* location shall be less than or equal to plus or minus ½ in. (13 mm).
(b) The horizontal variation in location from the specified position of each *anchor rod* centerline at any location along its projection above the concrete shall be less than or equal to the dimensions given for the *anchor rod* diameters listed as follows:

| Anchor Rod Diameter, in. (mm) | Horizontal Variation, in. (mm) |
|---|---|
| ¾ and ⅞ (19 and 22) | ¼ (6) |
| 1, 1¼, 1½ (25, 31, 38) | ⅜ (10) |
| 1¾, 2, 2½ (44, 50, 63) | ½ (13) |

**Commentary:**
The tolerances established in this Section have been selected for compatibility with the holes sizes that are recommended for base plates. This work was a collaboration between ACI and AISC to accommodate standard anchor rod placement. If special conditions require more restrictive tolerances, such as for smaller holes, the required tolerances should be stated in the *contract documents*. When the *anchor rods* are set in sleeves, the adjustment provided may be used to satisfy the required anchor-rod setting tolerances.

7.5.2. Unless otherwise specified in the *contract documents*, *anchor rods* shall be set with their longitudinal axis perpendicular to the theoretical bearing surface.

7.5.3. Embedded items and *connection* materials that are part of the work of other trades, but that will receive *structural stainless steel*, shall be located and set by the *owner's designated representative for construction* in accordance with an approved *embedment drawing*. The variation in location of these items shall be limited to a magnitude that is consistent with the tolerances that are specified in Section 7.13 for the erection of the *structural stainless steel*. Embedded items and *connection* materials that are part of work of other trades shall be marked in such a way as to indicate whether the embedded items are *other steel alloys* or *stainless steel*.

7.5.4. All work that is performed by the *owner's designated representative for construction* shall be completed so as not to delay or interfere with the work of the *fabricator* and the *erector*. The *owner's designated representative for construction* shall conduct a survey of the as-built locations of *anchor rods*, foundation bolts, and other embedded items, and shall verify that all items covered in Section 7.5 meet the corresponding tolerances. When corrective action is necessary, the *owner's designated representative for construction* shall obtain the guidance and approval of the *owner's designated representative for design*.

**Commentary:**
Few *fabricators* or *erectors* have the capability to provide this survey. Under standard practice, it is the responsibility of others.

## 7.6. Installation of Bearing Devices

All leveling plates, leveling nuts and washers, and loose base and bearing plates that can be handled without a derrick or crane are set to line and grade by the *owner's designated representative for construction*. Loose base and bearing plates that require handling with a derrick or crane shall be set by the *erector* to lines and grades established by the *owner's designated representative for construction*. The *fabricator* shall clearly scribe loose base and bearing plates with lines or other suitable marks to facilitate proper alignment.

Promptly after the setting of *bearing devices*, the *owner's designated representative for construction* shall check them for line and grade. The variation in elevation relative to the established grade for all *bearing devices* shall be less than or equal to plus or minus ⅛ in. (3 mm). The final location of *bearing devices* shall be the responsibility of the *owner's designated representative for construction*.

**Commentary:**
The ⅛ in. (3 mm) tolerance on elevation of *bearing devices* relative to established grades is provided to permit some variation in setting *bearing devices*, and to account for the accuracy that is attainable with standard surveying instruments. The use of leveling plates larger than 22 in. by 22 in. (550 mm by 550 mm) is discouraged and grouting is recommended with larger sizes. For the purposes of erection stability, the use of leveling nuts and washers is discouraged when base plates have less than four *anchor rods*.

## 7.7. Grouting

Grouting shall be the responsibility of the *owner's designated representative for construction*. Leveling plates and loose base and bearing plates shall be promptly grouted after they are set and checked for line and grade. Columns with attached base plates, beams with attached bearing plates, and other similar members with attached *bearing devices* that are temporarily supported on leveling nuts and washers, shims, or other similar leveling devices shall be promptly grouted after the *structural stainless steel* frame, or portion thereof, has been plumbed.

**Commentary:**
In the majority of structures the vertical load from the column bases is transmitted to the foundations through structural grout. In general, there are three methods by which support is provided for column bases during erection:

(a) Pre-grouted leveling plates or loose base plates
(b) Shims
(c) Leveling nuts and washers on the *anchor rods* beneath the column base

Standard practice provides that loose base plates and leveling plates are to be grouted as they are set. *Bearing devices* that are set on shims or leveling nuts are grouted after plumbing, which means that the weight of the erected *structural stainless steel* frame is supported on the shims or washers, nuts, and *anchor rods*. The *erector* must take care to ensure that the load that is transmitted in this temporary condition does not exceed the strength of the shims or washers, nuts, and *anchor rods*. These considerations are presented in greater detail in AISC Design Guide 1, *Base Plate and Anchor Rod Design*, and AISC Design Guide 10, *Erection Bracing of Low-Rise Structural Steel Frames*, which are written for *structural steel* but generally apply to *structural stainless steel* as well.

## 7.8. Field Connection Material

7.8.1. The *fabricator* shall provide field *connection* details that are consistent with the requirements in the *contract documents* and that will, in the *fabricator's* opinion, result in economical fabrication and erection.

7.8.2. When the *fabricator* is responsible for erecting the *structural stainless steel*, the *fabricator* shall furnish all materials that are required for both temporary and permanent *connection* of the component parts of the *structural stainless steel* frame.

7.8.3. When the erection of the *structural stainless steel* is not performed by the *fabricator*, the *fabricator* shall furnish the following field *connection* material:

(a) Bolts, nuts, and washers in sufficient quantity for all *structural stainless steel*-to-*structural stainless steel* field *connections* that are to be permanently bolted. The *fabricator* shall include an extra 2% plus three bolts, subject to a minimum of five extra bolts, of each grade, type, diameter, length, and production lot number. Bolt material, alloy grade, and type shall be as specified in the *contract documents*.
(b) Shims that are shown as necessary for make-up of permanent *structural stainless steel*-to-*structural stainless steel* field *connections*.
(c) Backing and run-off tabs that are required for field welding.

7.8.4. The *erector* shall furnish all welding electrodes, fit-up bolts, and drift pins used for the erection of the *structural stainless steel*. Non-steel backing, if used, shall be furnished by the *erector*.

7.8.5. The supplier of temporary supports, backing, and other erection aids shall take all care necessary to provide materials that are compatible with the *structural stainless steel* and its intended long term surface finish. Galvanized bolts shall not be supplied without the approval of the *owner's designated representative for construction*.

**Commentary:**
For temporary bracing and supports, bolts used to join *structural stainless steel* to itself and to *other steel alloys* should be of material and grade that is equal to or better than the neighboring material in corrosion resistance. Galvanized bolts are generally not appropriate even for short term use.

The use of *other steel alloys* for temporary bracing and assembly fixtures can leave the surface of *structural stainless steel* contaminated. Where finished *structural stainless steel* is specified, the *fabricator* and *erector* should protect against contamination and damage. If contamination occurs, the corrosion resistance of the *structural stainless steel* should be restored using ASTM A967/A967M or ASTM A380/A380M depending on the severity of the damage.

## 7.9. Loose Material

Unless otherwise specified in the *contract documents*, loose *structural stainless steel* items that are not connected to the *structural stainless steel* frame shall be set by the *owner's designated representative for construction* without assistance from the *erector*.

## 7.10. Temporary Support of Structural Stainless Steel Frames

7.10.1. The *owner's designated representative for design* shall identify the following in the *contract documents*:

(a) The lateral force-resisting system and connecting diaphragm elements that provide for lateral strength and stability in the completed structure
(b) Any special erection conditions or other considerations that are required by the design concept, such as the use of shores, jacks, or loads that must be adjusted as erection progresses to set or maintain camber, position within specified tolerances, or prestress

**Commentary:**
The intent of Code Section 7.10.1 is to alert the *owner's designated representative for construction* and the *erector* of the means for lateral force resistance in the completed structure so that appropriate planning can occur for construction of the building. Examples of a description of the lateral force-resisting system as required in Section 7.10.1(a) are shown in the following.

Example 1 is an all-steel building with a composite metal deck and concrete floor system. All lateral force resistance is provided by welded moment frames in each orthogonal building direction. One suitable description of this lateral force-resisting system is:

*All lateral force resistance and stability of the building in the completed structure is provided by moment frames with welded beam-to-column connections framed in each orthogonal direction (see plan sheets for locations). The composite metal deck and concrete floors serve as horizontal diaphragms that distribute the lateral wind forces horizontally to the vertical moment frames. The vertical moment frames carry the applied lateral loads to the building foundation.*

Example 2 is a steel-framed building with a composite metal deck and concrete floor system. All beam-to-column *connections* are simple *connections* and all lateral force resistance is provided by reinforced concrete shear walls in the building core and in the stairwells. One suitable description of this lateral force-resisting system is:

*All lateral force resistance and stability of the building in the completed structure is provided exclusively by cast-in-place reinforced concrete shear walls in the building core and stairwells (see plan sheets for locations). These walls provide all lateral force resistance in each orthogonal building direction. The composite metal deck and concrete floors serve as horizontal diaphragms that distribute the lateral wind forces horizontally to the concrete shear walls. The concrete shear walls carry the applied lateral loads to the building foundation.*

See also Commentary Section 7.10.3.

Section 7.10.1(b) is intended to apply to special requirements inherent in the design concept that could not otherwise be known by the *erector*. Such conditions might include designs that require the use of shores or jacks to impart a load or to obtain a specific elevation or position in a subsequent step of the erection process in a sequentially erected structure or member. These requirements would not be apparent to an *erector*, and must be identified so the *erector* can properly bid, plan, and perform the erection.

The *erector* is responsible for installation of all members (including cantilevered members) to the specified plumbness, elevation, and alignment within the erection tolerances specified in this Code. The *erector* must provide all temporary supports and devices to maintain elevation or position within these tolerances. These works are part of the means and methods of the *erector,* and the *owner's designated representative for design* need not specify these methods or related equipment.

See also the preset requirements for cantilevered members in Section 3.1.

7.10.2. The *owner's designated representative for construction* shall indicate to the *erector* prior to bidding, the installation schedule for elements that are not *structural stainless steel* of the lateral force-resisting system and connecting diaphragm elements identified by the *owner's designated representative for design* in the *contract documents*.

**Commentary:**
See Commentary Section 7.10.3.

7.10.3. Based upon the information provided in accordance with Sections 7.10.1 and 7.10.2, the *erector* shall determine, furnish, and install all temporary supports, such as temporary guys, beams, falsework, cribbing, or other elements required for the erection operation. These temporary supports shall be sufficient to secure the bare *structural stainless steel* framing or any portion thereof against loads that are likely to be encountered during erection, including those due to wind and those that result from erection operations.

The *erector* need not consider loads during erection that result from the performance of work by, or the acts of, others, except as specifically identified by the *owner's designated representatives for design* and *construction*, nor those that are unpredictable, such as loads due to hurricane, tornado, earthquake, explosion, or collision.

Temporary supports that are required during or after the erection of the *structural stainless steel* frame for the support of loads caused by non-*structural stainless steel* elements, including cladding, interior partitions, and other such elements that will induce or transmit loads to the *structural stainless steel* frame during or after erection, shall be the responsibility of others.

**Commentary:**

Many *structural stainless steel* frames have lateral force-resisting systems that are activated during the erection process. Such lateral force-resisting systems may consist of welded moment frames, braced frames, or in some instances, columns that cantilever from fixed-base foundations. Such frames are normally braced with temporary guys that, together with the steel deck floor and roof diaphragms or other diaphragm bracing that may be included as part of the design, provide stability during the erection process. The guy cables are also commonly used to plumb the *structural stainless steel* frame. The *erector* normally furnishes and installs the required temporary supports and bracing to secure the bare *structural stainless steel* frame, or portion thereof, during the erection process. When *erection bracing drawings* are required in the *contract documents*, those drawings show this information.

If the *owner's designated representative for construction* determines that steel decking is not installed by the *erector*, temporary diaphragm bracing may be required if a horizontal diaphragm is not available to distribute loads to the vertical and lateral force-resisting system. If the steel deck will not be available as a diaphragm during *structural stainless steel* erection, the *owner's designated representative for construction* must communicate this condition to the *erector* prior to bidding. If such diaphragm bracing is required, it should be furnished and installed by the *erector*.

Sometimes structural systems that are employed by the *owner's designated representative for design* rely upon other elements besides the *structural stainless steel* frame for lateral force resistance. For instance, concrete or masonry shear walls or precast spandrels may be used to provide resistance to vertical and lateral forces in the completed structure. Because these situations

may not be obvious to the contractor or the *erector*, it is required in this Code that the *owner's designated representative for design* must identify such situations in the *contract documents*. Similarly, if a structure is designed so that special erection techniques are required, such as jacking to impose certain loads or position during erection, it is required in this Code that such requirements be specifically identified in the *contract documents*.

In some instances, the *owner's designated representative for design* may elect to show erection bracing in the structural *design documents*. When this is the case, the *owner's designated representative for design* should then confirm that the bracing requirements were understood by review and approval of the *erection documents* during the submittal process.

Sometimes during construction of a building, collateral building elements, such as exterior cladding, may be required to be installed on the bare *structural stainless steel* frame prior to completion of the lateral force-resisting system. These elements may increase the potential for lateral loads on the temporary supports. Such temporary supports may also be required to be left in place after the *structural stainless steel* frame has been erected. Special provisions should be made by *the owner's designated representative for construction* for these conditions.

7.10.4. All temporary supports that are required for the erection operation and furnished and installed by the *erector* shall remain the property of the *erector* and shall not be modified, moved, or removed without the consent of the *erector*. Temporary supports provided by the *erector* shall remain in place until the portion of the *structural stainless steel* frame that they brace is complete and the lateral force-resisting system and connecting diaphragm elements identified by the *owner's designated representative for design* in accordance with Section 7.10.1 are installed. Temporary supports that are required to be left in place after the completion of *structural stainless steel* erection shall be removed when no longer needed by the *owner's designated representative for construction* and returned to the *erector* in good condition.

## 7.11. Safety Protection

7.11.1. The *erector* shall provide floor coverings, handrails, walkways, and other safety protection for the *erector's* personnel as required by law and the applicable safety regulations. Unless otherwise specified in the *contract documents*, the *erector* is permitted to remove such safety protection from areas where the erection operations are completed.

7.11.2. When safety protection provided by the *erector* is left in an area for the use of other trades after the *structural stainless steel* erection activity is completed, the *owner's designated representative for construction* shall:

(a) Accept responsibility for and maintain this protection.
(b) Indemnify the *fabricator* and the *erector* from damages that may be incurred from the use of this protection by other trades.

(c) Ensure that this protection is adequate for use by other affected trades.
(d) Ensure that this protection complies with applicable safety regulations when being used by other trades.
(e) Remove this protection when it is no longer required and return it to the *erector* in the same condition in which it was received.

7.11.3. Safety protection for other trades that are not under the direct employment of the *erector* shall be the responsibility of the *owner's designated representative for construction*.

7.11.4. When permanent steel decking is used for protective flooring and is installed by the *owner's designated representative for construction*, all such work shall be scheduled and performed in a timely manner so as not to interfere with or delay the work of the *fabricator* or the *erector*. The sequence of installation that is used shall meet all safety regulations.

7.11.5. Unless the interaction and safety of activities of others, such as construction by others or the storage of materials that belong to others, are coordinated with the work of the *erector* by the *owner's designated representative for construction*, such activities are not permitted until the erection of the *structural stainless steel* frame or portion thereof is completed by the *erector* and accepted by the *owner's designated representative for construction*.

## 7.12. Structural Stainless Steel Frame Tolerances

The accumulation of the mill tolerances and fabrication tolerances shall not cause the erection tolerances to be exceeded.

**Commentary:**
It is recognized that accumulations of mill tolerances and fabrication tolerances generally occur between the locations at which erection tolerances are applied, and not at the same locations.

## 7.13. Erection Tolerances

Erection tolerances shall be defined relative to member working points and working lines, which shall be defined as follows:

(a) For members other than horizontal members, the member work point shall be the actual center of the member at each end of the shipping piece.
(b) For horizontal members, the working point shall be the actual centerline of the top flange or top surface at each end.
(c) The member working line shall be the straight line that connects the member working points.

The substitution of other working points is permitted for ease of reference, provided they are based upon the preceding definitions.

The tolerances on *structural stainless steel* erection shall be in accordance with the requirements in Sections 7.13.1 through 7.13.3.

**Commentary:**
Thermal expansion and contraction may be a consideration in design and construction (see Figures C-7.1 and C-7.2). The coefficient of thermal expansion for *stainless steel* is different from *other steel alloys* and varies by *stainless steel* family (values for the coefficient of thermal expansion of *stainless steel* can be found in ANSI/AISC 370). Differential temperature effects should also be taken into account in plumbing surveys when tall *structural stainless steel* members are subjected to sun exposure on one side.

The alignment of lintels, spandrels, wall supports, and similar members that are used to connect other building construction units to the *structural stainless steel* frame should have an adjustment of sufficient magnitude to allow for the accumulation of mill tolerances and fabrication tolerances, as well as the erection tolerances. See Figure C-7.3.

7.13.1. The tolerances on position and alignment of member working points and working lines shall be as described in Sections 7.13.1.1 through 7.13.1.3.

7.13.1.1. For an individual column shipping piece, the angular variation of the working line from a plumb line shall be less than or equal to 1/500 of the distance between working points, subject to the following additional limitations:

(a) For an individual column shipping piece that is adjacent to an elevator shaft, the displacement of member working points shall be less than or equal to 1 in. (25 mm) from the *established column line* in the first 20 stories. Above this level, an increase in the displacement of 1/32 in. (1 mm) is permitted for each additional story up to a maximum displacement of 2 in. (50 mm) from the *established column line*.

(b) For an exterior individual column shipping piece, the displacement of member working points from the *established column line* in the first 20 stories shall be less than or equal to 1 in. (25 mm) toward and 2 in. (50 mm) away from the building exterior. Above this level, an increase in the displacement of 1/16 in. (2 mm) is permitted for each additional story up to a maximum displacement of 2 in. (50 mm) toward and 3 in. (75 mm) away from the building exterior.

**Commentary:**
The limitations that are described in this Section and illustrated in Figures C-7.4 and C-7.5 make it possible to maintain built-in-place or prefabricated facades in a true vertical plane up to the 20th story, if *connections* that provide for 3 in. (75 mm) of adjustment are used. Above the 20th story, the facade may be maintained within 1/16 in. (2 mm) per story with a maximum total deviation of 1 in. (25 mm) from a true vertical plane, if *connections* that provide for 3 in. (75 mm) of adjustment are used. *Connections* that permit adjustments of plus 2 in. (50 mm) to minus 3 in. (75 mm)—a total of 5 in. (125 mm)—will be necessary in cases where it is desired to construct the facade to a true vertical plane above the 20th story.

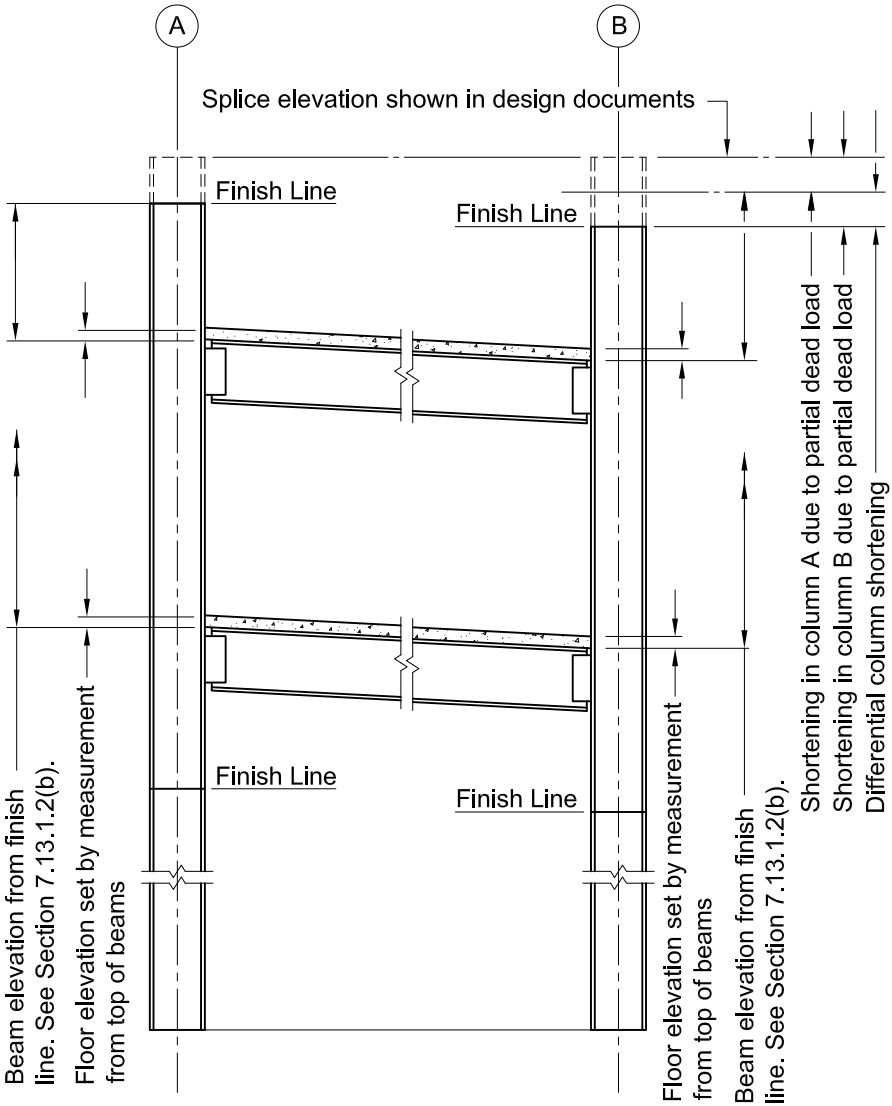
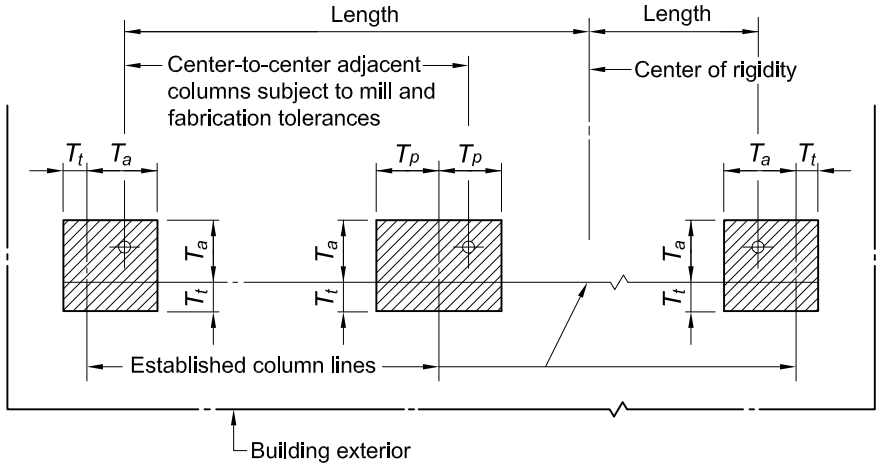
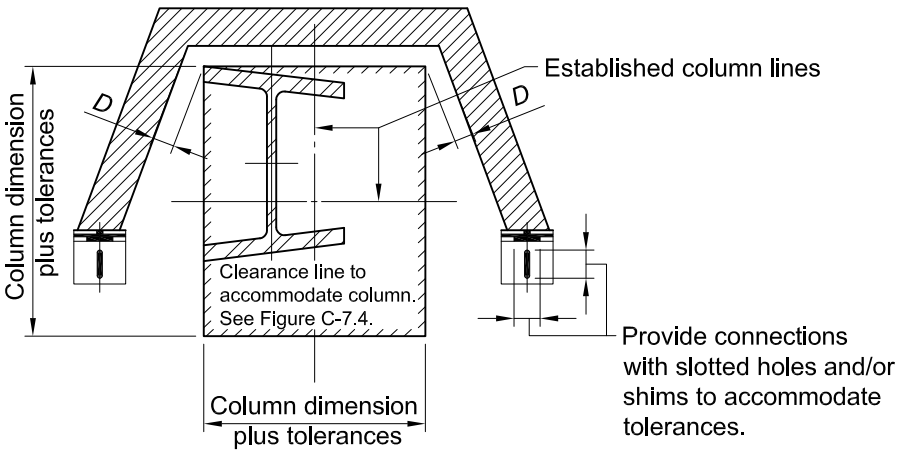



*Fig. C-7.1. Effects of differential column shortening.*

When plumbing columns, apply a temperature adjustment at a rate of 3/16 in. per 100 ft for each change of 15°F (3 mm per 10 m for each change of 15°C) between the temperature at the time of erection and the working temperature.



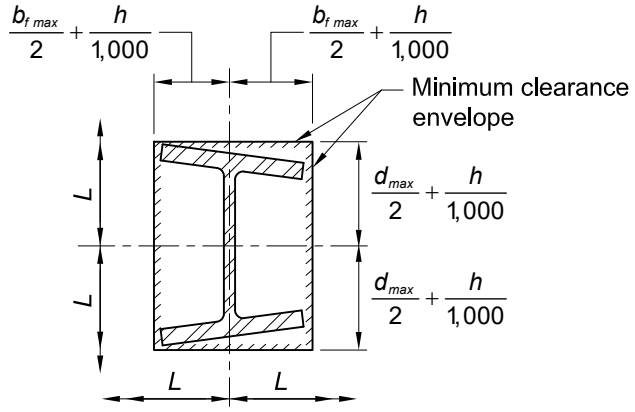

*Fig, C-7.2. Tolerances in plan location of column.*



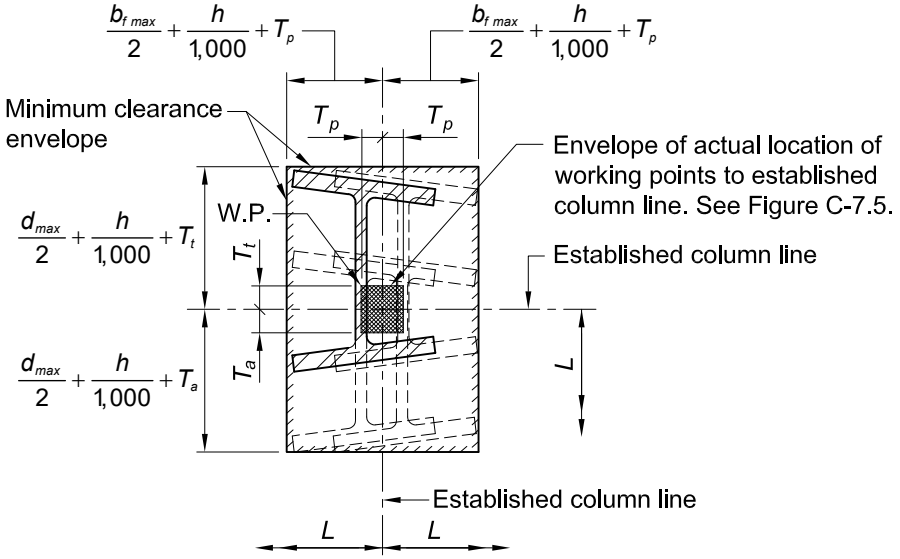

If facia joints are set from nearest column finish line, allow ±⅝ in. (16 mm) for vertical adjustment. The entity responsible for the facia details must allow for progressive shortening of steel columns.

*D* = Tolerance required by manufacturer of wall unit plus survey tolerances.

*Fig. C-7.3. Clearance required to accommodate fascia.*



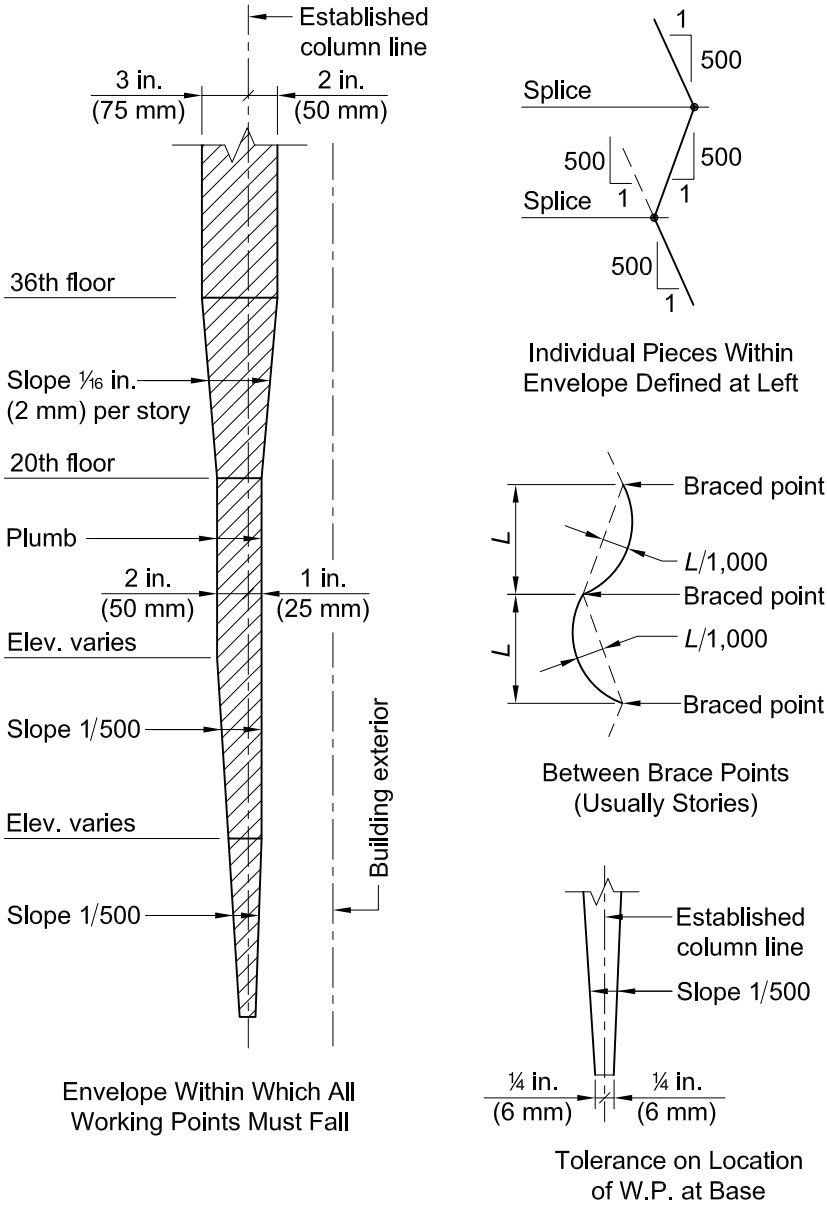

For Enclosures or Attachments That May Follow Column Alignment




For Enclosures or Attachments That Must Be Held to Precise Plan Location

$L$ = Actual center-to-center of columns = plan dimensions ± column cross-section tolerance of columns ± beam length tolerance
$T_a$ = Plumbness tolerance away from building exterior (varies, see Figure C-7.5)
$T_t$ = Plumbness tolerance toward building exterior (varies, see Figure C-7.5)
$T_p$ = Plumbness tolerance parallel to building exterior (= $T_a$)

*Fig. C-7.4. Clearance required to accommodate accumulated column clearance.*




Note: The plumb line through the base working point for an individual column is not necessarily the precise plan location because Section 7.13.1.1 deals only with plumbness tolerances and does not include inaccuracies in location of the established column line, foundations, and anchor rods beyond the erector's model.

*Fig. C-7.5. Exterior column plumbness tolerance normal to building exterior.*

(c) For an exterior individual column shipping piece, the member working points at any splice level for multi-*tier* buildings and at the tops of columns for single-*tier* buildings shall fall within a horizontal envelope, parallel to the exterior *established column line*, that is less than or equal to 1½ in. (38 mm) wide for buildings up to 300 ft (91 m) in length. An increase in the width of this horizontal envelope of ½ in. (13 mm) is permitted for each additional 100 ft (30 m) in length up to a maximum width of 3 in. (75 mm).

**Commentary:**
This Section limits the position of exterior column working points at any given splice elevation to a narrow horizontal envelope parallel to the exterior *established column line* (see Figure C-7.6). This envelope is limited to a width of 1½ in. (38 mm), normal to the exterior *established column line*, up to 300 ft (90 000 mm) of building length. The horizontal location of this envelope is not necessarily directly above or below the corresponding envelope at the adjacent splice elevations, but should be within the limitation of the 1 in 500 plumbness tolerance specified for the controlling columns (see Figure C-7.5).

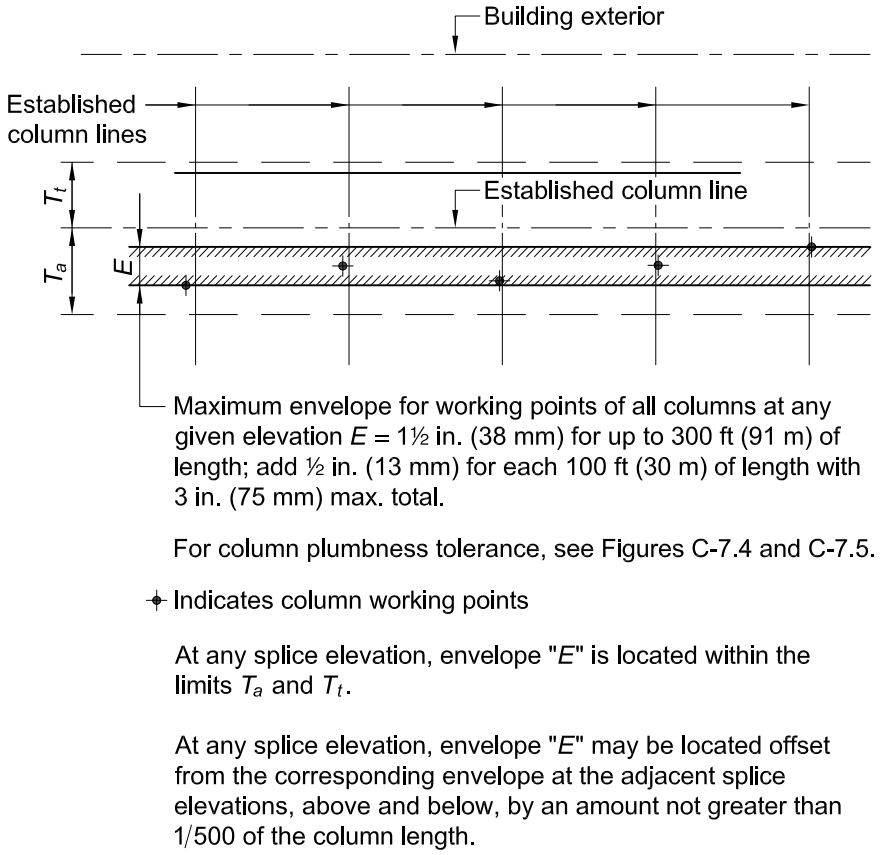



*Fig. C-7.6. Tolerance in plan at any splice elevation of exterior columns.*

(d) For an exterior column shipping piece, the displacement of member working points from the *established column line* that is nominally parallel to the building exterior shall be less than or equal to 2 in. (50 mm) in the first 20 stories. Above this level, an increase in the displacement of 1/16 in. (2 mm) is permitted for each additional story up to a maximum displacement of 3 in. (75 mm) in the direction nominally parallel to the building exterior.

7.13.1.2. For members other than column shipping pieces, the following limitations shall apply:

(a) For a member that consists of an individual, straight shipping piece without field splices, other than a cantilevered member, the variation in alignment shall be acceptable if it is caused solely by variations in column alignment and/or primary supporting member alignment that are within the permissible variations for the fabrication and erection of such members.

(b) For a member that consists of an individual, straight shipping piece that connects to a column, the variation in the distance from the member working point to the upper finished splice line of the column shall be less than or equal to plus 3/16 in. (5 mm) and minus 5/16 in. (8 mm).

(c) For a member that consists of an individual shipping piece that does not connect to a column, the variation in elevation shall be acceptable if it is caused solely by the variations in the elevations of the supporting members within the permissible variations for the fabrication and erection of those members.

(d) For a member that consists of an individual, straight shipping piece and that is a segment of a field assembled unit containing field splices between points of support, the plumbness, elevation, and alignment shall be acceptable if the angular variation, vertically and horizontally, of the working line from a straight line between points of support is less than or equal to 1/500 of the distance between working points.

**Commentary:**
The angular misalignment of the working line of all fabricated shipping pieces relative to the line between support points of the member as a whole in erected position should not exceed 1 in 500. Note that the tolerance is not stated in terms of a linear displacement at any point and is not to be taken as the overall length between supports divided by 500. Typical examples are shown in Figure C-7.7. Numerous conditions within tolerance for these and other cases are possible. The condition described in (d) applies to both plan and elevation tolerances.

(e) For a cantilevered member that consists of an individual, straight shipping piece, the plumbness, elevation, and alignment shall be acceptable if the angular variation of the working line from a straight line that is extended in the plan direction from the working point at its supported end is less than or equal to 1/500 of the distance from the working point at the free end.

**Commentary:**
This tolerance is evaluated after the fixed end condition is sufficient to stabilize the cantilever and before the temporary support is removed. The preset specified in the *contract documents* should be calculated accordingly. The temporary support cannot be used to induce artificial deflection into the cantilever to meet this tolerance after the fixed end is restrained.

(f) For a member of irregular shape, the plumbness, elevation, and alignment shall be acceptable if the fabricated member is within its tolerances and the members that support it are within the tolerances specified in this Code.

(g) For a member that is fully assembled in the field in an unstressed condition, the same tolerances shall apply as if fully assembled in the shop.

(h) For a member that is field-assembled in place, element by element, temporary support shall be used or an alternative erection plan shall be submitted to the *owner's designated representatives for design* and *construction*. The tolerance in Section 7.13.1.2(d) shall be met in the supported condition with working points taken at the point(s) of temporary support.

**Commentary:**
Trusses fabricated and erected as a unit or as an assembly of truss segments normally have excellent controls on vertical position regardless of fabrication and erection techniques. However, a truss fabricated and erected by assembling individual components in place in the field is potentially more sensitive to deflections of the individual truss components and the partially completed work during erection, particularly the chord members. In such a case, the erection process should follow an erection plan that addresses this issue.

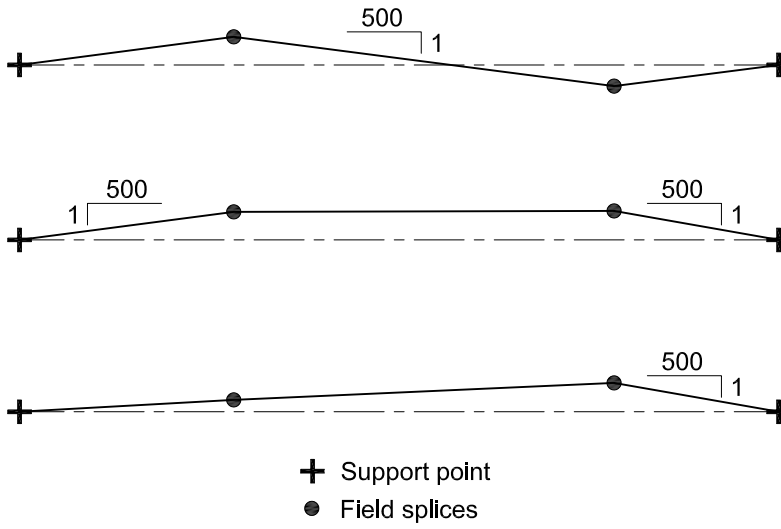



*Fig. C-7.7. Alignment tolerances for members with field splices.*

7.13.1.3. For members that are identified as *adjustable items* by the *owner's designated representative for design* in the *contract documents*, the *fabricator* shall provide adjustable *connections* for these members to the supporting *structural stainless steel* frame. Otherwise, the *fabricator* is permitted to provide nonadjustable *connections*. When *adjustable items* are specified, the *owner's designated representative for design* shall indicate the total adjustability that is required for the proper alignment of these supports for other trades. The variation in the position and alignment of *adjustable items* shall be as follows:

(a) The variation in the vertical distance from the upper finished splice line of the nearest column to the support location specified in the structural *design documents* shall be less than or equal to plus or minus ⅜ in. (10 mm).
(b) The variation in the horizontal distance from the established finish line at the particular floor shall be less than or equal to plus or minus ⅜ in. (10 mm).
(c) The variation in vertical and horizontal alignment at the abutting ends of *adjustable items* shall be less than or equal to plus or minus 3⁄16 in. (5 mm).

**Commentary:**
When the alignment of lintels, wall supports, curb angles, mullions, and similar supporting members for the use of other trades is required to be closer than that permitted by the foregoing tolerances for *structural stainless steel*, the *owner's designated representative for design* must identify such items in the *contract documents* as *adjustable items*.

7.13.2. In the design of *stainless steel* structures, the *owner's designated representative for design* shall provide for the necessary clearances and adjustments for material furnished by other trades to accommodate the mill tolerances, fabrication tolerances, and erection tolerances in this Code for the *structural stainless steel* frame.

**Commentary:**
In spite of all efforts to minimize inaccuracies, deviations will still exist; therefore, in addition, the designs of prefabricated wall panels, partition panels, fenestrations, floor-to-ceiling door frames, and similar elements must provide for clearance and details for adjustment as described in Section 7.13.2. Designs must provide for adjustment in the vertical dimension of prefabricated facade panels that are supported by the *structural stainless steel* frame because the accumulation of shortening of loaded steel columns will result in the unstressed facade supported at each floor level being higher than the *structural stainless steel* framing to which it must be attached. Observations in the field have shown that where a heavy facade is erected to a greater height on one side of a multistory building than on the other, the *structural stainless steel* framing will be pulled out of alignment. Facades should be erected at a relatively uniform rate around the perimeter of the structure.

7.13.3. Prior to placing or applying any other materials, the *owner's designated representative for construction* shall determine that the location of the *structural stainless steel* is acceptable for plumbness, elevation, and alignment. The *erector* shall be given either timely notice of acceptance by the *owner's designated representative for construction* or a listing of specific items that are to be corrected in order to obtain acceptance. Such notice shall be rendered promptly upon completion of any part of the work and prior to the start of work by other trades that may be supported, attached, or applied to the *structural stainless steel* frame.

## 7.14. Correction of Errors

The correction of minor misfits by moderate amounts of reaming, grinding, welding, or cutting, and the drawing of elements into line with drift pins, shall be considered to be normal erection operations. Errors that cannot be corrected using the foregoing means, or that require major changes in member or *connection* configuration, shall be promptly reported to the *owner's designated representatives for design* and *construction* and the *fabricator* by the *erector*, to enable the responsible entity to either correct the error or approve the most efficient and economical method of correction to be used by others.

**Commentary:**
As used in this Section, the term "moderate" refers to the amount of reaming, grinding, welding, or cutting that must be done on the project as a whole, not the amount that is required at an individual location. It is not intended to address limitations on the amount of material that is removed by reaming at an individual bolt hole, for example, which is limited by the bolt-hole size and tolerance requirements in ANSI/AISC 370.

## 7.15. Cuts, Alterations, and Holes for Other Trades

Neither the *fabricator* nor the *erector* shall cut, drill, or otherwise alter their work, nor the work of other trades, to accommodate other trades, unless such work is clearly specified in the *contract documents*. When such work is so specified, the *owner's designated representatives for design* and *construction* shall furnish complete information as to materials, size, location, and number of alterations in a timely manner so as not to delay the preparation of the *approval documents*.

## 7.16. Handling and Storage

The *erector* shall take reasonable care in the proper handling and storage of the *structural stainless steel* during erection operations to avoid the accumulation of excess dirt, cross contamination between *stainless steel* to *other steel alloys*, and foreign matter. The *erector* shall not be responsible for the removal from the *structural stainless steel* of dust, dirt, or other foreign matter that may accumulate during erection as the result of job-site conditions or exposure to the elements. The *erector* shall be responsible for any reconditioning necessary that is a result of handling or storage at site.

**Commentary:**
During storage, loading, transport, unloading, and erection, blemish marks caused by slings, chains, blocking, tie-downs, cross contamination, etc., occur in varying degrees. Abrasions caused by handling or cartage after finishing are to be expected. It must be recognized that any shop-applied finished surface, no matter how carefully protected, may require reconditioning in the field. Reconditioning these blemished areas in accordance with project specification requirements is the responsibility of the contractor performing the field reconditioning.

The *erector* is responsible for the proper storage and handling of fabricated *structural stainless steel* at the job site during erection. Finished and shop-painted *structural stainless steel* that is stored in the field pending erection should be kept free of the ground and positioned so as to minimize the potential for water retention. The *owner* or *owner's designated representative for construction* is responsible for providing suitable job-site conditions and proper access so that the *fabricator* and the *erector* may perform their work. Job-site conditions are frequently muddy, sandy, dusty, or a combination thereof during the erection period. Under such conditions, it may be impossible to store and handle the *structural stainless steel* in such a way as to completely avoid any accumulation of mud, dirt, or sand on the surface of the *structural stainless steel*, even though the *fabricator* and the erector manage to proceed with their work.

Repairs of damage to finished surfaces and/or removal of foreign materials due to adverse job-site conditions are outside the scope of responsibility of the *fabricator* and the *erector* when reasonable attempts at proper handling and storage have been made.

## 7.17. Field Finishing

Neither the *fabricator* nor the *erector* is responsible for finishing field bolt heads and nuts, or field welds, nor to touch up abrasions of shop applied surface finish, nor to perform any other field finishing.

## 7.18. Final Cleaning Up

Upon the completion of erection and before final acceptance, the *erector* shall remove all of the *erector's* falsework, rubbish, and temporary buildings.

## SECTION 8. QUALITY CONTROL

### 8.1. General

8.1.1. The *fabricator* shall maintain a quality control program to ensure that the work is performed in accordance with the requirements in this Code, ANSI/AISC 370, and the *contract documents.*

8.1.2. The *erector* shall maintain a quality control program to ensure that the work is performed in accordance with the requirements in this Code, ANSI/AISC 370, and the *contract documents*. The *erector* shall be capable of performing the erection of the *structural stainless steel*, and shall provide the equipment, personnel, and management for the scope, magnitude, and required quality of each project.

8.1.3. When the *owner* requires more extensive quality control procedures or independent inspection by qualified personnel, this shall be clearly stated in the *contract documents*, including a definition of the scope of such inspection.

### 8.2. Inspection of Mill Material

Material test reports shall constitute sufficient evidence that the mill product satisfies material order requirements. The *fabricator* shall make a visual inspection of material that is received from the mill, but need not perform any material tests unless the *owner's designated representative for design* specifies in the *contract documents* that additional testing is to be performed at the *owner's* expense.

### 8.3. Nondestructive Testing

When nondestructive testing is required, the process, extent, technique, and standards of acceptance shall be clearly specified in the *contract documents*.

### 8.4. Independent Inspection

When inspection by personnel other than those of the *fabricator* and/or *erector* is specified in the *contract documents*, the requirements in Sections 8.4.1 through 8.4.6 shall be met.

8.4.1. The *fabricator* and the *erector* shall provide the *inspector* with access to all places where the work is being performed. A minimum of 24 hours notification shall be given prior to the commencement of work.

8.4.2. Inspection of shop work by the *inspector* shall be performed in the *fabricator's* shop to the fullest extent possible. Such inspections shall be timely, in-sequence, and performed in such a manner that will not disrupt fabrication operations and will permit the repair of nonconforming work prior to any required painting while the material is still in-process in the fabrication shop.

8.4.3. Inspection of field work shall be promptly completed without delaying the progress or correction of the work.

8.4.4. Rejection of material or workmanship that is not in conformance with the *contract documents* shall be permitted at any time during the progress of the work. However, this provision shall not relieve the *owner* or the *inspector* of the obligation for timely, in-sequence inspections.

8.4.5. The *fabricator*, *erector*, and *owner's designated representatives for design* and *construction* shall be informed of deficiencies that are noted by the *inspector* promptly after the inspection. Copies of all reports prepared by the *inspector* shall be promptly given to the *fabricator*, *erector*, and *owner's designated representatives for design* and *construction*. The necessary corrective work shall be performed in a timely manner.

8.4.6. The *inspector* shall not suggest, direct, or approve the *fabricator* or *erector* to deviate from the *contract documents* or the approved *approval documents*, or approve such deviation, without the written approval of the *owner's designated representatives for design* and *construction*.

## SECTION 9. CONTRACTS

### 9.1. Types of Contracts

9.1.1. For contracts that stipulate a lump sum price, the work that is required to be performed by the *fabricator* and the *erector* shall be completely defined in the *contract documents*.

9.1.2. For contracts that stipulate a price per pound (price per kilogram), the scope of work that is required to be performed by the *fabricator* and the *erector*, the type of materials, the character of fabrication, and the conditions of erection shall be based upon the *contract documents*, which shall be representative of the work to be performed.

9.1.3. For contracts that stipulate a price per item, the work that is required to be performed by the *fabricator* and the *erector* shall be based upon the quantity and the character of the items that are described in the *contract documents*.

9.1.4. For contracts that stipulate unit prices for various categories of *structural stainless steel*, the scope of work that is required to be performed by the *fabricator* and the *erector* shall be based upon the quantity, character, and complexity of the items in each category as described in the *contract documents*, and shall also be representative of the work to be performed in each category.

9.1.5. When an *allowance* for work is called for in the *contract documents* and the associated work is subsequently defined as to the quantity, complexity, and timing of that work after the contract is executed, the contract price for this work shall be adjusted by change order.

**Commentary:**
*Allowances*, if used, are not a true definition of the cost of work to be performed. By nature, an *allowance* is only an estimate and placeholder in the bid. Once the actual work is defined, the actual cost can be provided. It should be recognized that the actual cost can be higher or lower than the *allowance*. See Section 9.4.

*Allowances* required by the *contract documents* or proposed by the bidder should be as thoroughly defined as practicable as to the distinct nature of the work covered by the *allowance*, including whether the *allowance* is to include materials only, fabrication costs, and/or erection costs.

### 9.2. Calculation of Weights

Unless otherwise specified in the contract, for contracts stipulating a price per pound (price per kilogram) for fabricated *structural stainless steel* that is delivered and/or erected, the quantities of materials for payment shall be determined by the calculation of the gross weight of materials as shown in the *fabrication documents*.

**Commentary:**
The standard procedure for calculation of weights that is described in this Code meets the need for a universally acceptable system for defining "pay weights" in contracts based upon the weight of delivered and/or erected materials. These procedures permit the *owner* to easily and accurately evaluate price-per-pound (price-per-kilogram) proposals from potential suppliers and enables all parties to a contract to have a clear and common understanding of the basis for payment.

The procedure in this Code affords a simple, readily understood method of calculation that will produce pay weights that are consistent throughout the industry and that may be easily verified by the *owner*. While this procedure does not produce actual weights, it can be used by purchasers and suppliers to define a widely accepted basis for bidding and contracting for *structural stainless steel*. However, any other system can be used as the basis for a contractual agreement. When other systems are used, both the supplier and the purchaser should clearly understand how the alternative procedure is handled.

9.2.1. The weights shall be calculated based on the densities for the alloy family.

**Commentary:**
ANSI/AISC 370, Table User Note A3.1, is a source for these density values.

9.2.2. The weights of *structural stainless steel* shapes, plates, and bars shall be calculated on the basis of *fabrication documents* that show the actual quantities and dimensions of material to be fabricated, as follows:

(a) The weights of all *structural stainless steel* shapes shall be calculated using the nominal weight per ft (mass per m) and the detailed overall length.
(b) The weights of plates and bars shall be calculated using the detailed overall rectangular dimensions.
(c) When parts can be economically cut in multiples from material of larger dimensions, the weight shall be calculated on the basis of the theoretical rectangular dimensions of the material from which the parts are cut.
(d) When parts are cut from sections produced in standard lengths, leaving a length that is not useable on the same contract, the weight shall be calculated using the nominal weight per ft (mass per m) and the overall length of the section from which the parts are cut.
(e) Deductions shall not be made for material that is removed for cuts, copes, clips, blocks, drilling, punching, boring, slot milling, planing, or weld joint preparation.

9.2.3. The weights of items such as *anchor rods*, clevises, turnbuckles, sleeve nuts, recessed-pin nuts, cotter pins, and similar components shall be taken from the manufacturer's catalog and the manufacturer's shipping weight shall be used.

9.2.4. The weights of shop or field weld metal and protective coatings shall not be included in the calculated weight for the purposes of payment.

## 9.3. Revisions to the Contract Documents

*Revisions* to the *contract documents* shall be confirmed by change order or extra work order. Unless otherwise noted, the issuance of a *revision* to the *contract documents* shall constitute authorization by the *owner* that the *revision* is *released for construction*. The contract price and schedule shall be adjusted in accordance with Sections 9.4 and 9.5.

## 9.4. Contract Price Adjustment

9.4.1. When the scope of work and responsibilities of the *fabricator* and the *erector* are changed from those previously established in the *contract documents*, an appropriate modification of the contract price shall be made. In computing the contract price adjustment, the *fabricator* and the *erector* shall consider the quantity of work that is added or deleted, the modifications in the character of the work, and the timeliness of the change with respect to the status of material ordering, detailing, fabrication, and erection operations.

**Commentary:**
The fabrication and erection of *structural stainless steel* is a dynamic process. Typically, material is being acquired at the same time that the *approval documents* are being prepared. Additionally, the fabrication shop will normally fabricate pieces in the order that the *structural stainless steel* is being shipped and erected.

Items that are revised or placed on hold generally upset these relationships and can be very disruptive to the digital modeling, digital detailing, fabricating, and erecting processes. The provisions in Sections 3.5, 4.4.2, and 9.3 are intended to minimize these disruptions so as to allow work to continue. Accordingly, it is required in this Code that the reviewer of requests for contract price adjustments recognize this and allow compensation to the *fabricator* and the *erector* for these inefficiencies and for the materials that are purchased and the detailing, fabrication, and erection that has been performed, when affected by the change.

9.4.2. Requests for contract price adjustments shall be presented by the *fabricator* and/or the *erector* in a timely manner and shall be accompanied by a description of the change that is sufficient to permit evaluation and timely approval by the *owner*.

9.4.3. Price-per-pound (price per kilogram) and price-per-item contracts shall provide for additions or deletions to the quantity of work that are made prior to the time the work is *released for construction*. When changes are made to the character of the work at any time, or when additions and/or deletions are made to the quantity of the work after it is released for detailing, fabrication, or erection, the contract price shall be equitably adjusted.

## 9.5. Scheduling

9.5.1. The contract schedule shall state when the *design documents* will be *released for construction*, if the *design documents* are not available at the time of bidding, and when the job site, foundations, piers, and abutments will be ready, free from obstructions and accessible to the *erector*, so that erection can start at the designated time and continue without interference or delay caused by the *owner's designated representative for construction* or other trades.

9.5.2. The *fabricator* and the *erector* shall advise the *owner's designated representatives for design* and *construction*, in a timely manner, of the effect any *revision* has on the contract schedule.

9.5.3. If the fabrication or erection is significantly delayed due to *revisions* to the requirements of the contract, or for other reasons that are the responsibility of others, the *fabricator* and/or *erector* shall be compensated for the additional costs incurred.

## 9.6. Terms of Payment

The *fabricator* shall be paid for *mill materials* and fabricated product that is stored off the job site. Other terms of payment for the contract shall be outlined in the *contract documents*.

**Commentary:**
These terms include such items as progress payments for material, fabrication, erection, retainage, performance and payment bonds, and final payment. If a performance or payment bond, paid for by the *owner*, is required by contract, no retainage shall be required.

# SECTION 10. ARCHITECTURALLY EXPOSED STRUCTURAL STAINLESS STEEL

## 10.1. General Requirements

When members are specifically designated as *architecturally exposed structural stainless steel* or *AESSS* in the *contract documents*, the requirements in Sections 1 through 9 shall apply as modified in Section 10. Surfaces exposed to view of *AESSS* members and components shall be fabricated and erected with the care and dimensional tolerances that are stipulated in Sections 10.2 through 10.6.

**Commentary:**
The designation of *structural stainless steel* as *AESSS* adds cost, and that cost is higher as the level of the *AESSS* designation increases.

10.1.1. The following categories shall be used when referring to *AESSS*:

**AESSS 1:** Basic elements.
**AESSS 2:** Feature elements viewed at a distance greater than 20 ft (6 m).
**AESSS 3:** Feature elements viewed at a distance less than 20 ft (6 m).
**AESSS 4:** Showcase elements with special surface and edge treatment beyond fabrication.
**AESSS C:** Custom elements with characteristics described in the *contract documents*.

**Commentary:**
The categories are listed in the *AESSS* matrix shown in Table 10.1. Each category describes characteristics with successively more detailed—and costly— requirements.

- Basic elements in AESSS 1 are those that have workmanship requirements that exceed what would be done in non-AESSS construction.
- Feature elements in AESSS 2 and 3 exceed the basic requirements, but the intent is to allow the viewer to see the art of metalworking. AESSS 2 is achieved primarily through geometry without finish work, and treats elements that can be seen at a larger viewing distance, like enhanced treatment of bolts, welds, *connection* and fabrication details, and tolerances for gaps, copes, and similar details. AESSS 3 is achieved through geometry and basic finish work, and treats elements that can be seen at a closer viewing distance or are subject to touch by the viewer, with welds that are generally smooth but visible. AESSS 3 involves the use of a mock-up and acceptance is based upon the approved conditions of the mock-up.
- Showcase elements in AESSS 4 are those for which the designer intends that the form is the only feature showing in an element. All welds are ground and blended, edges are ground square and true. All surfaces are finished to a smoothness that doesn't catch on a cloth or glove. Tolerances of fabricated forms are more stringent—generally half of standard tolerance. AESSS 4 involves the use of a mock-up and acceptance is based upon the approved conditions of the mock-up.
- Custom elements in AESSS C are those with other requirements defined in the *contract documents*.

# TABLE 10.1
# AESSS Category Matrix

| Id | Characteristics | AESSS C<br>Custom Elements | AESSS 4<br>Showcase Elements | AESSS 3<br>Feature Elements in Close View | AESSS 2<br>Feature Elements Not in Close View | AESSS 1<br>Basic Elements | SSSS<br>Standard Structural Stainless Steel |
|---|---|---|---|---|---|---|---|
| 1.1 | Surface preparation and cleaning | | • | • | • | • | |
| 1.2 | Sharp edges ground smooth | | • | • | • | • | |
| 1.3 | Continuous weld appearance | | • | • | • | • | |
| 1.4 | Standard structural bolts | | • | • | • | • | |
| 1.5 | Weld spatters removed | | • | • | • | • | |
| 1.6 | Components protected for shipping and erection | | • | • | • | • | |
| 2.1 | Visual samples | | • | • | optional | | |
| 2.2 | One-half standard fabrication tolerances | | • | • | • | | |
| 2.3 | Fabrication marks not apparent | | • | • | • | | |
| 2.4 | Welds uniform and smooth | | • | • | • | | |
| 3.1 | Mill marks removed | | • | • | | | |
| 3.2 | Butt and plug welds ground smooth | | • | • | | | |
| 3.3 | HSS weld seam oriented for reduced visibility | | • | • | | | |
| 3.4 | Cross-sectional abutting surface aligned | | • | • | | | |
| 3.5 | Joint gap tolerances minimized | | • | • | | | |
| 3.6 | All welded connections | | optional | optional | | | |
| 4.1 | HSS seam not apparent | | • | | | | |
| 4.2 | Welds contoured and blended | | • | | | | |
| 4.3 | Visible faces are free of visible pits below the specified finish | | • | | | | |
| 4.4 | Weld show-through minimized | | • | | | | |
| C.1 | | | | | | | |
| C.2 | | | | | | | |
| C.3 | | | | | | | |

**User Note:**

1.1 Refer to Section 6.5 for shop cleaning requirements.
1.2 Rough surfaces are deburred and ground smooth. Sharp edges resulting from flame cutting, grinding, and especially shearing are softened.
1.3 Intermittent welds are made continuous by seal welding. Seams of hollow structural sections are acceptable as produced.
1.4 All bolt heads in *connections* are on the same side, as specified, and consistent from one *connection* to another.
1.5 Weld spatter, slivers, and surface discontinuities are removed. Weld projections up to 1/16 in. (2 mm) are acceptable for butt and plug welded joints.
1.6 Components wrapped with protective cover to prevent damage to finishes.
2.1 Visual samples are either a physical sample, a first-off inspection, a scaled mock-up, or a full-scale mock-up, as specified in the *contract documents*.
2.2 These tolerances are one-half of those for standard *structural stainless steel* as specified in this Code.
2.3 Members markings during the fabrication and erection process are not visible.
3.1 All mill marks are not visible in the finished product.
3.3 Seams are oriented away from view or as indicated in the *contract documents*.
3.4 The matching of abutting cross sections is required.
3.5 This characteristic is similar to 2.2 above. A clear distance between abutting members of 1/8 in. (3 mm) is required.
3.6 Hidden bolts may be considered.
4.1 HSS seams are treated so they are not apparent.
4.2 In addition to a contoured and blended appearance, welded transitions between members also are contoured and blended.
4.3 The steel surface imperfections are filled and sanded.
4.4 Weld show-through on the visible back side of a welded element can be minimized in the design of the welds and careful welding procedure. Weld show-through can be mitigated with grinding and refinishing on some surface finishes.
C. Additional characteristics may be added for custom elements. Surface finshes other than cleaned mill material must be included as part of the project specification.

10.1.2. A mock-up shall be required for AESSS 3 and 4. If a mock-up is to be used in other *AESSS* categories, it shall be specified in the *contract documents*. When required, the nature and extent of the mock-up shall be specified in the *contract documents*. Alternatively, when a mock-up is not practical, the first piece of an element or *connection* can be used to determine acceptability.

**Commentary:**
Generally, a mock-up is produced and approved in the shop and subsequently placed in the field. The acceptability of the mock-up can be affected by many factors, including distance of view, lighting, and finishing. The expectations for the location and conditions of the mock-up at time of approval should be defined in the *contract documents*.

## 10.2. Contract Documents

The following additional information shall be provided in the *contract documents* when *AESSS* is specified:

(a) Specific identification of members or components that are *AESSS* using the AESSS Categories listed in Section 10.1.1 and Table 10.1.
(b) Fabrication and/or erection tolerances that are to be more restrictive than provided for in this Appendix, if any.
(c) For AESSS Category C, the *AESSS* matrix included in Table 10.1 shall be used to specify the required treatment of the element.
(d) Any variations from the *AESSS* characteristics of Table 10.1.
(e) Any other special requirements for *AESSS* members and components, such as the orientation of HSS weld seams and bolt heads.

## 10.3. Approval Documents

All members designated as *AESSS* shall be clearly identified to a Category, either AESSS 1, 2, 3, 4, or C, in the *approval documents*. Tack welds, temporary braces, backing, and fixtures used in fabrication of *AESSS* shall be shown in the *fabrication documents*. Architecturally sensitive *connection* details shall be submitted for approval by the *owner's designated representative for design* prior to completion of the *approval documents*.

**Commentary:**
Variations, if any, from the *AESSS* Categories listed must be clearly noted. These variations could include machined surfaces, locally abraded surfaces, and forgings. In addition, if distinction is to be made between different surfaces or parts of members, the transition line/plane must be clearly identified/defined on the *approval documents*.

## 10.4. Fabrication

10.4.1. The *fabricator* shall handle the *structural stainless steel* with care to avoid marking, contaminating, or distorting the *structural stainless steel* members:

(a) Slings shall be synthetic material such as nylon or polyester.
(b) Care shall be taken to minimize damage to any finished faces, edges, or features.
(c) When temporary braces or fixtures are required during fabrication or shipment, or to facilitate erection, care shall be taken to avoid blemishes, contamination from *free iron*, or unsightly surfaces resulting from the use or removal of such temporary elements.
(d) Tack welds not incorporated into final welds shall be treated consistently with requirements for final welds.
(e) All backing exposed to view and runoff tabs shall be removed and the welds ground smooth.
(f) All bolt heads in *connections* shall be on the same side, as specified, and consistent from one *connection* to another.

10.4.2. Members fabricated of unfinished *structural stainless steel* that are to be *AESSS* may still have erection marks on surfaces in the completed structure. Special requirements, if any, shall be specified as Category AESSS C.

10.4.3. The permissible tolerances for member depth, width, out-of-square, and camber and sweep shall be as specified in the references found in ANSI/AISC 370. The following exceptions apply:

(a) For Categories AESSS 3 and 4, the matching of abutting cross sections shall be required.

10.4.4. For curved structural members, the as-fabricated variation from the theoretical curvature shall be less than or equal to the standard camber and sweep tolerances permitted for straight members in the applicable ASTM or AWS standards.

**Commentary:**
The curvature tolerance for curved *AESSS* members is not reduced from that used for curved non-*AESSS* members because curved members have no straight line to sight and the resulting deviations are therefore indistinguishable. See also the Commentary to Section 6.4.2.

10.4.5. The tolerance on overall profile dimensions of welded *built-up sections* and *built-up members* shall meet the requirements in AWS D1.6/D1.6M. For Categories AESSS 2, 3, and 4, the as-fabricated straightness tolerance for the member as a whole shall be one-half of that specified in AWS D1.6/D1.6M.

10.4.6. For Categories AESSS 3 and 4, copes, miters, and cuts in surfaces exposed to view shall have a gap that is uniform within ⅛ in. (3 mm), if shown to be an open joint. If instead the joint is shown to be in contact, the contact shall be uniform within 1⁄16 in. (2 mm).

10.4.7. Unless otherwise noted in the *contract documents*, for Categories AESSS 1, 2, and 3, the surface condition of the *structural stainless steel* given in the ASTM or AWS standards for the shape used shall be acceptable as the base for final graining or abrasive finishing. For Category AESSS 4, surface imperfections shall be weld filled and sanded to meet the acceptance criteria established with the mock-up required in Section 10.1.2.

10.4.8. For Categories AESSS 1, 2, and 3, welds shall meet AWS D1.6/D1.6M requirements, except that (a) weld spatter exposed to view, if any, shall be removed, and (b) all heat staining shall be removed in accordance with ASTM A380/A380M. For Category AESSS 4, welds shall be contoured and blended, and spatter and heat staining exposed to view shall be removed in accordance with ASTM A380/A380M.

10.4.9. For Categories AESSS 1 and 2, weld projection up to 1⁄16 in. (2 mm) is acceptable for butt and plug welded joints. For Categories AESSS 3 and 4, welds shall be ground smooth or weld filled.

10.4.10. For Categories AESSS 1, 2, and 3, *weld show-through* shall be acceptable as produced. For Category AESSS 4, the *fabricator* shall minimize the *weld show-through*.

**Commentary:**
*Weld show-through* is a visual indication of the presence of a weld or welds on the opposite surface from the viewer. It is a function of weld size and material thickness and cannot be eliminated in thin material with thick welds. When *weld show-through* is a concern, this should be addressed in the mock-up.

10.4.11. *AESSS* shall be prepared as follows:

(a) All surface contaminants, including grease or oil, embedded iron, or other substances, if any is present, shall be removed by solvent cleaning to meet the requirements of SSPC-SP 1 and meet the passivation requirements of ASTM A967/A967M.
(b) Weld spatter, slivers, and similar surface discontinuities shall be removed.
(c) Sharp corners resulting from shearing, flame cutting, or grinding shall be eased.

10.4.12. For Categories AESSS 1 and 2, seams of hollow structural sections shall be acceptable as produced. For Category AESSS 3, seams shall be oriented as specified in the *contract documents*. For Category AESSS 4, seams shall be treated so they are not apparent.

## 10.5. Delivery of Materials

The *fabricator* shall use special care to avoid surface contamination, bending, twisting, or otherwise distorting *AESSS*. All tie-downs on loads shall be synthetic material such as nylon or polyester to avoid damage to edges and surfaces of members. The standard for acceptance of delivered and erected members shall be equivalent to the standard employed at fabrication.

## 10.6. Erection

The *erector* shall use special care in unloading, handling, and erecting *AESSS* to avoid contamination, marking, or distorting the *AESSS*. The *erector* shall plan and execute all operations in such a manner that allows the architectural appearance of the structure to be maintained:

(a) Slings shall be synthetic material such as nylon or polyester.
(b) Care shall be taken to minimize damage to any exposed surface.
(c) When temporary braces or fixtures are required to facilitate erection, care shall be taken to avoid any contamination, blemishes, holes, or unsightly surfaces resulting from the use or removal of such temporary elements.
(d) Tack welds not incorporated into final welds shall be ground smooth.
(e) All backing exposed to view and runoff tabs shall be removed and the welds ground smooth.
(f) All bolt heads in *connections* shall be on the same side, as specified, and consistent from one *connection* to another.
(g) For Category AESSS 4, open holes shall be filled with weld metal and smoothed by grinding to the standards applicable to the shop fabrication of the materials.
(h) Any surface contamination shall be removed in accordance with ASTM A967/A967M.


**Smarter. Stronger. Steel.**

American Institute of Steel Construction
130 E Randolph St, Ste 2000
Chicago, IL 60601
312.670.2400 | www.aisc.org

A313-21