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# Certification Standard for Steel Fabrication and Erection, and Manufacturing of Metal Components

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December 5, 2016



Supersedes the  
*Standard for Steel Building Structures* (AISC 201-06)  
*Standard for Bridge and Highway Metal Component Manufacturers* (AISC 204-08)  
*Standard for Steel Bridges* (AISC 205-11)  
*Standard for Structural Steel Erectors* (AISC 206-13)

Approved by the Certification Standards Committee



**AMERICAN INSTITUTE OF STEEL CONSTRUCTION**  
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AISC 207-16  
*Revised November 2017*

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## PREFACE

This Preface is not a part of AISC 207-16, *Certification Standard for Steel Fabrication and Erection, and Manufacturing of Metal Components*. It is intended for informational purposes only.

This Standard is the result of the deliberations of a balanced committee, the membership of which included engineers, fabricators, erectors, quality control consultants, a code official, a state bridge official, and a general contractor. This Standard is proprietary and has been created for the sole use of the AISC Certification Program as part of its policies and procedures for auditing and certification.

This Standard brings together provisions from four individual predecessor standards relating to the four industry segments: steel building fabrication (Chapter 2), metal component manufacturing (Chapter 3), steel bridge fabrication (Chapters 4, 4.I, 4.A, and 4.F), and steel erection (Chapter 5) that have been a part of the AISC Certification Program since its beginnings in 1975. Chapter 1 provides general requirements that apply to the four industry segments and Chapters 2, 3, 4, 4.I, 4.A, 4.F and 5 contain supplementary requirements in addition to those in Chapter 1. This revision of the standard includes editorial changes to the chapter and section headings intended to facilitate implementation of the standard.

The Committee thanks Seth Bransky for his contribution as a member of the Committee for part of this cycle.

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*Certification Standard for Steel Fabrication and Erection, and Manufacturing of Metal Components*

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AMERICAN INSTITUTE OF STEEL CONSTRUCTION

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# GLOSSARY

The terms listed below are to be used in addition to those in the AISC *Code of Standard Practice for Steel Buildings and Bridges*, hereafter referred to as the *Code of Standard Practice*; some commonly used terms are repeated here for convenience and marked with an †.

**AASHTO.** The American Association of State Highway and Transportation Officials.

**AISC.** † American Institute of Steel Construction.

**Approval documents.** † The *structural steel shop drawings*, erection drawings, and embedment drawings, or, where the parties have agreed in the *contract documents* to provide digital model(s), the fabrication and erection models. A combination of drawings and digital models also may be provided.

**Approved construction documents.** Those *construction documents* approved by the building official as part of the building permit issuance process.

**AREMA.** † The American Railway Engineering and Maintenance of Way Association.

**ASNT.** The American Society for Nondestructive Testing.

**Assembly.** Two or more *components* joined to make a part or product that can be the final item or that join to other *components*. Joining methods include welding, bolting, pressure fit, molding and adhesion.

**ASTM.** † American Society for Testing and Materials.

**AWS.** † American Welding Society.

**Checker.** A person in a *detailing* organization who, because of experience and ability, has advanced successfully to a position of responsibility with the ability to perform the final verification of *shop drawings* without direct supervision.

**Checking** (of *shop drawings*, digital models, and *erection drawings*). A detailed review of all sketches and dimensions on shop drawings, digital models, and *erection drawings* by a qualified *checker* other than the original *detailer*. *Checking* will compare the shop drawings, digital models, and *erection drawings* to project requirements that include, but are not limited to:

- (a) Geometry
- (b) Use of the correct connections
- (c) Proper notes
- (d) Proper material usage
- (e) Assignment of complete welding symbols
- (f) Proper coatings and preparation
- (g) Proper representation on erection drawings, including the notation of any necessary instructions and depiction of details necessary to conduct the work in the field

**Coating.** Coatings may include paint, powder coatings, galvanizing, metalizing, Teflon, and electro-deposited metals.

*Component.* A bridge- or transportation-related item that *contract documents* stipulate to be obtained from an AISC Certified Bridge and Highway Metal Component Manufacturer and that is not covered by the AISC Bridge Fabricator Certifications. A *component* may be entirely produced by the *manufacturer*, or comprised of subassemblies and parts from *subcontractors* and *suppliers*, assembled by the *manufacturer*. A finished *component* may ship as a single piece or multiple elements, and may require field *assembly* or adjustment, based upon installation instructions provided by the *manufacturer*.

*Construction documents.* Written, graphic and pictorial documents prepared or assembled for describing the design (including the structural system), location, and physical characteristics of the elements of a building necessary to obtain a building permit and construct a building. See also *approved construction documents*.

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

*Corrective action.* The action or actions undertaken to identify and eliminate the root cause of a service or process *nonconformance* to prevent its recurrence. *Corrective action* is not the *repair* or *rework* of identified nonconforming product or process to meet specified requirements.

*Corrective measure.* The measure taken to bring a nonconforming product or process into conformance with specified requirements.

*Customer furnished material.* Material or products that the *fabricator*, *erector* or *manufacturer* receives from the customer directly for incorporation into their work.

*Detailer.* See *steel detailer*.

*Detailing.* The function that produces *shop drawings*, digital models, and *erection framing* (or installation) drawings from *contract documents*.

*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 limited to, plans, elevations, sections, details, schedules, diagrams and notes.

*Documentation (documented).* Material that provides information or evidence. *Documentation* may include written instructions, drawings, diagrams, charts, photographs, electronic media, *specifications*, and references to or excerpts from appropriate technical standards and codes.

*Documented procedure.* A *procedure* that is established, *documented*, implemented and maintained. The *documentation* provides information about how to perform an activity or process consistently. *Documentation* shall contain:

- (a) The purpose of the *procedure*
- (b) Process definition that includes steps required for completion
- (c) Assignment of responsibility for performance
- (d) Assignment of responsibility for review, revision, and/or approval of the *procedure*
- (e) Identification of records that are generated
- (f) For inspection activities, frequency of observations or inspections and how those observations or inspections are *documented*

*Documented training.* Training in which there is a record of the course outline, a record of who attended, the date it was given, and the instructor who provides the *training*.

*Erection.* The process of assembling individual members into a *structural steel* building or bridge in accordance with all *contract documents*.

*Erection drawings.*† Field-installation or member-placement drawings that are prepared to show the location and attachment of the individual shipping pieces.

*Erection plan.* The *documentation* of major resources and activities anticipated to be needed in performance of the work as it is affected by the conditions and requirements of one singular project.

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

*Executive management.* The highest ranking official(s) in the company, e.g., CEO, President, General Manager, *Owner*, etc. *Executive management* has full authority in final decision making for all aspects of the *quality management system* and *safety management system*.

*Fabrication.* The process of preparation and *assembly* of individual parts into a shipping piece in accordance with all *contract documents*. *Fabrication* includes all production operations performed in the manufacturing and shipping of the product (e.g., *assembly*, drilling, sawing, milling, and thermal and mechanical cutting).

*Fabricator.*† The entity that is responsible for detailing (except in Section 4.5 of the *Code of Standard Practice*) and fabricating the *structural steel*.

*Installation drawings.* Field-installation or member placement drawings that are prepared by the *manufacturer* to show the location and attachment of the individual manufactured components.

*Key position.* *Executive management* and positions in the *fabricator's*, *manufacturer's* or *erector's quality management system* that manage *detailing*, purchasing, quality assurance, quality control, *fabrication* processes, *erection*, project management, and the *erector's* safety functions.

*Management systems.* See *safety management system* and *quality management system*.

*Manufacture (manufacturing, manufactured).* The process of designing, producing, testing and assembling components by the *manufacturer*.

*Manufacturer.* The entity that *manufactures components*.

*MTR.* Mill test report as defined in Section 14 of ASTM A6.

*Nonconformance.* Attributes of materials, consumables, fabricated or *manufactured* product (in-process or final), erected members, or processes that do not meet contract, regulatory, or internally defined requirements.

*NDT.* Nondestructive testing (nondestructive examination).

*Objective evidence.* Data supporting the existence or verification of something. Records, statements of fact, or other information that are relevant to the audit criteria and verifiable. In this context, it is evidence of whether the *quality management system* is functioning properly. *Objective evidence* may be obtained through:

- (a) Observation of the performance of a task or physical products
- (b) Measurements

- (c) Tests
- (d) Review of a record, document or procedure
- (e) The result of an interview with one or more employees about their duties or performance of a task

*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 steel* frame. This is usually the *structural engineer of record*.

*Procedure*. See *documented procedure*.

*PQR*. Procedure Qualification Record as defined by AWS A3.0M/A3.0.

*Quality assurance (QA)*. Monitoring and inspection tasks performed by an agency or firm other than the *fabricator*, *erector* or *manufacturer* to ensure that the material provided and work performed by the *fabricator*, *erector* and *manufacturer* meet the requirements of the approved *construction documents* and referenced standards. For buildings, *quality assurance* includes those tasks designated “special inspection” by the *applicable building code*. In certain circumstances, the building official may accept QC inspection for QA inspection. Some documents used in the steel bridge industry define “QA” as the quality verification activities carried out by the *owner*.

*Quality assurance inspection records*. Records pertaining to third-party *quality assurance* functions that are submitted to building officials and others.

*Quality control (QC)*. Controls and inspections implemented by the *fabricator* or *erector*, as applicable, to ensure that the material provided and work performed meet the requirements of the *approved construction* documents and referenced standards.

*Quality control records*. Documents that report the results of inspections mandated by the *documented procedures* and the *contract documents*.

*Quality manual*. A document stating the quality policy and describing the *quality management system*.

*Quality management system*. A system to establish policy, objectives, plans and resources to direct and control an organization with regard to quality.

*Quality record*. A document that provides *objective evidence* of activities performed or results achieved.

*RCSC*: † Research Council on Structural Connections.

*Repair*. Action taken on a nonconforming product to make it acceptable for the intended use.

*Registered design professional*. An individual who is registered or licensed to practice his/her respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

*Released for fabrication.* Status of the work as described in Section 4 of the *Code of Standard Practice*.

*Rework.* Action taken on a nonconforming product to make it conform to the requirements.

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

*Safety management system.* A system to establish policy, goals, plans and resources to identify and document hazards and their elimination, mitigation or isolation related to the safety and health of employees and third parties, and to eliminate property and equipment damage that may be caused by unsafe acts or unsafe conditions. *Safety management systems* only apply to *erectors*.

*Safety manual.* A document stating the safety policy and describing the *safety management system* of the *erector's* organization.

*Safety plan.* The identification and *documentation* of specific hazards related to a singular project and the means and methods to be used to eliminate, mitigate or isolate those hazards.

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

*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.

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

*Structural engineer of record.*† The licensed professional who is responsible for sealing the *contract documents*, which indicate 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. See also *registered design professional*.

*Structural steel.*† Elements of the structural frame as given in Section 2.1 of the *Code of Standard Practice*.

*Structural steel buildings and other structures.* Buildings and other structures designed, fabricated and erected in accordance with the AISC *Specification for Structural Steel Buildings*. See AISC *Specification* Section A1.

*Subcontractor.* A firm that performs a portion of the *fabricator's*, *manufacturer's* or *erector's* contract work, such as *fabrication*, *erection*, *detailing*, *coating* application, inspection or consulting services.

*Supplier.* A firm that supplies materials (including, but not limited to, mill materials, process supplies, welding consumables, *coatings* and process machinery) and completed purchased product (including, but not limited to, fasteners, decking, joists and proprietary buy-out items) needed to fulfill the contract requirements.

*Training.* See *documented training*.

*WPS.* Welding procedure specification as defined by AWS A3.0M/A3.0.

# CHAPTER 1

## GENERAL REQUIREMENTS

### 1.1. PURPOSE

The purpose of this Standard is to confirm to *owners*, the design community, the construction industry, and public officials that those who adhere to the requirements in this Standard have the personnel, organization, experience, *documented procedures*, knowledge, equipment and commitment to:

- (a) produce fabricated steel to the quality required for *structural steel buildings and other structures*, or
- (b) produce *components* to the quality required for bridge and highway construction, or
- (c) produce fabricated steel to the quality required for steel highway or railroad bridge construction, or
- (d) erect fabricated steel to the quality required for *structural steel buildings and other structures*, steel highway or railroad bridge construction.

### 1.2. SCOPE

The requirements in this Standard shall apply as follows:

- (a) Chapters 1 and 2 shall apply to Building Fabricators, who fabricate and supply the structural steel frames for buildings.
- (b) Chapters 1 and 3 shall apply to Metal Component Manufacturers, who manufacture components that include bracing not designed for primary loads (diaphragms, cross frames and lateral bracing); camera, light, sign and signal support structures; bridge rail; stairs; walkways; grid decks; drains; scuppers; expansion joints; bearings; ballast plates; and mechanical movable bridge equipment. Manufacturers of camera, light, sign and signal support structures; high mast light towers; bridge rail; complex expansion joints; high load multi-rotational (HLMR) bearings; and mechanical movable bridge equipment shall also be required to meet specific supplemental requirements to this Standard.
- (c) Chapters 1 and 4 shall apply to Bridge Fabricators, who fabricate and supply steel highway or railroad bridges.
- (d) Chapters 1 and 5 shall apply to Erectors.

In Chapters 2 through 5, only those subsections that are supplementary to Chapter 1 are indicated.

The Glossary is an integral part of this Standard. Nonmandatory Commentaries are provided for background, and the user is encouraged to consult them.

### 1.3. REFERENCES

The reference documents and standards necessary to make personnel aware of work requirements shall be consistent with the requirements of existing *contract documents* and shall be readily available to those who need them.

The ability to work to and meet the requirements of the latest edition of the following documents shall be demonstrated:

- (a) ANSI/AISC 303 *Code of Standard Practice for Steel Buildings and Bridges*
- (b) RCSC *Specification for Structural Joints Using High-Strength Bolts*
- (c) AISC 503 *Selected ASTM Standards for Structural Steel Fabrication*, or equivalent
- (d) AWS A2.4 *Symbols*
- (e) AWS A3.0M/A3.0 *Terms and Definitions*
- (f) AWS D1.1/D1.1M *Structural Welding Code—Steel*

### 1.4. DEFINITIONS

Definitions for terms in the body of this Standard printed in italics are defined in the Glossary. Acronyms for professional organizations are not italicized in the text but are included in the Glossary.

As used in this Standard, the words **shall** or **will** denote a mandatory requirement. The word **should** denotes a guideline or recommendation. The words **may** or **can** denote an opportunity to make a choice.

### 1.5. MANAGEMENT RESPONSIBILITY

#### 1.5.1. Policy for Quality

*Executive management* shall ensure that the policy for quality is understood, implemented and maintained. The policy for quality shall include:

- (a) A commitment to quality that includes a commitment to meet the requirements in *contract documents*.
- (b) A *quality management system* that provides a framework for establishing, communicating and reviewing quality goals.

*Executive management* shall establish goals to improve quality. Goals shall be measurable and *documented* through *objective evidence*. As quality goals are achieved, new goals shall be set that demonstrate commitment to continuous improvement.

**Commentary:** New quality goals can be a new level of achievement of a previous goal, or a new goal that has not been previously identified.

### 1.5.2. Periodic Management Review

*Executive management* shall conduct periodic review of the *quality management system* at planned intervals, but annually at a minimum. Management review shall encompass, assess and report the following, at a minimum:

- (a) A summary of previous management reviews.
- (b) Results of any internal and external audits conducted since the previous management review.
- (c) An assessment of customer feedback and feedback mechanisms, identifying opportunities for improving quality.
- (d) An assessment of product or work *nonconformances*. Both the number and severity of *nonconformances* shall be assessed.
- (e) An assessment of process *nonconformances*, including compliance with the *documented procedures* comprising the *quality management system*.
- (f) An assessment of the effectiveness of the *corrective actions* taken.
- (g) An assessment of the results of equipment inspections, including the adequacy of equipment resources.
- (h) An assessment of the adequacy of the *training* program with respect to the levels of qualification required as appropriate.
- (i) An assessment of any proposed or required modifications to the *quality management system*.

The management review record shall include the decisions and actions required for implementation of:

- (a) Improvement of the effectiveness of the *quality management system* and its processes
- (b) Improvement of product quality
- (c) Resource needs

Records from management reviews shall be maintained according to the record retention policy.

### 1.5.3. Responsible Quality Personnel

*Executive management* shall designate a management representative for quality who shall report directly to (or be a part of) *executive management*. The designated management representative for quality may perform other functions within the company, provided that those functions do not conflict with the quality responsibilities. The designated management representative(s) shall have the ability, responsibility and authority to:

- (a) Ensure that *documented procedures* needed for the *quality management systems* are established, implemented and maintained in accordance with this Standard.
- (b) Report to *executive management* on the performance of the *quality management system* and any need for improvement.
- (c) Communicate with external parties on matters relating to the *quality management system*.

#### 1.5.4. Resource Management

Resources necessary to comply with the *contract documents* shall be available. Resources shall include, but are not limited to, the resources described in the following. Personnel performing defined functions shall have the required qualifications and the ability to successfully perform the function.

**Commentary:** *Objective evidence* of qualification may be demonstrated through biographies, resumes, *documented training*, and individual licenses or certifications. Personnel may be assigned to more than one function, provided they are qualified and able to perform fully the duties of each position.

**User Note:** See Sections 2.5.4, 3.5.4, 4.5.4, 4.I.5.4 and 5.5.4 for nonpersonnel industry-specific resource requirements.

#### 1.5.5. Quality Management System

The *quality management system* shall satisfy all of the requirements of this Standard and the requirements of the *contract documents* and referenced standards. The *quality management system* shall include a *quality manual*, *documented procedures* and records as required by this Standard.

**Commentary:** The extent of the *quality management system documentation* can differ from one organization to another due to the size of organization, the type of activities, and the complexity and interaction of processes. Requirements may be satisfied in a single document called the *quality manual* that may incorporate separate documents by reference.

#### 1.5.6. Internal Communication

*Executive management* shall ensure that appropriate communication processes are established and that communication takes place on a regular basis regarding the effectiveness of management systems.

#### 1.5.7. Quality Manual

The *quality manual* shall include a page showing the current revision date and the name and location of the facility or organization.

The *quality manual* shall include or incorporate by reference the following documents at a minimum:

- (a) *Documented* statements of a quality policy and quality objectives as required by this Standard.
- (b) *Documented procedures* established for the *quality management system* (or references to them), along with their associated *quality records*.

- (c) Documents needed by the organization to ensure the effective planning, operation and control of its processes.
- (d) Organizational chart describing the interrelationship of functional positions that manage, perform and verify work affecting quality.
- (e) Job descriptions outlining responsibilities, authority and required qualifications for *key positions*.
- (f) Qualification evidence for individuals in *key positions/functions*.
- (g) Equipment list.
- (h) Facility plan (not applicable to *erectors*).

*Executive management* shall define additional *documented procedures*, drawings or other documents that are required beyond the minimum requirements set by this Standard to meet the needs of the organization and its customers.

The highest ranking member of *executive management* shall sign and date the *quality manual*.

**Commentary:** *Executive management* determines the level of detail in the *quality manual* and procedures. At a minimum, these documents should be detailed enough to adequately describe the *quality management system* used to assure the end work meets the required quality.

## 1.6. CONSTRUCTION DOCUMENT REVIEW AND COMMUNICATION

A *documented procedure* shall be developed for contract and project *specification* review. The procedures shall require these reviews for each project, and the review shall begin no later than the acceptance of responsibility for performing the work.

**Commentary:** Ideally, the review should begin during the project estimation or bid process.

The review should identify, plan for and record the specific project requirements. The *documented procedure* should provide for review of the *contract documents* and referenced standards to ensure awareness of the contract requirements.

Evidence of contract review may take the form of technical summaries, sign-offs, schedules, change orders, and allocation of adequate resources, as well as development of an *erection plan* and a *safety plan* as applicable. Such evidence should indicate consideration of pertinent Sections of this Standard and other critical project requirements that, if missed, will have a major impact on project quality.

## 1.7. DETAILING

Section 1.7 does not apply to *erectors*.

### 1.7.1. Detailing Standards

The *fabricator* or *manufacturer* shall prepare and use *detailing* standards describing technical preferences and requirements. These standards shall show special information required on advance bills such as allowances for cuts, camber, or supplementary requirements. The *detailing* standards shall include how bills of material are prepared which, at a minimum, include:

- (a) Sizes and quantities
- (b) Appropriate *specification* references
- (c) Special ordering information
- (d) Any allowances or tolerances

The *detailing* standards shall describe the *fabricator's* or *manufacturer's* methods of drawing layout, including, but not limited to:

- (a) Sections and views.
- (b) Title block information.
- (c) The method of designating shipping sequences.
- (d) The piece marking system.
- (e) Commonly used shop abbreviations.
- (f) *Fabricators*: Showing bolt placement lists (including bolt type and installation requirements).
- (g) *Fabricators*: Information required on weld symbols including any special *NDT* requirements.
- (h) *Manufacturers*: If applicable, illustrate information to be included on weld symbols and the preferred way to designate surface preparation and *coating* requirements.
- (i) *Fabricators*: The *detailing* standards shall describe the method for:
  - (i) Selection of connection type, connection geometry and connection material.
  - (ii) *Detailing* holes, fasteners, washers, cuts and copes.
  - (iii) Assignment of appropriate welding symbols (shop and field welds).
  - (iv) Selecting bolt installation method (for shop-installed bolts).
  - (v) Showing surface preparation (including *specification* of surface finish).
  - (vi) Designating *coating* requirements (including *coating* materials and dry film thickness).
  - (vii) Showing any necessary special instructions to fabricate and erect the steel.

### 1.7.2. Checking

The *fabricator* or *manufacturer* shall develop a *documented procedure* to provide for *checking* of all shop, installation and *erection* framing drawings and to describe the method used to release *shop drawings* for *fabrication*. The *documented procedure* for *checking* of shop and *erection* framing drawings and *installation drawings* shall describe the method used by the *fabricator*, *manufacturer* or its *subcontractor*

to perform and record the final check of drawings to ensure compliance with *contract documents* before release. Records shall provide means for identification of the individual *checker* who performed the final check of each drawing.

For computer-generated *shop drawings* and digital models, the *documented procedure* shall identify the data, variables, graphics, calculating formulas, and other output that are checked to determine that the software is functioning correctly, and shall include provisions for verifying accuracy of input.

When *detailing* is performed by a *subcontractor*, the *documented procedure* shall define the extent of review required by management and the extent of *checking* required of received *detailing* products before release.

The *documented procedure* for *checking shop drawings*, digital models, and *erection* framing drawings shall include comparing those documents and models to project requirements that include at a minimum:

- (a) Geometry
- (b) Use of the correct connections
- (c) Proper notes
- (d) Proper material usage
- (e) Assignment of complete welding symbols
- (f) Proper *coatings* and preparation
- (g) Proper representation on *erection* framing drawings, including the notation of any necessary instructions and depiction of details necessary to conduct the work in the field

### 1.7.3. Approval of Approval Documents and Release for Fabrication

A *documented procedure* shall be developed for the approval of *approval documents*, and shall describe the method used to document *owner* approval of *approval documents released for fabrication*, whether produced in-house or through a *subcontractor*.

**Commentary:** Such methods may include signatures, stamps, logs, files or lists.

See the *Code of Standard Practice* for an elaboration of the process of approval of *approval documents*.

### 1.7.4. Shop Drawings Supplied by Others

When the *fabricator* or *manufacturer* receives *shop drawings* from others (i.e., the *owner* or an outside entity), a *documented procedure* shall define the method of receipt, revision and control of those drawings.

**Commentary:** Refer to *Code of Standard Practice* Section 4.5 for further elaboration.

### 1.7.5. Management of Detailing

The *fabricator's* or *manufacturer's* staff shall manage *detailing*. Responsibilities for *detailing* management shall include:

- (a) Overseeing the production of shop and *erection drawings*, including the work of *subcontractors*
- (b) Communicating with *owners'* representatives for design
- (c) Scheduling
- (d) Developing and maintaining company *detailing* standards and *documented detailing procedures*
- (e) Transmittals related to obtaining approval from the *owner's designated representative for design or construction*
- (f) Coordinating and incorporating construction requirements
- (g) *Training* of employed *detailers* and *checkers*

Qualification requirements for *detailing* management personnel shall include experience in *detailing* and *checking* shop and *erection* framing drawings that have been approved for a variety of structures representative of projects the *fabricator* or *manufacturer* provides.

The *fabricator* or *manufacturer* shall determine and describe methods to demonstrate competence of *detailing* management personnel.

*Detailing* management shall be familiar with the requirements of pertinent codes and *specifications*.

### 1.7.6. Detailing Functions

Personnel who perform *detailing* or *checking* of shop, manufacturing and *erection drawings* shall have experience in drawing projects similar to the projects the *fabricator* or *manufacturer* provides and shall have knowledge of applicable material *specifications* and of mill rolling practices as they affect the *detailing* of *structural steel*.

*Detailers* in *training* shall work under the supervision of a trained *detailer* or *checker*.

A qualified *checker* shall check all drawings before release for *fabrication*. Qualification requirements for *checkers* shall be defined and *documented* and include *training* and experience in connection selection. Demonstrated competency of employed and subcontracted individuals performing final checks shall be *documented* by *detailing* management.

**Commentary:** Detailers and checkers should be assigned on the basis of qualification, evidenced by experience, training and education. Qualification standards and certifications granted by recognized industry organizations, such as the National Institute of Steel Detailing, Inc. (NISD), can be used as a basis for qualification.

### 1.7.7. Subcontract Services

*Subcontractors* may be used for the following functions: *detailing*, connection shop standards, delegated connection design as applicable; *checking* of shop, *manufacturing*, and *erection drawings*; and *training* of *detailers* and *checkers*. The *fabricator* or *manufacturer* shall define and document the qualification and selection process for choosing *subcontractors*.

## 1.8. CONTROL OF MANAGEMENT SYSTEM DOCUMENTS AND PROJECT DOCUMENTS

### 1.8.1. Management System Documents

A *documented procedure* shall be developed to control *quality management system* documents.

#### 1.8.1.1. Quality Management System Documents

Documents covered by this Section shall include, but not be limited to, the *quality manual*, the *safety manual* as applicable, and any *documented procedures*.

#### 1.8.1.2. Review and Approval

Documents shall be reviewed and approved by the same function and authority level that authorized the original document.

The function and authority levels that have responsibility for review and approval of internal standards and *documented procedures* shall be designated. Revisions to the *quality manual* and other *quality management system* documents shall be reviewed for adequacy and approved by the same function and authority level that authorized the original document.

The *documented procedure* for document and data control shall describe the frequency and requirements for review and updating, and establish a method to identify changes.

#### 1.8.1.3. Revision Control

Revisions shall be clearly identifiable and there shall be a method for monitoring and identifying the latest revision.

Revisions shall be reviewed for adequacy and approved by the same function and authority level that authorized the original document.

Documents shall remain legible and easily identifiable.

#### **1.8.1.4. Access**

Documents shall be available and readily accessible to all personnel responsible for performing functions affecting the quality of the completed work.

#### **1.8.1.5. Communication**

Changes and revisions shall be clearly communicated to all personnel responsible for performing functions affecting the quality of the completed work.

### **1.8.2. Project Documents**

A *documented procedure* shall be developed to control project documents. Documents covered by this Section shall include, but not be limited to, *contract documents*, revised *contract documents*, *shop drawings*, *erection drawings*, *RFIs*, and any *quality assurance* documents received.

#### **1.8.2.1. Tracking**

*Contract documents* and changes to the *contract documents*, including, but not limited to, revised *contract documents*, change orders, and *RFIs*, shall be tracked.

Tracking information shall indicate, at a minimum, date of receipt, summary of issue, and ultimate disposition of the change, including distribution of the final decision to the appropriate parties.

The *documented procedure* shall define methods for receipt and *documentation* of *owner* and general contractor requirements and *fabricator*-originated changes as they occur throughout the *fabrication* and *detailing* process. Requirements may be received in original *contract documents*; in subsequent telecommunications, letters, transmittals related to product requirements; and in change orders or contract addenda.

The *documented procedure* shall require records (e.g., logs, files or master lists) that show receipt of change data, incorporation, issue, and distribution of approved and revised approval documents to all necessary departments and personnel at the *fabricator*'s facility and necessary external organizations, *subcontractors* or *suppliers*.

#### **1.8.2.2. Revision Control**

For project documents that the fabricator, erector or manufacturer produces, revisions shall be clearly identifiable and there shall be a method for monitoring and identifying the latest revision.

The *documented procedure* shall include provisions to prevent inadvertent use of obsolete documents.

Documents shall remain legible and easily identifiable.

### 1.8.2.3. Access

Documents shall be available and readily accessible to all personnel responsible for performing functions affecting the quality of the completed work.

### 1.8.2.4. Communication

Changes and revisions shall be clearly communicated to all personnel responsible for performing functions affecting the quality of the completed work.

## 1.9. MAINTENANCE OF QUALITY RECORDS

A *documented procedure* shall be developed for the maintenance of *quality records* that provide for record identification, collection, storage and retrieval, retention, and disposition.

**Commentary:** *Quality records* commonly include items such as:

- (a) Certificates of conformance
- (b) *Corrective action* requests
- (c) Drawing logs
- (d) Equipment maintenance records
- (e) Inspection records
- (f) Internal and external *quality management system* and *safety management system* audits
- (g) Mill and consumable purchase orders
- (h) *MTRs*
- (i) *NDT* reports
- (j) Personnel certifications
- (k) Records or summaries of *nonconformance* reports
- (l) Revisions to the *contract documents*
- (m) *RFIs* and related *documentation*
- (n) *Subcontractor* and *supplier* evaluations
- (o) *Training* records

### 1.9.1. Retention

*Quality records* shall be subject to an established retention policy. The *documented procedure* for the control of *quality records* shall contain provisions for the disposition of the records at the end of the retention period.

**Commentary:** The retention and disposition *procedure* should consider the *Code of Standard Practice* and contract and legal requirements.

### 1.9.2. Storage

*Quality records* shall be stored in a manner that minimizes damage, deterioration or loss.

### 1.9.3. Retrieval

*Quality records* shall be accessible in a reasonable time frame.

## 1.10. PURCHASING

A *documented procedure* shall be developed to ensure that *subcontractors* and *suppliers* provide contracted services and materials conforming to project requirements.

### 1.10.1. Purchasing Data

Purchasing documents shall clearly describe subcontracted work, purchased materials and services ordered in written purchasing documents. This information shall include, but shall not be limited to:

- (a) The type of service, material, class, grade, and other unique identification
- (b) The applicable *specifications*, drawings, process requirements, and inspection instructions and any witness points
- (c) Delivery instructions and date
- (d) Required quality reports, certified test reports, and certificates of compliance/conformance of purchased materials

### 1.10.2. Selection of Subcontractors and Suppliers

*Subcontractors* and *suppliers* shall be evaluated and selected on the basis of their ability to meet subcontract requirements, the *management system* requirements, the requirements of this Standard, and the requirements of the approved *construction documents* and referenced standards.

A *documented procedure* shall be developed that describes how the certified company conducts initial and ongoing evaluation of all *subcontractors* and *suppliers*.

Management shall determine:

- (a) Evaluation criteria
- (b) Reevaluation interval
- (c) Personnel involved in the evaluation process

*Subcontractors* and *suppliers* shall be evaluated via an audit or *documented* acceptable past experience. As a minimum, quality of the final products and timely, proper delivery of services or products shall be part of the evaluation.

### 1.10.3. Verification of Purchased Product, Materials and Services

The *documented procedure* for verification shall identify the activities necessary for ensuring that purchased products, materials and services meet project requirements. Purchasing documents, *subcontractor* and *supplier* qualification records, and records of the periodic evaluation of *subcontractors* and *suppliers* shall be maintained as required by Section 1.9.

#### 1.10.4. Control of Customer-Furnished Material

If materials are furnished by the customer, the organization shall verify, store and maintain materials in an appropriate fashion. *Customer-furnished material* shall be protected to prevent use for other than its intended purpose. Any such product that is lost, damaged, or otherwise unsuitable for use shall be recorded and reported to the customer.

### 1.11. MATERIAL IDENTIFICATION

A *documented procedure* shall be developed for the identification of material. Records that provide a basis for material identification shall be maintained as defined for *quality control records*.

*Structural steel* material shall be identified as stated in the *Code of Standard Practice*, unless otherwise noted in the *contract documents*.

Welding consumables shall be identified in accordance with the appropriate AWS *specification*.

*Coating* materials (excluding metallic *coating*) shall be identified on the container by, at a minimum, color (pigment description and federal standard number, or *manufacturer's* number), lot/batch number, ID/stock number, quantity of *coating* in container, date of *manufacture*, date of expiration, and *manufacturer's* name and address.

Metallic *coatings* shall be identified by composition and the appropriate *ASTM specification*, including hot dip or mechanical galvanizing and metallizing.

Fasteners shall be stored in containers clearly identified by type, grade, size and lot number(s).

Material traceability to corresponding *MTRs* is necessary only when specifically required by contract. The *fabricator* or *manufacturer* shall develop a *documented procedure* to maintain traceability, when required, of materials from the point of receipt and throughout the course of *fabrication*.

**Commentary:** *MTRs*, *manufacturer's* test reports, certificates of conformance for base materials, fasteners, welding consumables, and *coatings* provide material identification. In the absence of specific contract requirements, these records usually constitute sufficient evidence that the product satisfies material order requirements.

For traceability, the marking method may identify material type and grade or use a method that provides traceability through piece, *assembly* or group numbering.

## 1.12. PROCESS CONTROLS

*Documented procedures* shall be developed for the processes necessary to produce a consistent, acceptable level of quality of the completed work in accordance with applicable codes and project requirements.

Regardless if these processes are routinely performed, effective implementation of the following *documented procedures* is required as a minimum.

### 1.12.1. Welding

A *documented procedure* shall be developed for welding.

The *documented procedure* for welding shall address the development and management of:

- (a) *WPSs*
- (b) Preheat requirements
- (c) *PQRs*
- (d) Storage (including ovens) and identification requirements for welding consumables
- (e) Welder, welding operator, and tack welder qualifications and qualification test records in accordance with appropriate AWS requirements
- (f) Welder, welding operator, and tack welder performance records—to provide *objective evidence* that the “period of effectiveness” has not been exceeded and satisfactory performance is consistently achieved
- (g) Traceability of welds to the welders who produce them, as applicable

*WPSs* shall be in close proximity to and used by the welders, welding operators or tack welders.

### 1.12.2. Bolt Installation

A *documented procedure* shall be developed for bolting. The *procedure* shall meet the requirements of the *RCSC Specification for Structural Joints Using High-Strength Bolts* and the requirements of approved *construction documents* and referenced standards. The *documented bolting procedure* shall include storage, pre-installation verification, installation, and inspection of fastener assemblies for snug-tightened, pretensioned and slip-critical joint types.

### 1.12.3. Material Preparation for Application of Coatings

The *documented procedure* for surface preparation shall support achievement of cleanliness and surface profile required by *coating manufacturer* recommendations, product data sheets, and *contract documents*.

### 1.12.4. Coating Application

The *documented procedure* shall support application and curing of *coatings* in accordance with *manufacturer* recommendations and product data sheets and with *contract documents*.

### 1.12.5. Equipment Maintenance

The *documented procedure* for equipment maintenance shall, at a minimum, define the evaluation of and preventive maintenance for equipment necessary to meet product or work quality and delivery requirements.

## 1.13. INSPECTION AND TESTING

A *documented procedure* shall be developed to ensure that the completed work meets the requirements of the *contract documents*.

**Commentary:** Product or work determined during inspection and testing to be nonconforming should be addressed by the *fabricator's, erector's* or *manufacturer's nonconformance procedure*.

### 1.13.1. Assignment of QC Inspections and Monitoring

Qualification requirements for QC inspectors shall be defined and *documented* as required in Section 1.5.4.

**Commentary:** QC inspectors should be assigned on the basis of qualification, evidenced by experience, *training* and education. Qualification standards and certifications granted by recognized industry organizations can be used as a basis for qualification.

Production personnel may be assigned to QC inspection duties under the following conditions:

- (a) They are knowledgeable in proper inspection methods and acceptance criteria specified for the material or products they are inspecting and hold the required certification as applicable.
- (b) They are aware of their responsibilities and are given time to perform them.
- (c) They do not inspect their own work.
- (d) Their inspections are monitored by qualified *quality control* personnel.

### 1.13.2. In-Process Inspection

Materials shall be inspected before the work begins. The *fabricator, manufacturer* or *erector* shall employ in-process inspection plans and practices for specified process requirements and inspection acceptance criteria that are not verifiable at final inspection or for which final inspection can hinder *subsequent work*. In-process inspection is appropriate for processes including, but not limited to, welding, bolting, *coating* surface preparation, and *coating* application, as applicable.

Compliance with *documented* process control *procedures* shall be monitored.

### 1.13.3. Final Inspection

Final inspection shall be conducted. QC inspectors qualified and responsible for final inspection shall perform the final inspection of *structural steel* products and metal components prior to delivery in the case of *fabrication*, or after the completion of work in the case of *erection*.

### 1.13.4. Inspection Records

The inspection procedure shall indicate what records and marks are used to *document* inspections. In-process inspections shall be verifiable until the final inspection of the piece.

Final inspections shall be *documented*. The *quality records* produced shall be filed and retained as defined in the procedure required by Section 1.9. Inspection records shall clearly show what was inspected, the result of the inspection, and who performed the inspection.

## 1.14. CALIBRATION OF INSPECTION, MEASURING AND TEST EQUIPMENT

A *documented procedure* shall be developed to calibrate and maintain inspection, measuring and testing equipment. The *procedure* shall define equipment calibration frequency. However, the volt/amp meters used to verify compliance with WPS parameters (may be welding machine volt and amp meters or auxiliary volt/amp meters) shall be calibrated at a minimum every 12 months, unless a more frequent interval is required. The *documented procedure* shall include provisions for:

- (a) A unique identifier for each piece of equipment.
- (b) An equipment list.
- (c) Service use for each piece of equipment, including the required precision for the types of inspections, measurements or tests made.
- (d) Calibration or adjustment instructions in accordance with the *manufacturer's* recommendations.
- (e) Frequency of calibration or adjustment.
- (f) Tracking calibrations, adjustments and *repairs*.
- (g) Storage and handling of inspection, measuring, and test equipment to maintain accuracy and fitness for use.
- (h) Identification of standards or certified equipment having a known valid relationship to internationally or nationally recognized standards used to calibrate each listed piece of equipment. Where such standards do not exist, the basis used for calibration shall be *documented*.
- (i) The action to be taken when equipment does not meet the calibration requirements. This action includes disposition of the measuring device and an evaluation of the impact to product that was measured using the device.
- (j) Method of preventing inadvertent use of uncalibrated equipment where calibration is required.

Calibration or adjustment history shall be available.

Rented or borrowed equipment must be accompanied by a valid calibration certificate and is subject to the requirements of this Section.

For equipment that is damaged, dropped, knocked over or functioning improperly, the *documented procedure* shall include provisions for prominently marking or tagging such equipment to preclude usage and removing the equipment from service until it can be recalibrated, adjusted or repaired.

Whenever the accuracy of inspection, measuring and test equipment is in question, proactive calibration shall occur, regardless of *manufacturer's* recommendations.

The precision required of any piece of equipment shall be sufficient to satisfy the acceptance standards of the project *specifications* or industry standards

## 1.15. CONTROL OF NONCONFORMANCES

A *documented procedure* shall be developed to identify and control *nonconformances*.

### 1.15.1. Nonconformance with Management Systems

A *nonconformance* related to the performance of the *management system* shall be *documented* to the detail level described by the *documented procedure*. These *nonconformances* may be identified by the *management systems*, during external audits, or by *quality assurance* inspections.

### 1.15.2. Nonconforming Product and Work

The *documented procedure* for nonconforming product and work shall provide for identification, *documentation*, evaluation, treatment of nonconforming product and work, and notification of the relevant functions concerned. Nonconforming product and work may also be identified in a *quality assurance* inspection report. These reports, when received, become *quality assurance* inspection records. The *procedure* shall provide for the disposition of *quality assurance* inspection records.

Nonconforming product and work shall be clearly marked as soon as practical after it is discovered. Records shall be kept of the pieces affected, the nature of the *nonconformance*, the treatment selection, authorization, and reinspection results if applicable.

The treatment of nonconforming work may include:

- (a) Redesign and *rework*, as approved by the responsible party, and as required in the *contract documents*
- (b) *Repair*, as approved by the responsible party, and as required in the *contract documents*
- (c) Use as-is, as approved by the responsible party, and as required in the *contract documents*
- (d) Scrap

If the treatment is *rework* or *repair*, the result will be inspected per project requirements, as well as per the *quality control* process.

## 1.16. CORRECTIVE ACTION

A *documented procedure* shall be developed for *corrective action* to improve quality. Any *corrective action* taken shall be to the degree appropriate to the magnitude of problems and commensurate with the risks to quality. The *documented procedure* shall include periodic review of records or summaries of *nonconformances* and of internal and external quality audit reports for determination and initiation of *corrective actions*. The *corrective action procedure* shall address these steps:

- (a) Document a *corrective action* request (CAR) that includes the *nonconformance* to be addressed by the *corrective action* and the requirement that has not been met. The *corrective action procedure* shall define the functional positions authorized to issue a CAR and initiate the *corrective action* process.
- (b) Assign responsibility and establish a time frame for the response to a CAR.
- (c) Investigate and document the scope of the *nonconformance*, root causes, *corrective measures* taken, and list the actions to be taken to prevent recurrence.
- (d) Communicate the *corrective action* request and resolution to *executive management* and appropriate members of the organization.
- (e) Follow up the *corrective action* taken with periodic monitoring to assure the *corrective action* is implemented and is effective.

*Corrective action* shall be applied when:

- (a) There is a *nonconformance* that is repetitive in nature as identified by periodically reviewing *nonconformance* reports or summaries for negative trends.
- (b) Process *nonconformances* are found during the internal and external quality audits indicating that the *quality management systems* may not be implemented and functioning as stated in the *quality manual*.
- (c) *Nonconformance* with the *quality management system* is found during the day-to-day execution of the system.
- (d) *Nonconformance* is unacceptable as determined by management.
- (e) A customer complaint has been investigated and *corrective action* has been determined necessary.

## 1.17. HANDLING, STORAGE AND DELIVERY OF PRODUCTS AND MATERIALS

Products and materials shall be stored, loaded and shipped to avoid damage and deterioration as required by the *Code of Standard Practice*. Products and materials shall be protected to prevent use in other than its intended purpose. Any such material that is lost, damaged, or otherwise unsuitable for use shall be recorded and reported as appropriate.

## 1.18. TRAINING

Personnel responsible for functions that affect quality, including, but not limited to, project managers, field/shop supervisors, *detailers*, inspectors, welding personnel, fitters, painters, riggers, signal persons, and crane operators, shall receive

appropriate initial and periodic *documented training*. *Training* records shall be controlled in the same manner as *quality records*. Personnel providing *training* shall have appropriate *training* or experience in the subject they are teaching. *Training* course outlines include the subject and the key points.

**Commentary:** Evaluation of trainee comprehension of course material and *documentation* of successful completion is desirable.

## 1.19. INTERNAL AUDIT

In accordance with a documented procedure, an internal audit of each section of the *quality management system* shall be performed at least once a year to evaluate the compliance and the effectiveness of implementation. Different parts of the *management systems* may be audited at different times and different frequencies, as long as all sections of the *management systems* are audited annually.

The management representative or a qualified individual, independent of the function being audited, shall perform the audit and produce a written record of the audit result from each section.

Internal audit records shall be controlled in the same manner as *quality records*.



## CHAPTER 2

### BUILDING FABRICATOR REQUIREMENTS

The requirements in Chapter 2 shall apply in addition to the requirements in Chapter 1, except where noted.

#### 2.3. REFERENCES

The ability to work to and meet the requirements of the latest edition of the following documents shall be demonstrated:

- (a) ANSI/AISC 360 *Specification for Structural Steel Buildings*

**Commentary:** The *fabricator* should also have the following references available as applicable:

- (a) ANSI/AISC 341 *Seismic Provisions for Structural Steel Buildings*
- (b) ANSI/AISC 358 *Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications*
- (c) AWS D1.4 *Structural Welding Code—Reinforcing Steel*
- (d) AWS D1.8 *Structural Welding Code—Seismic Supplement*
- (e) SSPC *Steel Structures Painting Manual, Volume I, Good Painting Practice*
- (f) SSPC *Steel Structures Painting Manual, Volume II, Systems and Specifications*

#### 2.5. MANAGEMENT RESPONSIBILITY

##### 2.5.4. Resource Management

##### 2.5.4.2 Buildings, Workspace, Equipment and Associated Utilities

A *fabrication* facility shall consist of areas and buildings that provide space for the routine functions considered to be part of steel *fabrication*. The work areas and buildings (including housekeeping, ventilation and clean air supply, and electrical supply) shall be conducive to achieving consistent quality work. The *fabricator* shall have under their control the equipment and software necessary to perform *fabrication* and inspection consistent with the *contract documents*.



# CHAPTER 3

## METAL COMPONENT MANUFACTURER REQUIREMENTS

The requirements in Chapter 3 shall apply in addition to the requirements in Chapter 1, except where noted.

### 3.3. REFERENCES

The ability to work to and meet the requirements of the latest edition of the following documents shall be demonstrated:

- (a) ANSI/AISC 360 *Specification for Structural Steel Buildings*
- (b) AASHTO/ASTM standards applicable to the component manufacturer's product and/or contract documents (for verification purposes)
- (c) SSPC *Steel Structures Painting Manual, Volume I, Good Painting Practice*
- (d) SSPC *Steel Structures Painting Manual, Volume II, Systems and Specifications*

**Commentary:** The *fabricator* should also have the following references available as applicable:

- (a) AWS D1.2 *Structural Welding Code—Aluminum*
- (b) AWS D1.3 *Structural Welding Code—Sheet Steel*
- (c) AASHTO/AWS D1.5 *Bridge Welding Code*
- (d) AWS D1.6 *Structural Welding Code—Stainless Steel*

### 3.5. MANAGEMENT RESPONSIBILITY

#### 3.5.4. Resource Management

##### 3.5.4.2 Buildings, Workspace, Equipment and Associated Utilities

A *manufacturing* facility shall consist of areas and buildings that provide space for routine functions considered part of *component manufacturing*. Work areas and buildings shall be conducive to achieving consistent work quality. The *manufacturer* shall have under their control the equipment and software necessary to perform *manufacturing* and inspection consistent with the specifications and standards applicable to the work.

### 3.7. DETAILING

#### 3.7.8. Design Procedure

Where *component* design is provided by the *manufacturer*, the design process shall be defined by a *documented procedure*. The *procedure* shall describe steps in the

design development, review and verification phases of the process. The *procedure* shall:

- (a) Define methods for determining *component* product requirements from *contract documents*, customer and industry input, regulatory and code requirements, and similar *component* designs.
- (b) Define a design review process to identify and propose solutions for *nonconformances* with product requirements. Identify the individuals responsible and keep records of the design review process.
- (c) Define methods to identify, document, evaluate and approve design changes before implementation. Keep records of all documents.
- (d) Describe a means for validating the function of the resulting component with respect to intended uses and identified component requirements. Identify individuals responsible and keep records of the validation process.

### 3.7.9. Design for Standard Components

For products that are standard *components* not specific to any one project, the *manufacturer* shall have on file and available to the customer a set of design calculations reviewed and prepared and sealed by a *registered design professional* to signify that the designed product meets the current applicable code requirements for its intended use. Any design tables or design processes published with the product literature shall also be reviewed and stamped by a *registered design professional*. *Shop drawings* for these *components* shall include a statement that the *component* details are based on designs that have been reviewed and stamped by a *registered design professional* and are on file with the *manufacturer*.

### 3.7.10 Design for Nonstandard Components

For products that are job specific, the *manufacturer* shall retain the services of a registered professional to prepare and seal the site-specific design of the *component*. The registered professional shall also review the *shop drawings* produced for the *component* and verify their consistency with the design. The results of this review shall be indicated on the *component shop drawings*.

# CHAPTER 4

## BRIDGE FABRICATOR REQUIREMENTS

The requirements in Chapter 4 shall apply in addition to the requirements in Chapter 1, except where noted.

### 4.2. SCOPE

This Standard establishes three categories of bridges: simple, intermediate and advanced. *Fabricators* producing intermediate bridges, advanced bridges, or fracture-critical members shall be required to meet supplemental requirements in Chapters 4.I, 4.A and 4.F, as applicable.

Bridge Category Descriptions:

Simple bridges consist of unspliced rolled sections.

Intermediate bridges are typical bridges that do not require extraordinary measures.

**Commentary:** Common examples of intermediate bridges include:

- (a) A rolled beam bridge with field or shop splices, either straight or with a radius over 500 ft
- (b) A built-up I-shaped plate girder bridge with constant web depth (except for dapped ends), with or without splices, either straight or with a radius over 500 ft
- (c) A built-up I-shaped plate girder with variable web depth (e.g., haunched), either straight or with a radius over 1000 ft
- (d) A truss with a length of 200 ft or less that is entirely or substantially preassembled at the certified facility and shipped in no more than three subassemblies

Advanced bridges are those requiring an additional standard of care in *fabrication* and *erection*, particularly with regard to geometric tolerances.

**Commentary:** Common examples of advanced bridges include:

- (a) Tub or trapezoidal box girders
- (b) Closed box girders
- (c) Large or non-preassembled trusses
- (d) Arches
- (e) Bascule bridges
- (f) Cable-supported bridges
- (g) Moveable bridges
- (h) Bridges with a particularly tight curve radius

### 4.3. REFERENCES

The ability to work to and meet the requirements of the latest edition of the following documents shall be demonstrated:

- (a) AASHTO/AWS D1.5 *Bridge Welding Code*

**Commentary:** The *fabricator* should also have the following references available as applicable:

- (a) AASHTO/NSBA S4.1 *Steel Bridge Fabrication QC/QA Guide Specification*
- (b) Chapter 15 of the AREMA *Manual for Railway Engineering*

### 4.5. MANAGEMENT RESPONSIBILITY

#### 4.5.4. Resource Management

##### 4.5.4.1. Personnel

In addition to the requirements in Section 1.5.4, the following additional qualification requirements shall apply:

- (a) For production and QA management functions, at least five years steel *fabrication* experience or *training*
- (b) For QC and purchasing management functions and for *detailing checkers*, at least three years steel *fabrication* experience or *training*

The *fabricator* shall have the following personnel on staff or available under contract, who are certified in accordance with the *fabricator's* NDT program:

- (a) At least one Certified Level III NDT administrator for each NDT method performed in the shop
- (b) At least one Certified Level II technician for each NDT method performed in the shop

**Commentary:** ASNT Recommended Practice No. SNT-TC-1A provides guidelines for employers to establish in-house certification programs for the qualification and certification of nondestructive testing personnel.

The *fabricator* shall have *documented procedures* for certifying and updating *NDT* personnel.

The *fabricator* shall have enough AWS Certified Welding Inspectors (or other personnel as permitted by AWS D1.5 clause 6.1.3, “Inspection Personnel Qualification”) to monitor all shifts on which welding is performed.

The *fabricator* shall have a competent welding technician on staff. The welding technician shall have extensive knowledge and experience with or education in welding processes, *procedures*, and equipment and with the development, preparation, qualification and execution of welding *procedure specifications*.

#### **4.5.4.2. Buildings, Workspace, Equipment and Associated Utilities**

A *fabrication* facility shall consist of areas and buildings that provide space for the routine functions considered to be part of steel *fabrication*. The work areas and buildings (including housekeeping, ventilation and clean air supply, and electrical supply) shall be conducive to achieving consistent quality work. The *fabricator* shall have under their control the equipment and software necessary to perform *fabrication* or *manufacturing* and inspection consistent with the *contract documents*.

### **4.7. DETAILING**

#### **4.7.8. Preparation of Shop Drawings and Erection Drawings**

Any *shop drawings*, digital models, *erection* framing drawings, and *manufacturing* drawings shall incorporate all contract requirements, *specifications*, codes and relevant standards to adequately procure materials, fabricate the structure or *manufacture* the *component*, and erect the structure or install the *component*. To ensure this, a *documented procedure* for preparation of *shop drawings*, *erection* framing drawings, or *manufacturing* drawings shall be developed, which describes:

- (a) How project requirements are reviewed and incorporated
- (b) How the *fabricator* coordinates, proposes changes, and tracks information with the general contractor or *owner* (e.g., change orders and *RFIs*), and how the associated resolutions are tracked and controlled

### **4.12. PROCESS CONTROLS**

#### **4.12.2. Bolt Installation**

The documented procedure for bolting shall meet the requirements of Report No. FHWA-SA-91-031 *High-Strength Bolts for Bridges* for Rotational Capacity Testing or of Chapter 15, Part 3, of AREMA *Manual for Railway Engineering*, as applicable.



# CHAPTER 4.I

## SUPPLEMENTAL REQUIREMENTS FOR FABRICATORS OF INTERMEDIATE BRIDGES

The requirements in Chapter 4.I shall apply in addition to the requirements in Chapter 4, except where noted.

The *fabricator* shall have either:

- (a) Supplied plate girder spans with field splices for highway or railroad bridges within the last five years, or
- (b) Established a *documented training* program for the purpose of communicating intermediate bridge work functions to the work forces, and demonstrated capability to fabricate intermediate bridges.

**Commentary:** Users of this Standard are encouraged to evaluate *fabricator* capability on a project-specific basis.

### 4.I.5. MANAGEMENT RESPONSIBILITY

#### 4.I.5.4. Resource Management

##### 4.I.5.4.2 Buildings, Workspace, Equipment and Associated Utilities

Equipment shall include automatic, mechanized or semiautomatic welding equipment.

### 4.I.7. DETAILING

#### 4.I.7.1. Detailing Standards

The *detailing* standards shall define the *fabricator's* method for presenting information on shop assembly (blocking) drawings.

#### 4.I.7.6. Detailing Functions

*Detailing* personnel shall have an understanding of bridge geometry, including, but not limited to, vertical and horizontal alignment, cross-slope, and roadway transitions.

### 4.I.12. PROCESS CONTROLS

#### 4.I.12.6 Laydown/Assembly

The *fabricator's documented procedure* for shop *assembly* of field connections shall include, at a minimum, the following items:

- (a) Provisions for control of assembled dimensions for both vertical and horizontal geometry
- (b) Provisions for control of accuracy of drilling and reaming of field connections
- (c) *Documented procedures*, including reference drawings, for match-marking shop-assembled pieces
- (d) Provisions for assuring the accuracy of numerically controlled equipment, if *contract documents* permit the use of such equipment in lieu of physical assembly

## CHAPTER 4.A

### SUPPLEMENTAL REQUIREMENTS FOR FABRICATORS OF ADVANCED BRIDGES

The requirements in Chapter 4.A shall apply in addition to the requirements in Chapter 4, except where noted.

The *fabricator* shall have either:

- (a) Supplied advanced bridges for highway or railroad applications within the last five years, or
- (b) Supplied intermediate bridges for highway or railroad use, established a *documented training* program for the purpose of communicating advanced bridge work functions to the work forces, and demonstrated capability to fabricate advanced bridges.

*Fabricators* of advanced bridges shall also meet the supplemental requirements of Sections 4.I.5, 4.I.7 and 4.I.12.

**Commentary:** Users of this Standard are encouraged to evaluate *fabricator* capability on a project-specific basis.

#### 4.A.6. CONSTRUCTION DOCUMENT REVIEW AND COMMUNICATION

The *fabricator's documented procedure* shall include a process for communicating with individuals in the *fabricator's* organization, the general contractor, and the *owner* regarding special *fabrication*-related requirements for advanced bridges, including:

- (a) Shop assemblies
- (b) Dimensional control and verification
- (c) Welding
- (d) *NDT*
- (e) High-performance materials
- (f) *Erection* considerations
- (g) Other atypical or special job requirements

Decisions made in the process of these communications shall be recorded, approved by the appropriate parties (if applicable), and the record shall be distributed to the appropriate parties. This distribution shall be controlled in accordance with Sections 1.6 and 1.8.

## **4.A.12. PROCESS CONTROLS**

### **4.A.12.1. Welding**

The *fabricator's documented procedure* for welding shall include a distortion control program.

## CHAPTER 4.F

### SUPPLEMENTAL REQUIREMENTS FOR FABRICATORS OF FRACTURE-CRITICAL MEMBERS

The requirements in Chapter 4.F shall apply in addition to the requirements in Chapter 4, except where noted.

The *fabricator* shall have either:

- (a) Supplied fracture-critical members in accordance with AWS D1.5 within the last five years, or
- (b) Established a *documented training* program for the purpose of communicating fracture-critical work functions to the work forces, and demonstrated capability to fabricate fracture-critical members.

#### 4.F.5. MANAGEMENT RESPONSIBILITY

##### 4.F.5.7. Quality Manual

The *quality manual* shall include or reference a written fracture control plan meeting the requirements of AWS D1.5.

#### 4.F.7. DETAILING

##### 4.F.7.1. Detailing Standards

The *detailing* standards for preparation of bills of material shall include whether the material is to be used for fracture-critical applications.

The *detailing* standards for the *fabricator's* shop and *erection* framing drawings shall define the manner of identifying fracture-critical welds.

#### 4.F.10. PURCHASING

##### 4.F.10.1. Purchasing Data

The *fabricator's* written purchasing documents shall identify material to be used for fracture-critical applications.

#### 4.F.11. MATERIAL IDENTIFICATION

The *fabricator's documented procedures* for identification of material and for material traceability shall include provisions for maintaining heat and *MTR* identity of fracture-critical material throughout the *fabrication* process.

#### **4.F.12. PROCESS CONTROLS**

##### **4.F.12.1. Welding**

The *fabricator's documented procedure* for welding shall include:

- (a) *PQRs* for fracture-critical *WPSs*
- (b) Fracture-critical provisions for welding procedure qualification, preheat, and storage of consumables

#### **4.F.13. INSPECTION AND TESTING**

The *fabricator's documented procedure* shall include provisions for inspection of fracture-critical welds.

#### **4.F.15. CONTROL OF NONCONFORMANCES**

##### **4.F.15.2. Nonconforming Product**

The *fabricator's documented procedure* shall include provisions for critical and noncritical *repairs* of fracture-critical welds in accordance with AWS D1.5.

## CHAPTER 5

### ERECTOR REQUIREMENTS

The requirements in Chapter 5 shall apply in addition to the requirements in Chapter 1, except where noted.

#### 5.3. REFERENCES

The ability to work to and meet the requirements of the latest edition of the following documents shall be demonstrated:

- (a) ANSI/AISC 360 *Specification for Structural Steel Buildings*

#### 5.3.1. Seismic Erection

For the *erection* of structures requiring the use of ANSI/AISC 341, *Seismic Provisions for Structural Steel Buildings*, the *erector* shall have available and demonstrate the ability to work to and meet the requirements of:

- (a) ANSI/AISC 341 *Seismic Provisions for Structural Steel Buildings*
- (b) AWS D1.8 *Structural Welding Code—Seismic Supplement*

#### 5.3.2. Metal Deck Installation

When the *erector's* work includes the installation of metal deck, the *erector* shall have available and demonstrate the ability to work to and meet the requirements of *ANSI/SDI QA/QC Standard for Quality Control and Quality Assurance for Installation of Steel Deck*. Instructions for metal deck installation shall be provided in the *erection plan* and the *safety plan*.

- (a) AWS D1.3 *Structural Welding Code—Sheet Steel*

#### 5.3.3. Bridge Erection

For the *erection* of bridges, the *erector* shall have available and demonstrate the ability to work to and meet the requirements of:

- (a) AASHTO/AWS D1.5 *Structural Welding Code—Bridge Welding Code*

**Commentary:** The *fabricator* should also have the following references available as applicable:

- (a) AASHTO/NSBA S10.1 *Steel Bridge Erection Guide Specification*

### 5.3.4. Safety

The *erector* shall provide access to *OSHA Part 1926 Safety and Health Regulations for Construction* or the appropriate state equivalent to employees and others who require access to this information to perform their scope of work.

## 5.5. MANAGEMENT RESPONSIBILITY

### 5.5.2. Periodic Management Review

*Executive management* shall conduct periodic review of the *safety management system* at planned intervals, but annually at a minimum. The management review shall encompass the following, at a minimum:

- (a) A brief summary of applicable previous management reviews.
- (b) Results of any internal and external audits conducted since the previous management review.
- (c) An assessment of customer feedback and feedback mechanisms, identifying opportunities for improving safety.
- (d) An assessment of product *nonconformances*. Both the number and the severity of product *nonconformances* shall be assessed.
- (e) An assessment of process *nonconformances*, including compliance with the *documented procedures* comprising the *safety management system*.
- (f) An assessment of the results of equipment inspections, including the adequacy of equipment resources.
- (g) An assessment of the adequacy of the *training* program with respect to the levels of qualification required, as appropriate.
- (h) An assessment of any proposed or required modifications to the *safety management system*.

Records from management reviews shall be maintained according to the record retention policy.

### 5.5.4. Resource Management

#### 5.5.4.3. Erection Tools and Equipment

The *erector* shall have under their control the tools and equipment necessary to perform the work, and the tools and equipment shall be maintained at the level necessary to produce the required quality.

### 5.5.8. Safety Manual

The highest ranking member of *executive management* shall sign and date the *safety manual*. The *safety manual* shall contain the following information at a minimum:

- (a) Safety policy statement
- (b) Identification of the individual responsible for the *safety management system*
- (c) Safety and health inspections
- (d) Incident investigation

- (e) Hazard prevention and control
- (f) Safety and health *training*
- (g) Personal protective equipment
- (h) Hazard communication
- (i) Lockout/tagout *procedure*
- (j) Respiratory protection
- (k) Fall protection

### 5.5.9. Policy for Safety

*Executive management* shall be responsible for *training* employees on the policy for safety as well as for implementation and ongoing maintenance. The policy for safety shall include:

- (a) A commitment to safety that includes, at a minimum, a commitment to meet federal and/or state requirements for construction safety
- (b) A *safety management system* that provides a framework for establishing, communicating and reviewing safety goals
- (c) A commitment to safety *training*

*Executive management* shall establish safety goals. Goals shall be measurable and *documented* through *objective evidence*. As safety goals are achieved, new goals shall be set that demonstrate commitment to continuous improvement.

**Commentary:** New safety goals can be a new level of achievement of a previous goal or a new goal that has not been previously identified.

### 5.5.10. Responsible Safety Personnel

*Executive management* shall designate a management representative for safety who shall report directly to (or be a part of) *executive management*. The designated management representative for safety may perform other functions within the company, provided that those functions do not conflict with the safety responsibilities. The designated management representative(s) shall have the ability, responsibility and authority to:

- (a) Ensure that *documented procedures* needed for the *safety management systems* are established, implemented and maintained in accordance with this Standard.
- (b) Report to *executive management* on the performance of the *safety management system* and any need for improvement.
- (c) Communicate with external parties on matters relating to the *safety management system*.

## **5.8. CONTROL OF MANAGEMENT SYSTEM DOCUMENTS AND PROJECT DOCUMENTS**

### **5.8.1. Management System Documents**

#### **5.8.1.4. Access**

The *safety management system* documents shall be available and readily accessible to all personnel affected by the *safety management system*.

#### **5.8.1.5. Communication**

Changes and revisions to the *safety management system* documents shall be clearly communicated to all personnel affected by the *safety management system*.

### **5.8.2. Project Documents**

#### **5.8.2.1. Tracking**

A transmittal system shall be established to record the distribution of project information to steel *erection* personnel, *subcontractors* and *suppliers*. Transmittals shall indicate the status of approval and release for *erection*.

#### **5.8.2.3. Access**

The safety plan shall be available and readily accessible to all personnel affected by the *safety management system*.

## **5.10. PURCHASING**

The information included in purchasing documents shall include safety data sheets.

## **5.16. CORRECTIVE ACTION**

Any *corrective action* taken shall be to the degree appropriate to the magnitude of problems and commensurate with the risks to *erection* safety. The *documented procedure* shall include periodic review of records or summaries of *nonconformances* and of internal and external safety audit reports for determination and initiation of *corrective actions*.

*Corrective action* shall be applied when:

- (a) Process *nonconformances* are found during the internal and external safety audits indicating that the *safety management system* may not be implemented and functioning as stated in the *safety manual*.
- (b) *Nonconformance* with the *safety management system* is found during the day-to-day execution of the system.

## **5.18. TRAINING**

The requirements in Section 1.18 shall additionally apply to personnel responsible for functions that affect safety.

Safety *training* shall include weekly safety *training* talks and an initial safety orientation for each employee.

Safety *training* shall include the requirements of OSHA 1926, as applicable.

**Commentary:** The *safety plan* described in Section 5.21 is an integral component of safety *training*.

OSHA provides minimum requirements for *training* in the following Subparts:

- (a) General Safety and Health Provisions (OSHA Subpart C)
- (b) Occupational Health and Environmental Controls (OSHA Subpart D)
- (c) Hazard Communication
- (d) Personal Protective and Life-Saving Equipment (OSHA Subpart E)
- (e) Respiratory protection
- (f) Fire Protection and Prevention (OSHA Subpart F)
- (g) Signs, Signals and Barricades (OSHA Subpart G)
- (h) Tools—Hand and Power (OSHA Subpart I)
- (i) Welding and Cutting (OSHA Subpart J)
- (j) Electrical (OSHA Subpart K)
- (k) Scaffolding (OSHA Subpart L)
- (l) Fall Protection (OSHA Subpart M)
- (m) Motor Vehicles, Mechanized Equipment and Marine Operations (OSHA Subpart O)
- (n) Steel *Erection* (OSHA Subpart R)
- (o) Connector *Training*
- (p) Multiple Lift Rigging *Training*
- (q) Stairways and Ladders (OSHA Subpart X)
- (r) Toxic and Hazardous Substances (OSHA Subpart Z)
- (s) Cranes and Derricks in Construction (OSHA Subpart CC)
- (t) Aerial lift *Training*
- (u) Qualified Rigger *Training*
- (v) Qualified Signal Person *Training*
- (w) Certified Crane Operator *Training*

It is the responsibility of the *erector* to maintain current editions of all reference documents and regulations incorporated into this Standard, as well as any replacement or additional references that become relevant subsequent to the initial publication of this Standard.

## 5.19. INTERNAL AUDIT

The requirements in Section 1.19 shall additionally apply to the *safety management system*.

## 5.20. ERECTION PLAN

The *erector* shall prepare an *erection plan* for every project. The *erection plan*, in whole or in part, may be described graphically or in text. The *erection plan* shall include the following information as appropriate for the project:

- (a) Project name and location.
- (b) Indication of access for material delivery and equipment delivery, including lay-down, shake-out, and field-*assembly* areas.
- (c) Sequence of *erection*.
- (d) Dimensions and locations of cranes or other lifting equipment.
- (e) Required site conditions for the crane location and confirmation of adequate base support for the crane.
- (f) Sizes, model names or numbers, and capacity charts for lifting equipment.
- (g) Information regarding the heaviest lift and its radius; the longest radius and its lift weight; and the boom configuration for each at every location of the lifting equipment.
- (h) Indicate critical lifts, if any, and include the critical lift protocol or *procedure*.
- (i) Requirements for multi-lift rigging.
- (j) Types of slings to be used and, if more than one type, the locations in which they will be used.
- (k) Rigging information for atypical lifts (weight, geometry, center of gravity, etc.) such as slings and hardware, rated lifting beams, beam clamps (including catalog cuts), as applicable to the lift.
- (l) Designation of crane paths from position to position, indicating load travel paths, swing restrictions, and personnel exclusion zones.
- (m) Designation of space required for field *assembly* prior to *erection*.
- (n) Identification of special fastening sequences and/or methods.
- (o) Identification of special or atypical connections.
- (p) Traffic control notes.
- (q) Identification of *specification* requirements for *erection*, such as plumbing tolerances smaller than those stipulated in the *Code of Standard Practice*.
- (r) The stability of the structure and individual members during *erection* shall be checked in accordance with Section 7.10.3 of the *Code of Standard Practice*.
- (s) Falsework requirements and corresponding design calculations.
- (t) Jacking layout and jacking *procedure*.
- (u) Notation of special problems due to overhead restrictions, underground utilities, barriers to crane tail swing, etc.

The *erection plan* shall be reviewed before the start of *erection* by the *erector's* project management team and be available to all employees assigned to the project. All revisions shall be approved by the site superintendent and communicated to affected personnel at the time of the revision.

## 5.21. SAFETY PLAN

The *erector* shall prepare a *safety plan* for every project.

A *safety plan* shall consider known or reasonably anticipated hazards relating to the project site and construction activities. The *safety plan* shall include a pre-task analysis for each steel *erection* activity that occurs on the project site, a list of all hazardous materials in the control of the erector at the project site, an emergency evacuation plan, and requirements for regularly scheduled safety inspections.

The *safety plan* shall include the following information as appropriate for the project:

- (a) Project name and location
- (b) The *erector's* emergency contacts on site and off site
- (c) Medical services available on site, contact information for emergency services, and emergency evacuation *procedures*
- (d) Fall protection requirements that differ from those in the *safety manual*
- (e) Required personal protective equipment
- (f) Protection for openings and perimeters
- (g) Special *procedures* required, such as, but not limited to, lockout/tagout, confined space *training*, and lead exposure mitigation
- (h) Special *training* required
- (i) Employee drug-testing requirements that differ from those in the *safety manual*
- (j) Requirements for work attire
- (k) Information as provided to the erector regarding other hazardous materials onsite

The *safety plan* shall be reviewed before the start of *erection* by the *erector's* project management team and be available to all employees assigned to the project. All revisions shall be approved by the individual responsible for the *safety management system* and communicated to affected personnel at the time of the revision.

**Commentary:** The *safety plan* is an integral component of the safety *training* described in Section 5.18.

## 5.22. OTHER PROJECT-SPECIFIC REQUIREMENTS

In accordance with OSHA Subpart R, the *Code of Standard Practice*, and the *contract documents*, prior to the start of *erection*, the *erector* shall have *documentation* or other evidence that required site conditions have been met.

In accordance with the *Code of Standard Practice* and *contract documents*, the *erector* shall have *documentation* or other evidence that the required information in Section 7.10 of the *Code of Standard Practice* has been provided.

**Commentary:** The specific requirements are found in OSHA Subpart R 1926.752 a, b and c; OSHA 1926.755 b; and the *Code of Standard Practice* Sections 7.2 and 7.3.







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