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Standard for Certification Programs

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Approved by the Certification Standards Committee

Smarter. Stronger. Steel.

by

American Institute of Steel Construction

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PREFACE

This Preface is not a part of AISC 207-25, *Standard for Certification Programs*. 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 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 relating to the five industry segments: steel building fabrication (Chapter 2), metal component manufacturing (Chapter 3), steel bridge fabrication (Chapters 4, 4.I, 4.A, and 4.F), steel erection (Chapter 5), and hydraulic metal structures (Chapters 6, 6.A, and 6.F). Chapter 1 provides general requirements that apply to all industry segments, and Chapters 2, 3, 4, 4.I, 4.A, 4.F, 5, 6, 6.A, and 6.F contain supplementary requirements in addition to those in Chapter 1.

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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 a †. Where used, terms are italicized to alert the user that the term is defined in this Glossary.

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.

Assembly. Two or more *components* that are joined together. Joining methods include welding, bolting, pressure fit, molding, and adhesion.

Calibration. The process of comparing the measurements of a device of known accuracy or standard to the device under calibration to determine if the difference is acceptable when compared to the desired accuracy.

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 *fabrication* and *erection documents* without direct supervision.

Checking (of *fabrication documents* and *erection documents*). A detailed review of the graphical depictions on the *fabrication documents* and *erection documents* by a *checker* other than the original *detailer*.

Coating. A layer or layers of a protective film designed to isolate the prevailing service environment from the base steel and prevent the onset of corrosion using galvanic, barrier, or inhibitive means, or a combination thereof. Coatings may include paint, powder coatings, galvanizing, metalizing, and electro-deposited metals.

Component. A bridge- or highway-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 composed 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, as determined by 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.

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 a *nonconformance*.

Corrective measure. The action taken to bring a *nonconformance* into conformance.

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

Design documents.† *Design drawings*, *design model*, or a combination of drawings and models.

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.† Three-dimensional digital model of the structure that conveys the *structural steel* requirements given in *Code of Standard Practice* Section 3.1.

Detailer.† See *steel detailer*.

Detailing. The function that produces *fabrication* and *erection* (or installation) *documents* from *contract documents*.

Documentation, documented. Material that provides information or evidence. Documentation may include written instructions, drawings, models, 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.

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.

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

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

Erection documents.† *Erection drawings*, *erection model*, or a combination of drawings and models.

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

Erection model.† Three-dimensional digital model produced to convey the information necessary to erect the *structural steel*. This may be the same digital model as the *fabrication model*, but it is not required to be.

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—for example, CEO, president, general manager, *owner*, etc. Executive management has full authority in final decision making for all aspects of the *quality management system*.

Fabrication. The process of preparation and assembly of individual parts into a shipping piece in accordance with the *construction documents*—for example, assembly, drilling, sawing, milling, thermal and mechanical cutting, and shipping.

Fabrication documents.† *Shop drawings*, *fabrication model*, or a combination of drawings and models.

Fabrication model.† Three-dimensional digital model produced to convey the information necessary to fabricate the *structural steel*.

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 documents. The *installation drawings* or, where the parties have agreed in the *contract documents* to provide digital model(s), the *installation model*. A combination of drawings and digital models may also be provided.

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*.

Installation model. A dimensionally accurate 3D digital model 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*, and project management. Key positions also include personnel, such as quality inspectors, *detailers*, etc., below the level of manager.

Management systems. See *quality management system*.

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

Manufacturer. The entity that manufactures *components*.

Manufacturing documents. Documents, drawings, or, where parties have agreed in the *contract documents* to provide digital model(s), the *manufacturing model* that illustrates the *manufacturing* of *components* for production.

Manufacturing model. A dimensionally accurate 3D digital model produced to convey the information necessary to *manufacture components*.

Nonconformance. Attributes of materials, consumables, fabricated work, *manufactured components*, erected members, or processes that do not meet contract, regulatory, or internally defined requirements.

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
(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 (ODRC).† 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 (ODRD).† 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*.

Quality assurance (QA). That part of quality management focused on providing confidence that quality requirements will be fulfilled. For the purposes of this program, quality assurance is the planned system of *documented procedures* and organizational requirements developed and implemented in order to measure and assure compliance with customer requirements and provide confidence that quality goals are achieved. Quality assurance encompasses such areas as compliance with project specification requirements, compliance with referenced standards, and achievement of customer service objectives. Specific functions included in quality assurance are

- Determination of quality criteria
- Establishment of a plan to monitor quality, including assignment of *quality control (QC)* (inspection)
- Determination of acceptance criteria
- Determination of *QC* personnel qualifications
- Oversight of *QC* activities
- Summarizing and reporting quality conformance measures to management

The foregoing definition is solely applicable to this Standard. It is mutually exclusive with other definitions for the term "quality assurance" that are found in other AISC publications, such as the *Specification for Structural Steel Buildings*.

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 require-

ments of the *construction documents* and referenced standards.

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

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

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

Registered design professional. An individual who is registered or licensed to practice his or her 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.

Repair. Action taken on nonconforming work to make it acceptable for the intended use.

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

Rework. Action taken on nonconforming work to make it conform to the requirements.

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.

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 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. See also *registered design professional*.

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

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 buyout items, needed to fulfill the contract requirements.

Training. See *documented training*.

Verification. The confirmation through *objective evidence* that the *quality management system* requirements have been met.

ABBREVIATIONS

The following abbreviations appear in this Standard.

AASHTO (American Association of State Highway and Transportation Officials)

AISC (American Institute of Steel Construction)

AMPP (Association for Materials Protection and Performance)

ANSI (American National Standards Institute)

AREMA (American Railway Engineering and Maintenance of Way Association)

ASNT (American Society for Nondestructive Testing)

ASTM (ASTM International)

AWS (American Welding Society)

FHWA (Federal Highway Administration)

FSPG (folded steel plate girder)

HLMR (high-load multi-rotational)

MTR (mill test report as defined in Section 14 of ASTM A6)

NDT (nondestructive testing)

NSBA (National Steel Bridge Alliance)

ODRC (owner's designated representative for construction)

ODRD (owner's designated representative for design)

PBTG (press brake tub girder)

PQR (procedure qualification record as defined by AWS A3.0M/A3.0)

RCSC (Research Council on Structural Connections)

RFI (request for information)

UFGS (Unified Facilities Guide Specifications)

WPS (welding procedure specification as defined by AWS A3.0/A3.0M)

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 certified participants who adhere to the requirements in this Standard have the personnel, organization, experience, *documented procedures*, knowledge, equipment, and commitment to quality to perform *fabrication*, *manufacturing*, and/or *erection* as described in this Standard.

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 where elements of the frames are as defined in AISC *Code of Standard Practice* Section 2.1.

(b) Chapters 1 and 3 shall apply to metal *component manufacturers*, who *manufacture components* that include bracing not designed for primary loads, such as 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.

When specified in the *contract documents, 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 meet specific supplemental requirements to those in Chapter 3.

(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* of *structural steel*.

(e) Chapters 1 and 6 shall apply to hydraulic metal structure *fabricators*.

In Chapters 2 through 6, 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) *Selected ASTM Standards*, as available from AISC (at their portal for ASTM online access), or ASTM standards necessary for compliance with the contract documents
(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

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

1.5. MANAGEMENT RESPONSIBILITY

1.5.1. Policy for Quality

Executive management shall ensure that a policy for quality is communicated, 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 the quality goals of the organization

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 include a new level of achievement of a previous goal or a new goal that has not been previously identified.

1.5.2. Quality Management System

The *quality management system* shall satisfy 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. The *quality management system* must address both *quality control* and *quality assurance* as defined in the Glossary of this Standard. *Documented procedures* shall contain the following:

(a) The purpose of the *procedure*
(b) A 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

Commentary: The extent of the *quality management system documentation* can differ from one organization to another based upon 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.

1.5.3. Management Review

Executive management shall conduct a review of the *quality management system* at planned intervals, but annually at a minimum. Further, at a minimum, management review shall include assessment and *documentation* of the following:

(a) A summary of previous management reviews
(b) Results of any internal and external audits conducted since the previous management review
(c) Customer feedback and feedback mechanisms, identifying opportunities for improving quality
(d) Work *nonconformances*; both the number and severity of *nonconformances* shall be assessed
(e) Process *nonconformances*, including compliance with the *documented procedures* comprising the *quality management system*
(f) Effectiveness of the *corrective actions* taken
(g) Results of equipment maintenance and preventive maintenance, including the adequacy of equipment resources
(h) Adequacy of the *training* program with respect to the levels of qualification required
(i) Proposed or required modifications to the *quality management system*

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

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

Records from management reviews shall be maintained in accordance with the *documented procedure* as required in Section 1.9.

1.5.4. Responsible Quality Personnel

Executive management shall designate a management representative or representatives for quality who shall report directly to, or be a part of, *executive management*. The designated management representative(s) 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.*

1.5.5. Resource Management

The resources necessary to comply with the *contract documents* shall be available. Resources are applicable to both personnel and nonpersonnel. The qualification requirements, responsibility, authority, and interrelation of functional positions that manage, perform, and verify work affecting quality shall be defined as required in Section 1.5.7 and in the industry-specific chapters. Other provisions relating to personnel are found elsewhere in the Standard. See Sections 2.5.5, 3.5.5, 4.5.5, 4.I.5.5, and 5.5.5.3, and 6.5.5.2 for nonpersonnel, industry-specific resource requirements.

Commentary: *Objective evidence* of qualification may be demonstrated through biographies, résumés, *documented training*, and 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.

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*
(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 affect quality
(e) Job descriptions outlining and describing responsibilities, authority, required qualifications, and activities for *key positions*
(f) Qualification evidence for individuals in *key positions*/functions

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 ensure 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 *procedure* shall require these reviews for each project, and the review shall begin no later than the acceptance of responsibility for performing the work. Records of this review shall be maintained in accordance with the *documented procedure* as required in Section 1.9.

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* as applicable. Such evidence should indicate consideration of pertinent sections of this Standard and other critical project requirements that, if missed, may 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 materials are prepared, which, at a minimum, include the following:

(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 nondestructive testing (NDT) requirements
(h) *Fabricators*: The *detailing* standards shall describe the method for:
    (i) Selection of connection type, connection geometry, and connection material
    (ii) *Detailing* of holes, fasteners, washers, cuts, and copes
    (iii) Assignment of appropriate and complete welding symbols for 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
(i) *Manufacturers*: If applicable, illustrate information to be included on weld symbols and the preferred way to designate surface preparation and *coating* requirements

1.7.1.1. Digital Document Production

For digital *fabrication*, *manufacturing*, *erection*, and *installation documents*, the *documented procedure* for producing these documents shall identify the data, variables, graphics, calculating formulas, and other output, as appropriate, that are

checked to determine that the software is functioning correctly.

1.7.2. Checking

The *fabricator* shall develop a *documented procedure* to provide for *checking* of the *fabrication* and *erection documents*. The *documented procedure* for *checking* of these documents shall describe the method used by the *fabricator* or its *subcontractor* to perform and record the final check to ensure compliance with *contract documents*. Records shall provide a means for identification of the individual *checker* who performed the final check of each document.

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 documents prior to submittal for approval.

The *documented procedure* for *checking fabrication* and *erection documents* shall include comparison and compliance with project requirements.

During the *checking* process, the following shall be verified:

(a) Geometry
(b) Use of connections as specified in the *contract documents*
(c) Appropriate notes are included
(d) Material usage as specified in the *contract documents*
(e) Shop bills contain all required information
(f) Use of appropriate and complete welding symbols
(g) Use of *coatings* and surface preparations as specified in the *contract documents*
(h) Proper representation on *erection drawings*, including the notation of any necessary instructions and depiction of details necessary to conduct the work in the field
(i) All information is accurately presented and in compliance with the *Code of Standard Practice* requirements
(j) All steel included in the *contract documents* has been detailed

1.7.3. Control of Approval Documents

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

Commentary: Such methods used to document *owner* approval [through the *owner's designated representative for design (ODRD)* and the *owner's designated representative for construction (ODRC)*] may include signatures, stamps, logs, files, or lists. Section 4.4 in the AISC *Code of Standard Practice for Steel Buildings and Bridges* addresses the approval of *approval documents* (previously known as *shop* and *erection drawings*). Subsection 4.4.1 states that "Approval, approval subject to corrections noted, and similar approvals of the *approval documents* shall constitute...release by the *ODRD* and the *ODRC* for the *fabricator* to begin *fabrication* using the approved submittals." See AISC *Code of Standard Practice* Section 4 for further elaboration of the process of approval of *approval documents*.

1.7.4. Fabrication and/or Installation Documents Supplied by Others

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

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

1.7.5. Management of Detailing

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

(a) Overseeing the production of *fabrication*, *manufacturing*, *erection*, and *installation documents*, including the work of *subcontractors*
(b) Communicating with *owner's* representative for design
(c) Scheduling
(d) Developing and maintaining company *detailing* standards and documented *detailing* procedures
(e) Preparing and sending 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 fabrication* and *erection documents* 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 applicable codes and specifications.

1.7.6. Detailing Functions

Personnel who perform *detailing* or *checking* 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 the *fabrication* and *erection documents* prior to submittal for approval. Qualification requirements for *checkers* shall be defined and documented and include *training* and experience in selecting connections. Demonstrated experience and 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., can be used as a basis for qualification. See AISC *Code of Standard Practice* Section 4 for an elaboration of the process of approval of *approval documents*.

1.7.7. Subcontracted Services

Subcontractors may be used for the following functions: *detailing*, connection shop standards, delegated connection design as applicable, and *checking* 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 are not limited to, the *quality manual* 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.

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

1.8.1.3. Revision Control

Revisions to *quality management system* documents shall be 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.

Quality management system documents shall remain legible and easily identifiable.

1.8.1.4. Access

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

1.8.1.5. Communication

Changes and revisions shall be communicated to the 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 are not limited to, *contract documents*; revised *contract documents*; *requests for information (RFI)*; and *fabrication*, *manufacturing*, *erection*, and *installation documents*.

1.8.2.1. Tracking

Project documents and changes to project documents 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, and related transmittals; and in change orders or contract addenda.

The *documented procedure* shall require records, such as logs, files, or master lists, that show receipt of change data, incorporation, issue, and distribution of approved and revised *approval documents* to the 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 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.

Project documents shall remain legible and easily identifiable.

1.8.2.3. Access

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

1.8.2.4. Communication

Changes and revisions shall be communicated to the 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) *Calibration* records
(b) Certificates of conformance
(c) *Corrective action* requests
(d) Drawing logs
(e) Equipment maintenance records
(f) Inspection records
(g) Internal and external *quality management system* audits
(h) Mill and consumable purchase orders
(i) Mill test reports (MTR)
(j) Nondestructive testing (NDT) reports
(k) Personnel certifications
(l) Purchasing documents
(m) Records or summaries of *nonconformance* reports
(n) Revisions to the *contract documents*
(o) *RFI*s and related *documentation*
(p) *Subcontractor* and *supplier* evaluations
(q) *Training* records

1.9.1. Retention

The *documented procedure* for the maintenance of *quality records* shall define the retention policy and provisions for the disposition of the records at the end of the retention period.

Commentary: The retention and disposition *procedure* should consider the AISC *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 that conform to project requirements.

1.10.1. Purchasing Data

A *documented procedure* shall be developed that addresses purchasing documents. These documents shall describe subcontracted work, purchased materials, and services ordered in written purchasing documents. These documents shall be provided to *subcontractors* and *suppliers*. This information shall include, but shall not be limited to:

(a) The type of service, material, class, grade, and other unique identification
(b) The project *specifications*, *design documents*, applicable ASTM specifications, 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

Commentary: It should be noted that ASTM specifications often include ordering information that the purchaser should be aware of when placing an order.

1.10.2. Selection of Subcontractors and Suppliers

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

The *procedure* for the selection of *subcontractors* for *fabrication*, *manufacturing*, or *erection* shall include a provision that requires that these entities have current AISC Certification for the type of work that is being subcontracted when certification is required in the *contract documents*.

The *procedure* shall also include provisions for obtaining approval to retain a *subcontractor* who is not certified on a project-specific basis from the *owner*, *owner's designated representative for design*, and the *owner's designated representative for construction* when certification is required in the *contract documents*.

Subcontractors and *suppliers* shall be evaluated and selected on the basis of their ability to meet subcontract requirements, the *management system* requirements, the

applicable requirements of this Standard, and the requirements of the *construction documents* and referenced standards.

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 performance. As a minimum, their quality and timely, proper deliveries shall be part of the evaluation.

Commentary: This provision of the Standard requires a *documented procedure* for the selection of *subcontractors* and *suppliers*. In general, *subcontractors* that are *fabricators*, *component manufacturers*, and *erectors* are required to be certified when subcontracted to a certified entity. Situations may arise, however, in which a certified entity is not able to subcontract with another certified entity when certification is required in the *contract documents*. In such cases, the *documented procedure* needs to address how the certified entity obtains approval to employ a noncertified *subcontractor*.

1.10.3. Verification of Purchased Product, Materials, and Services

A *documented procedure* for *verification* shall identify the activities necessary for ensuring that purchased products, materials, and services meet project requirements.

1.10.4. Control of Customer-Furnished Work and Material

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

1.10.5. Purchasing Records

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.

1.11. MATERIAL IDENTIFICATION

A *documented procedure* shall be developed for material identification. Records that provide a basis for material identification shall be maintained as required by Section 1.9.

Structural steel material shall be identified as stated in the AISC *Code of Standard*

Practice, unless otherwise noted in the *contract documents*.

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

Coating materials, excluding metallic *coating*, shall be identified on the container by, at a minimum, color—that is, 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 thermal spray *coating*.

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

Commentary: Material that has lost identification and is no longer traceable to its grade, size, or type, or it has passed an expiration or use-by date, should be marked in a manner to prevent its inadvertent use. Markings may include paint color, signage, roped-off area, or labeling. It is a common practice to label this type of material as "uncontrolled." This means it is no longer controlled by the *quality management system* and is not to be used for contract work.

Material traceability to corresponding mill test reports (MTR) 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 material satisfies 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 *fabrication*, *manufacturing*, and *erection* processes necessary to produce a consistent, acceptable level of quality of the completed work in accordance with applicable codes and project requirements.

Commentary: This section requires *documented procedure*(s) for those *fabrication*, *manufacturing*, and *erection* processes that affect quality. In addition to the processes listed in this section, other processes include, but are not limited to, drilling, sawing, reaming, milling, thermal and mechanical cutting, cambering, straightening, and *assembly*.

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

1.12.1. Welding

A *documented procedure* for welding shall be developed that addresses the management of:

(a) Welding procedure specifications (WPS)
(b) Preheat requirements
(c) Procedure qualification records (PQR)
(d) Storage, including ovens, handling, 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

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

Commentary: Traceability of welds refers to a method to identify which welder performed the weld. Project documents may apply specific requirements for the identification of the welder and the weld they produced. This may be either a permanent stamp, a record using a weld map showing each weld and who performed the weld, or another method. Weld traceability can include marking welder ID, welder mark, or welder initials on the piece, drawing, or capturing by electronic means. Methods that allow for traceability through final weld acceptance by *quality control (QC)* can be used.

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 *construction documents* and referenced standards. The documented bolting *procedure* shall include storage, pre-installation *verification*, installation, and inspection of fastener assemblies.

1.12.3. Material Preparation for Application of Coatings

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

1.12.4. Coating Application

The *documented procedure* for *coating* application shall support achievement of proper application and curing of *coatings* in accordance with *manufacturer* recommendations, product data sheets, and *contract documents*, as applicable.

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 work quality and delivery requirements.

1.13. INSPECTION AND TESTING

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

The *procedure* shall define receipt, in-process, and final inspection of work furnished for a project. Work determined during inspection and testing to be nonconforming shall be addressed following the *nonconformance procedure* requirements in Section 1.15.

When inspecting less than 100% of the work, the *procedure* shall describe the sampling plans for each type of inspection. The plans will adjust the level and frequency of inspection at any time the required level of quality is not met.

1.13.1. Assignment of QC Inspections and Monitoring

Qualification requirements for *quality control (QC)* inspectors shall be defined and documented as required in Section 1.5.5.

Commentary: *QC* inspectors should be assigned on the basis of qualification as 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 inspection methods and acceptance criteria specified for the material or work 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 inspect others' work.
(d) Their inspections are monitored by qualified *QC* personnel.

1.13.2. Receipt Inspection

Materials received shall be compared to the purchase order requirements and the receiving documents.

The receiver shall identify the material and quantity and check for visible shipping damages.

1.13.3. 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.

1.13.4. Final Inspection

Final inspection shall be conducted. *QC* inspectors qualified and responsible for final inspection shall perform the final inspection of *structural steel* and metal *components* prior to shipping in the case of *fabrication*, or after the completion of work in the case of *erection*. Final inspections shall be recorded and maintained as required by Section 1.9.

1.13.5. Inspection Records

The *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.

The *quality records* produced shall be filed and retained as defined in the *procedure* required by Section 1.9. Inspection records shall 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 shall be calibrated, at a minimum, every 12 months, unless a more frequent interval is required. The *procedure* shall include provisions for:

(a) A unique identifier for each piece of equipment
(b) A list of equipment that requires *calibration*
(c) The 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 *calibration*s, 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 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 equipment and an evaluation of the impact on work that was measured using it.
(j) Method of preventing inadvertent use of uncalibrated equipment where *calibration* is required

Commentary: *Calibration* is a process in which an instrument or piece of equipment's accuracy is compared with a known standard. When a variation exists, a determination is made whether to adjust, *repair*, replace, or accept the instrument or piece of equipment as is. In-house *calibration* can be performed using a written instruction against national traceable standards with records maintained of the measured points and results.

Calibration and 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 *procedure* shall include provisions for prominently marking or tagging such equipment to preclude usage and for 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, independent of the *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.

Records of *calibration* shall be maintained as required by Section 1.9.

Commentary: *Calibration* or adjustment history records include:

- Evidence that the *calibration* was performed and traceable to a national or international standard
- Identification of the equipment that was calibrated
- Who performed the *calibration*
- The date of the *calibration*
- The date the *calibration* expires or the date the next *calibration* is due

The *calibration* record should also include evidence of any adjustments that were performed during the *calibration* process.

1.15. CONTROL OF NONCONFORMANCES

A *documented procedure* shall be developed to identify and control *nonconformances*. Records of *nonconformances* shall be maintained as required by Section 1.9.

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 *procedure*. These *nonconformances* may be identified by the *management systems* during external audits or by internal audits.

1.15.2. Nonconforming Work

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

Nonconforming work shall be 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 shall be inspected in accordance with 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 *documented 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 *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, and *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 ensure 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 to be necessary

Records of *corrective actions* shall be maintained as required by Section 1.9.

1.17. HANDLING, STORAGE, AND DELIVERY OF MATERIALS, FABRICATED WORK, AND COMPONENTS

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

Commentary: AISC *Code of Standard Practice* Sections 5.1.2 and 5.1.3 allow a *fabricator* to receive material that does not conform to the project requirements with the expectation that corrective procedures will be used to bring the material into conformity. Project requirements may require approval from the *structural engineer of record* before applying corrective procedures. When nonconforming material is received as such, it should be clearly identified and segregated from conforming material.

1.18. TRAINING

Personnel responsible for functions that affect quality, including, but not limited to, project managers, field/shop supervisors, *detailers*, inspectors, welding personnel, bolting personnel, fitters, painters, riggers, signal persons, and crane operators, shall receive appropriate initial and periodic *documented training*. Personnel providing *training* shall have appropriate *training* or experience in the subject they are teaching. *Training* course outlines shall include the subject and the key points.

Evaluation of trainee comprehension of course material and *documentation* of successful completion is required.

Training records shall be maintained as required by Section 1.9.

1.19. INTERNAL AUDIT

A *documented procedure* shall be developed for the control and management of internal audits. 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. Sections of the *management systems* may be audited at different times and frequencies, provided that 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.

Records of internal audits shall be maintained as required by Section 1.9.

CHAPTER 2

BUILDING FABRICATOR REQUIREMENTS

This chapter addresses building *fabricator* requirements and applies as required in Section 1.2.

This chapter is organized as follows:

2.3. References
2.5. Management Responsibility

2.3. REFERENCES

The ability to work to and meet the requirements of the latest edition of ANSI/AISC 360 *Specification for Structural Steel Buildings* shall be demonstrated.

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/D1.4M *Structural Welding Code—Reinforcing Steel*
(d) AWS D1.8/D1.8M *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

2.5.5. Resource Management

2.5.5.1. 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

This chapter addresses metal *component manufacturer* requirements and applies as required in Section 1.2.

This chapter is organized as follows:

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

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

(a) AWS D1.2/ D1.2M *Structural Welding Code—Aluminum*
(b) AWS D1.3/D1.3M *Structural Welding Code—Sheet Steel*
(c) AASHTO/AWS D1.5M/D1.5 *Bridge Welding Code*
(d) AWS D1.6/D1.6M *Structural Welding Code—Stainless Steel*
(e) SSPC *Steel Structures Painting Manual, Volume I, Good Painting Practice*
(f) SSPC *Steel Structures Painting Manual, Volume II, Systems and Specifications*

3.5. MANAGEMENT RESPONSIBILITY

3.5.5. Resource Management

3.5.5.1. 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*, a *documented procedure* shall be developed to define the design process. 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* 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*. 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.
(d) Describe a means of 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 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 *component* meets the current applicable code requirements for its intended use. Any design tables or design processes published with the *component* literature shall also be reviewed and stamped by a *registered design professional*. *Manufacturing documents* 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 *components* 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 *manufacturing documents* produced for the *component* and verify their consistency with the design. The results of this review shall be indicated on the *component manufacturing documents*.

CHAPTER 4

BRIDGE FABRICATOR REQUIREMENTS

This chapter addresses bridge *fabricator* requirements and applies as required in Section 1.2.

This chapter is organized as follows:

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, folded steel plate girders (FSPG), and press brake tub girders (PBTG).

Intermediate bridges are those that require a high level of *fabrication* expertise, including, but not limited to, techniques for geometric control, bending, curving, welding, and handling.

Commentary: Common examples of intermediate bridges include:

(a) A rolled beam bridge with field or shop splices, either straight or with a radius greater than 500 ft (150 m)
(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 greater than 500 ft (150 m)
(c) A built-up I-shaped plate girder with variable web depth (e.g., haunched), either straight or with a radius greater than 1,000 ft (300 m)
(d) A truss with a length of 200 ft (60 m) or less that is entirely or substantially preassembled at the certified facility and shipped in no more than three subassemblies
(e) An FSPG or PBTG bridge with field or shop splices that is entirely or substantially preassembled at the certified facility

Advanced bridges are more complex bridge structures than simple or intermediate bridges, and they require a higher level of *fabrication* expertise.

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) Movable 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 D1.5M/D1.5 *Bridge Welding Code*
(b) ASTM F3125/F3125M *Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi, 144 ksi, and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength*
(c) ASTM F3148 *Standard Specification for High Strength Structural Bolt Assemblies, Steel and Alloy Steel, Heat Treated, 144ksi Minimum Tensile Strength, Inch Dimensions*

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

(a) AASHTO/NSBA G4.1 *Steel Bridge Fabrication QC/QA Guidelines*
(b) AREMA *Manual for Railway Engineering, Volume II—Chapter 15, Steel Structures*
(c) FHWA *Bridge Welding Reference Manual*, Publication No. FHWA-HIF-19-088, September 2019

4.5. MANAGEMENT RESPONSIBILITY

4.5.5. Resource Management

4.5.5.1. Personnel

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

(a) For production and *quality assurance (QA)* management functions, at least five years of steel *fabrication* experience that includes an appropriate amount of *training*
(b) For *quality control (QC)* and purchasing management functions and for *detailing checkers*, at least three years of steel *fabrication* experience that includes an appropriate amount of *training*

Commentary: Depending on the education level of the personnel, the combination of experience and *training* may vary depending on the tasks the individual undertakes. It could include more years of hands-on experience with less *training*, or it could be less hands-on experience with more *training*.

The *fabricator* shall have the following personnel on staff or available under contract that are certified in accordance with the *fabricator's* nondestructive testing (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 NDT personnel.

The *fabricator* shall have *documented procedures* for certifying and updating NDT personnel employed by the *fabricator*. Alternatively, the *fabricator's documented procedures* shall describe how they review the methods and/or written practices of contractors as suitable to subcontract to their organization.

The *fabricator* shall have enough AWS Certified Welding Inspectors or other personnel as permitted by AASHTO/AWS D1.5M/D1.5, "Inspection Personnel Qualification" to monitor all shifts on which welding is performed.

The *fabricator* shall have a competent welding technician on staff with 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.

4.5.5.2. 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 bridge *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 Fabrication and Erection Documents

Fabrication and *erection documents* shall incorporate the contract requirements, specifications, codes, and relevant standards to procure materials, and fabricate and erect the structure. To ensure this, a *documented procedure* for preparation of these documents shall be developed that 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*, such as change orders and *requests for information (RFI)*
(c) How the associated resolutions are tracked and controlled

4.11. MATERIAL IDENTIFICATION

4.11.1. Traceability

The *fabricator's documented procedures* for identification of material and for material traceability shall include provisions for maintaining heat and mill test report (MTR) identity of material throughout the *fabrication* process.

4.12. PROCESS CONTROLS

4.12.2. Bolt Installation

The *documented procedure* for bolting shall meet the requirements for rotational capacity testing as required by:

(a) ASTM F3125/F3125M *Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi, 144 ksi, and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength*
(b) ASTM F3148 *Standard Specification for High Strength Structural Bolt Assemblies, Steel and Alloy Steel, Heat Treated, 144ksi Minimum Tensile Strength, Inch Dimensions*

CHAPTER 4.I

SUPPLEMENTAL REQUIREMENTS FOR FABRICATORS OF INTERMEDIATE BRIDGES

This chapter addresses supplemental requirements for *fabricators* of intermediate bridges and applies as required in Section 4.2.

This chapter is organized as follows:

4.I.2. SCOPE

Eligible *fabricators* 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. *Training* shall include *detailing*, purchasing, and project management functions.

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

4.I.5. MANAGEMENT RESPONSIBILITY

4.I.5.5. Resource Management

4.I.5.5.1. 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* 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.12.1. Welding

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

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 matchmarking 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

This chapter addresses supplemental requirements for *fabricators* of advanced bridges and applies as required in Section 4.2.

This chapter is organized as follows:

4.A.2. SCOPE

Eligible *fabricators* 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 within the last five years, 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) Nondestructive testing (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 and approved by the appropriate parties, and the record shall be distributed to the appropriate parties. This distribution shall be controlled in accordance with Sections 1.6 and 1.8.

Commentary: High-performance steels are designated with an HPS such as ASTM A709 HPS 50W, ASTM A709 HPS 70W, and ASTM A709 HPS 100W. Other specified steels may also be contract-specific materials not addressed by AWS D1 welding codes.

CHAPTER 4.F

SUPPLEMENTAL REQUIREMENTS FOR FABRICATORS OF FRACTURE-CRITICAL MEMBERS

This chapter addresses supplemental requirements for *fabricators* of fracture-critical members and applies as required in Section 4.2.

This chapter is organized as follows:

4.F.2. SCOPE

Eligible *fabricators* shall have either:

(a) Supplied fracture-critical members in accordance with AASHTO/AWS D1.5M/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 AASHTO/AWS D1.5M/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 fabrication* and *erection documents* 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 mill test report (MTR) identity of fracture-critical material throughout the *fabrication* process. The *procedure* shall address how fracture-critical material is identified at receipt and throughout *fabrication* by unique mill piece or plate number. Further, the *procedure* shall also address how consumables purchased for fracture-critical welding are identified.

4.F.12. PROCESS CONTROLS

4.F.12.1. Welding

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

(a) Procedure qualification records (PQR) for fracture-critical welding procedure specifications (WPS)
(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 Work

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

CHAPTER 5

ERECTOR REQUIREMENTS

This chapter addresses *erector* requirements and applies as required in Section 1.2.

This chapter is organized as follows:

5.3. REFERENCES

The ability to work to and meet the requirements of the latest edition of ANSI/AISC 360 *Specification for Structural Steel Buildings* shall be demonstrated.

5.3.1. Seismic Erection Endorsement

For the *erection* of structures requiring the use of ANSI/AISC 341 *Seismic Provisions for Structural Steel Buildings*, the *erector* shall have available and shall 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/D1.8M *Structural Welding Code—Seismic Supplement*

5.3.2. Metal Deck Installation Endorsement

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:

(a) ANSI/SDI *QA/QC Standard for Quality Control and Quality Assurance for Installation of Steel Deck*
(b) AWS D1.3/D1.3M *Structural Welding Code—Sheet Steel*

Instructions for metal deck installation shall be provided in the *erection plan*.

5.3.3. Bridge Erection Endorsement

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 D1.5M/D1.5 *Bridge Welding Code*
(b) ASTM F3125/F3125M *Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi, 144 ksi, and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength*

(c) ASTM F3148 *Standard Specification for High Strength Structural Bolt Assemblies, Steel and Alloy Steel, Heat Treated, 144ksi Minimum Tensile Strength, Inch Dimensions*

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

(a) AASHTO/NSBA S10.1 *Steel Bridge Erection Guide Specification*
(b) AREMA *Manual for Railway Engineering, Volume II—Chapter 15, Steel Structures*

5.5. MANAGEMENT RESPONSIBILITY

5.5.5. Resource Management

5.5.5.3. 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.

5.12. PROCESS CONTROLS

5.12.3. Material Preparation for Application of Coatings

The following requirements apply for *erectors* in lieu of the requirements provided in Section 1.12.3. When the *erector's* work includes *coating* application or touch-up of *coatings*, the *documented procedure* for material preparation shall support achievement of cleanliness and the surface profile required by *coating manufacturer* recommendations, product data sheets, and *contract documents*, as applicable.

5.12.4. Coating Application

The following requirements apply for *erectors* in lieu of the requirements provided in Section 1.12.4. When the *erector's* work includes *coating* application or touch-up of *coatings*, the *documented procedure* for *coating* application shall support achievement of proper application and curing of *coatings* in accordance with *manufacturer* recommendations, product data sheets, and *contract documents*, as applicable.

5.12.6. 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
(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 AISC *Code of Standard Practice*
(r) Provisions for temporary supports as required by the AISC *Code of Standard Practice* Section 7.10.3
(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 the 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.

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

CHAPTER 6

HYDRAULIC METAL STRUCTURES FABRICATOR REQUIREMENTS

This chapter addresses hydraulic metal structures *fabricator* requirements and applies as required in Section 1.2.

This chapter is organized as follows:

6.2. SCOPE

This Standard establishes two categories of hydraulic metal structures: standard and advanced.

Fabricators producing standard hydraulic metal structures shall be required to meet the requirements in Chapter 6 and may be required to meet supplemental requirements in Chapter 6.F.

Fabricators producing advanced hydraulic metal structures shall be required to meet the requirements in Chapter 6 and the supplemental requirements in Chapters 6.A. and 6.F.

Hydraulic metal structure category descriptions:

Standard hydraulic metal structures are those that do not require sophisticated measures such as specialized equipment and techniques for geometric control, machining, welding, and handling.

Commentary: Common examples of standard hydraulic metal structures may include:

(a) Sluice gates
(b) Knife gates
(c) Spillway gates
(d) Bulkheads and stop logs
(e) Needle beams
(f) Lock culvert valves

Advanced hydraulic metal structures are those that require sophisticated measures in *fabrication* and *erection*, particularly with regard to size, curvature, plate thickness, distortion, machining, *fabrication* access, geometric tolerances, and constraint conditions.

Commentary: Common examples of advanced hydraulic metal structures include:

(a) Miter gates
(b) Vertical lift gates
(c) Roller gates
(d) Hoisting gates
(e) Bonneted gates
(f) Sector gates
(g) Submersible Tainter gates

6.3. REFERENCES

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

(a) ANSI/ASNT CP-189 *Standard for Qualification and Certification of Nondestructive Testing Personnel* or ASNT *Recommended Practice No. SNT-TC-1A Personnel Qualification and Certification in Nondestructive Testing*
(b) ASTM F3125/F3125M *Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi, 144 ksi, and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength*
(c) ASTM F3148 *Standard Specification for High Strength Structural Bolt Assemblies, Steel and Alloy Steel, Heat Treated, 144ksi Minimum Tensile Strength, Inch Dimensions*

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

- UFGS 05 59 20 *Fabrication of Hydraulic Steel Structures*
- AWS D1.2/D1.2M *Structural Welding Code—Aluminum*
- AWS D1.3/D1.3M *Structural Welding Code—Sheet Steel*
- AASHTO/AWS D1.5M/D1.5 *Bridge Welding Code*
- AWS D1.6/D1.6M *Structural Welding Code—Stainless Steel*

6.5. MANAGEMENT RESPONSIBILITY

6.5.5. Resource Management

6.5.5.1. Personnel

The following qualification requirements shall apply:

(a) For production and *quality assurance (QA)* management functions, at least five years of *fabrication* experience that includes an appropriate amount of *training*
(b) For *quality control (QC)* and purchasing management functions and for *detailing checkers*, at least three years of *fabrication* experience that includes an appropriate amount of *training*

Commentary: Depending on the education level of the personnel, the combination of experience and *training* may vary depending on the tasks the individual undertakes. It could include more years of hands-on experience with less *training*, or it could be less hands-on experience with more *training*.

The *fabricator* shall have the following personnel on staff or available under contract that are certified in accordance with the *fabricator's* nondestructive testing (NDT) program:

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

The *fabricator* shall have *documented procedures* for certifying and updating NDT personnel employed by the *fabricator*. Alternately, the *fabricator's documented procedures* shall describe how they review the methods and/or written practice of firms as suitable to subcontract to their organization.

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

The *fabricator* shall have an individual on staff who has knowledge and experience with:

(a) Welding processes, procedures, welding equipment, and welder performance qualifications
(b) Development, preparation, qualification, and execution of welding procedure specifications

In addition, the *fabricator* shall have AWS Certified Welding Inspectors or other personnel as permitted by AWS D1.1/D1.1M, "Qualification of Inspection Personnel" available to monitor all shifts on which welding is performed.

6.5.5.2. Buildings, Workspace, Equipment, and Associated Utilities

A *fabrication* facility shall consist of areas and buildings that provide adequate space for the routine functions considered to be part of hydraulic metal structure *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*.

Equipment shall include automatic, mechanized, or semiautomatic welding equipment.

6.6. 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 hydraulic metal structures, including:

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

Decisions made in the process of these communications shall be approved by and distributed to the appropriate parties. This distribution shall be controlled in accordance with Sections 1.6 and 1.8.

Commentary: High-performance steels are designated with an HPS such as ASTM A709 HPS 50W, ASTM A709 HPS 70W, and ASTM A709 HPS 100W. Other specified steels may also be contract-specific materials not addressed by AWS D1 welding codes.

6.7. DETAILING

6.7.1. Detailing Standards

The *detailing* standards shall define the *fabricator's* method of presenting information on shop *assembly* documents or other *fabrication documents*.

6.7.6. Detailing Functions

Detailing personnel shall have an understanding of geometry, machining methods and finishes, dimensioning formats, final tolerances, and materials related to the *fabrication* of the type of hydraulic projects the *fabricator* may undertake.

6.7.8. Preparation of Fabrication Documents

Any *fabrication documents* shall incorporate the contract requirements, specifications, codes, and relevant standards to procure materials and fabricate the structure. To ensure this, a *documented procedure* for preparation of *fabrication documents* shall be developed that 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,* such as change orders and *requests for information (RFI)*, and how the associated resolutions are tracked and controlled

6.12. PROCESS CONTROLS

6.12.1. Welding

The *documented procedure* for welding shall include welding of dissimilar metals.

Welding procedure specifications (WPS) and supporting procedure qualification records (PQR) shall be available for the dissimilar metals to be joined, including those not addressed by AWS D1 welding codes.

CHAPTER 6.A

SUPPLEMENTAL REQUIREMENTS FOR FABRICATORS OF ADVANCED HYDRAULIC METAL STRUCTURES

This chapter addresses supplemental requirements for *fabricators* of advanced hydraulic metal structures and applies as required in Chapter 6.

This chapter is organized as follows:

6.A.3. REFERENCES

The ability to work to and meet the requirements of the latest edition of:

(a) ASTM F3125/F3125M *Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi, 144 ksi, and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength*

(b) ASTM F3148 *Standard Specification for High Strength Structural Bolt Assemblies, Steel and Alloy Steel, Heat Treated, 144ksi Minimum Tensile Strength, Inch Dimensions*

6.A.5. MANAGEMENT RESPONSIBILITY

6.A.5.5. Resource Management

6.A.5.5.1. Personnel

The *fabricator* shall have AWS Certified Welding Inspectors present to monitor all shifts on which welding is performed. Alternate qualifications described in AWS D1.1, "Qualification of Inspection Personnel," are not permitted for *fabricators* of advanced hydraulic metal structures.

6.A.12. PROCESS CONTROLS

6.A.12.1. Welding

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

6.A.12.2. Bolt Installation

The *documented procedure* for bolting shall meet the requirements for rotational capacity testing as required by:

(a) ASTM F3125/F3125M *Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi, 144 ksi, and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength*
(b) ASTM F3148 *Standard Specification for High Strength Structural Bolt Assemblies, Steel and Alloy Steel, Heat Treated, 144ksi Minimum Tensile Strength, Inch Dimensions*

6.A.12.6. Trial Assembly

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

(a) Provisions for control of assembled dimensions
(b) Provisions for control of accuracy of drilling and reaming of shop connections
(c) *Documented procedures*, including reference drawings, for matchmarking 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*

6.A.12.7. Machining

A *documented procedure* shall be developed for machining, whether it is performed by the *fabricator* or a *subcontractor*.

CHAPTER 6.F

SUPPLEMENTAL REQUIREMENTS FOR FABRICATORS OF FRACTURE-CRITICAL MEMBERS OF HYDRAULIC METAL STRUCTURES

This chapter addresses supplemental requirements for *fabricators* of fracture-critical members of hydraulic metal structures and applies as required in Chapter 6.

This chapter is organized as follows:

6.F.3. REFERENCES

The ability to work to and meet the requirements of the latest edition of AASHTO/AWS D1.5M/D1.5 *Bridge Welding Code* shall be demonstrated.

6.F.5. MANAGEMENT RESPONSIBILITY

6.F.5.7. Quality Manual

The *quality manual* shall include or reference a written fracture control plan (FCP).

6.F.7. DETAILING

6.F.7.1. Detailing Standards

The *detailing* standards for preparation of bills of material shall include how fracture-critical members (FCM) are identified in bills of material. FCM shall be individually identified.

Commentary: Materials such as castings, stainless steel, aluminum, and steels other than ASTM A709 do not have properties specified for meeting the requirements of FCM.

The *detailing* standards shall define the manner of identifying fracture-critical welds.

6.F.10. PURCHASING

6.F.10.1. Purchasing Data

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

Commentary: Purchase orders no longer need to specify killed steel and prohibit mill *repairs* because they are now covered in ASTM A709. Purchase orders for fracture-critical material should reference the applicable requirements in ASTM A709.

If non-ASTM A709 material is specified for FCM, the *owner's* representative for design should indicate which properties and test methods are required.

Fracture-critical specific Charpy V-notch testing is not required in the specification of some materials. Without a published specification or supporting testing or research, the specifier should define these requirements for other materials like castings, stainless steel, or aluminum.

6.F.11. MATERIAL IDENTIFICATION

The *fabricator's documented procedures* for identification of material and for material traceability shall include provisions for maintaining heat and mill test report (MTR) identity of fracture-critical material throughout the *fabrication* process. The *procedure* shall address how fracture-critical material is identified at receipt and throughout *fabrication* by unique mill piece or plate number. Further, the *procedure* shall also address how consumables purchased for fracture-critical welding are identified.

6.F.12. PROCESS CONTROLS

6.F.12.1. Welding

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

(a) Fracture-critical provisions for welding procedure qualification, preheat, and storage of consumables
(b) Provisions for the creation and implementation of a FCP. The FCP shall be in accordance with the requirements of AASHTO/AWS D1.5M/D1.5 *Bridge Welding Code*, "AASHTO/AWS Fracture Control Plan (FCP) for Nonredundant Members," with the following modifications:
    (1) All instances of the word "bridge" shall be replaced with "hydraulic structure."
    (2) The first sentence of the section "Certification and Qualification" shall be omitted.

6.F.13. INSPECTION AND TESTING

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

6.F.15. CONTROL OF NONCONFORMANCES

6.F.15.2. Nonconforming Work

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