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USACE / NAVFAC / AFCEA / NASA UFGS-05 05 23 (July 2007)  
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Preparing Activity: USACE Superseding  
UFGS-05 05 23.00 14 (July 2006)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated March 2008

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07/07

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SECTION 05 05 23

WELDING, STRUCTURAL  
07/07

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NOTE: This guide specification covers the requirements for (1) qualifying welding procedures, welders and welding operators, and (2) the fabrication, welding and inspection of carbon steel, low alloy steel, extra-high-strength quenched and tempered low alloy steels, and austenitic stainless steel materials for structural steel for buildings, bridges, other structures and non-structural use. This section should not be included in NAVFAC projects.

Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

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

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

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

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PART 1 GENERAL

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NOTE: This specification can be used for bridges and other structures with similar types of live loads by implementing the requirements of AWS D1.1/D1.1M, Section 9 or 10, as applicable, in the design of the weldments, and deleting the references to AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

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## 1.1 REFERENCES

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

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

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

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

### AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 360 (2005) Specification for Structural Steel Buildings, with Commentary

### AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ASNT RP SNT-TC-1A (2001) Recommended Practice

### AMERICAN WELDING SOCIETY (AWS)

AWS A2.4 (2007) Standard Symbols for Welding, Brazing and Nondestructive Examination

AWS A3.0 (2001) Standard Welding Terms and Definitions Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting and Thermal Spraying

AWS D1.1/D1.1M (2006; Errata 2006) Structural Welding Code - Steel

AWS D1.3/D1.3M (2008) Structural Welding Code - Sheet Steel

AWS D1.4/D1.4M (2005; Errata 2005) Structural Welding Code - Reinforcing Steel

AWS D14.1/D14.1M (2005) Welding Industrial and Mill Cranes and Other Material Handling Equipment

AWS D14.4/D14.4M (2005) Welded Joints for Machinery and Equipment

AWS Z49.1 (2005) Safety in Welding, Cutting and Allied Processes

ASTM INTERNATIONAL (ASTM)

ASTM E 165 (2002) Standard Test Method for Liquid Penetrant Examination

ASTM E 709 (2001) Standard Guide for Magnetic Particle Examination

## 1.2 DEFINITIONS

Definitions of welding terms are in accordance with AWS A3.0. The following classifications [Class 1 (highest class) to Class 6 (lowest class)] indicate the project's class(es) of weld joints.

### 1.2.1 Class 1 Weld Joints

This covers complete penetration weld joints only. These weld joints apply where failure would cause a loss of the system and/or be hazardous to personnel. Class 1 weld joints are highly stressed (dynamic and cyclic loading) and characterized as a single point of failure with no redundancy for the redistribution of stress into another member.

### 1.2.2 Class 2 Weld Joints

This covers both complete and partial penetration groove weld joints and fillet weld joints. These weld joints apply where failure would reduce the overall efficiency of a system but loss of the system or a hazard to personnel would not be experienced.

### 1.2.3 Class 3 Weld Joints

This covers both complete and partial penetration groove weld joints and fillet weld joints. These weld joints apply where failure would not affect the efficiency of a system nor create a hazard to personnel. Class 3 weld joints are connections of secondary members not subject to dynamic action and/or low stressed miscellaneous applications.

### 1.2.4 Class 4 Weld Joints

This covers weld joints applicable to welding reinforcing steel to primary structural members.

### 1.2.5 Class 5 Weld Joints

This covers weld joints applicable to welding concrete reinforcing steel splices (prestressing steel excepted), steel connection devices, and inserts and anchors required in concrete construction.

### 1.2.6 Class 6 Weld Joints

This covers plug and slot weld joints as applicable to the requirements of the project's code(s).

### 1.3 GENERAL REQUIREMENTS

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NOTE: The drawings should be checked to ensure that any supplementary information required by the paragraph has been shown and that there is no conflict between the drawings and the specifications. Complete information about location, type, size, and extent of all welds and nondestructive testing, where required, must be clearly shown on the drawings. When welding is to be covered by more than one section in the contract specifications, this section covers all structural welding; the other sections cover the utilities or special equipment required inside the structure. Welding of utilities or special equipment to structural members must be done carefully so that the overall structure is not weakened. The extent of welding required must be clearly shown on drawings or covered by the contract specification. Revise this paragraph to clearly define the welding that is covered. Drawings or other section of the specifications must specify the strength of the base material.

Drawings or the text of the contract specifications must specify the weld requirements: tensile strength, elongation, shear strength, size, length, type, and location.

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Conform the design of welded connections to **AISC 360**, unless otherwise indicated or specified. Material with welds will not be accepted unless the welding is specified or indicated on the drawings or otherwise approved. Perform welding as specified in this section, except where additional requirements are shown on the drawings or are specified in other sections. Do not commence welding until welding procedures, inspectors, nondestructive testing personnel, welders, welding operators, and tackers have been qualified and the submittals approved by the Contracting Officer. Perform all testing at or near the work site. Each Contractor performing welding shall maintain records of the test results obtained in welding procedure, welder, welding operator, and tacker performance qualifications.

#### 1.3.1 Pre-erection Conference

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NOTE: ASTM A 992 steel must be used for all buildings which have groove welds in their lateral force resisting systems, and are either in Seismic Design Categories D, E and F or in Category C and are Seismic Use Group III; this and the following paragraph will be retained for this type of buildings.

Government personnel attending the pre-erection conference should include all field Quality Assurance (QA) inspectors, the building designer,

the Engineer of Record (EOR) (if different from the designer) and the Project Manager (PM).

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Hold a pre-erection conference prior to the start of the field welding, to bring all affected parties together and to gain a naturally clear understanding of the project and the Welding Procedure Specifications (WPS) (which the Contractor shall develop and submit for all welding, including welding done using pre-qualified procedures). Mandatory attendance is required by all Contractor's welding production and inspection personnel and appropriate Government personnel. Include as items for discussion: responsibilities of various parties; welding procedures and processes to be followed; welding sequence (both within a joint and joint sequence within the building); inspection requirements and procedures, both visual and ultrasonic; welding schedule; fabrication of mock-up model; and other items deemed necessary by the attendees.

#### 1.3.2 Mock-up Model

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NOTE: Building designer must designate, on the drawings, a joint to be used as a mock-up model. This model must represent a critical, but typical, field welded groove joint connection located at or near where a properly sequenced erection pattern starts.

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Perform first the field-welded connection designated as the mock-up model on the drawings. All welders qualified and designated to perform field-welded groove joints must be present during the welding of the mock-up model connections and each one shall perform a part of the welding. Simulate with the mock-up test all physical and environmental conditions that will be encountered during the welding of all groove joints. Execute all inspection procedures required for groove welded joints, including NDE tests, on the mock-up model. All Contractor inspection and testing personnel designated to perform QC of groove welded joints must be present during the welding of the mock-up model and each one shall perform the inspection procedures to be performed on production welding of these joints. This mock-up model connection represents the standard of performance, both for the welding and inspection procedures used and the results to be achieved in the production welding for these groove welded joints.

#### 1.4 SUBMITTALS

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

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

**submittal is sufficiently important or complex in context of the project.**

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

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

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

#### SD-03 Product Data

Welding Procedure Qualifications[; G][; G, [\_\_\_\_]]  
Welder, Welding Operator, and Tacker Qualification  
Inspector Qualification  
Previous Qualifications  
Pre-qualified Procedures

Copies of the welding procedure specifications; the procedure qualification test records; and the welder, welding operator, or tacker qualification test records.

#### SD-06 Test Reports

Quality Control  
Nondestructive Examination

A quality assurance plan and records of tests and inspections. Submit all records of nondestructive examination in accordance with paragraph "Acceptance Requirements".

#### SD-07 Certificates

Certified Welding Procedure Specifications (WPS)  
Certified Brazing Procedure Specifications (BPS)  
Certified Procedure Qualification Records (PQR)  
Certified Welder Performance Qualifications (WPQ)  
Certified Brazer Performance Qualifications (BPQ)

Certificates in accordance with paragraph "Other Applications".



## 1.5 WELDING PROCEDURE QUALIFICATIONS

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NOTE: Drawings or the text of the contract specifications must specify the weld requirements: tensile strength, elongation, shear strength, size, length, type, and location.

When the proposed shielded metal-arc welding procedures are reviewed, the voltage and travel speed must be within the limits shown in the following table:

Electrode	Voltage Limits	Travel Speed Limits
E6010	28 - 32	125 - 380 mm/minute (5 - 15 inch/minute)
E6011	28 - 32	150 - 300 mm/minute (6 - 12 inch/minute)
E6013	22 - 26	200 - 360 mm/minute (8 - 14 inch/minute)
E7018	25 - 28	150 - 510 mm/minute (6 - 20 inch/minute)
E7024	26 - 32	200 - 410 mm/minute (8 - 16 inch/minute)
E8018	22 - 28	200 - 510 mm/minute (8 - 20 inch/minute)
E11018	25 - 30	150 - 410 mm/minute (6 - 16 inch/minute)

These limits are for 3.0 mm (1/8 inch) diameter electrodes and the voltage will vary a small amount (plus or minus 2 volts) with different diameters. The travel speed limits must remain constant. Provide current limits, which are based on coating types and core wire diameter, as designated in AWS A5.1/A5.1M. The heat input, is measured in Joules per mm (Joules per inch),

$$(\text{Voltage} \times \text{Current} \times 60) / (\text{Travel speed inch/minute})$$

This may not exceed 2,165 Joules per mm (55,000 Joules per inch) for A36 steel. With higher heat inputs, the weld metal strengths fall below the specification limits. For gas metal-arc welding, the maximum heat input must be 1,969 Joules per mm (50,000 Joules per inch).

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Except for pre-qualified (per AWS D1.1/D1.1M) and previously qualified procedures, each Contractor performing welding shall record in detail and qualify the welding procedure specification for any welding procedure

followed in the fabrication of weldments. Conform qualification of welding procedures to AWS D1.1/D1.1M and to the specifications in this section. Submit for approval copies of the welding procedure specification and the results of the procedure qualification test for each type of welding which requires procedure qualification. Approval of any procedure, however, does not relieve the Contractor of the sole responsibility for producing a finished structure meeting all the specified requirements. Submit this information on the forms in Appendix E of AWS D1.1/D1.1M. Individually identify and clearly reference on the detail drawings and erection drawings all welding procedure specifications, or suitably key them to the contract drawings. In case of conflict between this specification and AWS D1.1/D1.1M, this specification governs.

#### 1.5.1 General Requirements

The organization performing this work must be certified in the following: American Institute of Steel Construction (AISC) Quality Certification Program Category [Category I Conventional Steel Structures] [Category II Complex Steel Building Structures] [Category III Major Steel Bridges].

a. For Structural Projects, provide documentation of the following:

- 1) Component Thickness 3 mm 1/8 inch and greater: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D1.1/D1.1M.
- 2) Component Thickness Less than 3 mm 1/8 inch: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D1.3/D1.3M.
- 3) Reinforcing Steel: Qualification documents (WPS, PWR, and WPQ) in accordance with AWS D1.4/D1.4M.

b. For other applications, provide documentation of the following:

- 1) Submit for [approval] [review] to the Contracting Officer [two] [\_\_\_\_\_] copies of Certified Welding Procedure Specifications (WPS), Certified Brazing Procedure Specifications (BPS) and Certified Procedure Qualification Records (PQR) within [fifteen] [\_\_\_\_\_] calendar days after receipt of Notice to Proceed.
- 2) Cranes: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D14.1/D14.1M.
- 3) Submit for [approval] [review] to the Contracting Officer [two] [\_\_\_\_\_] copies of Certified Welder Performance Qualifications (WPQ) and Certified Brazier Performance Qualifications (BPQ) within [fifteen] [\_\_\_\_\_] calendar days prior to any employee welding on the project material.
- 4) Machinery: Qualification documents (WPS, PQR, and WPQ) in accordance with AWS D14.4/D14.4M.

#### 1.5.2 Previous Qualifications

Welding procedures previously qualified by test may be accepted for this contract without re-qualification if the following conditions are met:

- a. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.

b. The qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.

c. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

#### 1.5.3 Pre-qualified Procedures

[Welding procedures which are considered pre-qualified as specified in AWS D1.1/D1.1M will be accepted without further qualification. The Contractor shall submit for approval a listing or an annotated drawing to indicate the joints not pre-qualified. Procedure qualification is mandatory for these joints.] [No pre-qualified welding procedures are allowed. Contractor shall qualify the welding procedures and welders by tests prescribed in the applicable code or specification notwithstanding the fact the code or specification may allow pre-qualified procedures.]

#### 1.5.4 Retests

If welding procedure fails to meet the requirements of AWS D1.1/D1.1M, the procedure specification must be revised and re-qualified, or at the Contractor's option, welding procedure may be retested in accordance with AWS D1.1/D1.1M. If the welding procedure is qualified through retesting, all test results, including those of test welds that failed to meet the requirements, must be submitted with the welding procedure.

#### 1.6 WELDER, WELDING OPERATOR, AND TACKER QUALIFICATION

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**NOTE: Additional requirements may be inserted if  
necessary. The methods of nondestructive testing  
required must be determined and specified.**  
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Each welder, welding operator, and tacker assigned to work on this contract must be qualified in accordance with the applicable requirements of AWS D1.1/D1.1M and as specified in this section. Welders, welding operators, and tackers who make acceptable procedure qualification test welds will be considered qualified for the welding procedure used.

##### 1.6.1 Previous Personnel Qualifications

At the discretion of the Contracting Officer, welders, welding operators, and tackers qualified by test within the previous 6 months may be accepted for this contract without re-qualification if all the following conditions are met:

- a. Copies of the welding procedure specifications, the procedure qualification test records, and the welder, welding operator, and tacker qualification test records are submitted and approved in accordance with the specified requirements for detail drawings.
- b. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.
- c. The previously qualified welding procedure conforms to the requirements of this specification and is applicable to welding

conditions encountered under this contract.

d. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

#### 1.6.2 Certificates

Before assigning any welder, welding operator, or tacker to work under this contract, submit the names of the welders, welding operators, and tackers to be employed, and certification that each individual is qualified as specified. The certification must state the type of welding and positions for which the welder, welding operator, or tacker is qualified, the code and procedure under which the individual is qualified, the date qualified, and the name of the firm and person certifying the qualification tests. Keep the certification current, on file, and furnish 3 copies.

#### 1.6.3 Renewal of Qualification

Re-qualification of a welder or welding operator is required under any of the following conditions:

- a. It has been more than 6 months since the welder or welding operator has used the specific welding process for which he is qualified.
- b. There is specific reason to question the welder or welding operator's ability to make welds that meet the requirements of these specifications.
- c. The welder or welding operator was qualified by an employer other than those firms performing work under this contract, and a qualification test has not been taken within the past 12 months. Submit as evidence of conformance all records showing periods of employment, name of employer where welder, or welding operator, was last employed, and the process for which qualified.
- d. A tacker who passes the qualification test is considered eligible to perform tack welding indefinitely in the positions and with the processes for which he is qualified, unless there is some specific reason to question the tacker's ability. In such a case, the tacker is required to pass the prescribed tack welding test.

#### 1.7 INSPECTOR QUALIFICATION

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NOTE: Additional requirements may be inserted if necessary. The methods of nondestructive testing required must be determined and specified. If quality control inspection is to be the responsibility of the Government, delete this paragraph.  
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[Inspector qualifications must be in accordance with AWS D1.1/D1.1M. Qualify all nondestructive testing personnel in accordance with the requirements of ASNT RP SNT-TC-1A for Levels I or II in the applicable nondestructive testing method. The inspector may be supported by assistant welding inspectors who are not qualified to ASNT RP SNT-TC-1A, and assistant inspectors may perform specific inspection functions under the

supervision of the qualified inspector.]

## 1.8 SYMBOLS

Symbols must be in accordance with AWS A2.4, unless otherwise indicated.

## 1.9 SAFETY

Safe welding practices and safety precautions during welding must conform to AWS Z49.1.

## PART 2 PRODUCTS

### 2.1 WELDING EQUIPMENT AND MATERIALS

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NOTE: Normally, the Contractor (fabricator) selects the specific electrode material for weldments. In all cases, a class of electrode should be called out based on the table of matching filler metals in AWS D1.1/D1.1M. If in special cases the selection of the proper electrode is critical to the design, the designer may specify the electrode to be used in this or other sections. In special cases, it may also be necessary to specify the welding process.  
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All welding equipment, electrodes, welding wire, and fluxes must be capable of producing satisfactory welds when used by a qualified welder or welding operator performing qualified welding procedures. All welding equipment and materials shall comply with the applicable requirements of AWS D1.1/D1.1M.

## PART 3 EXECUTION

### 3.1 WELDING OPERATIONS

\*\*\*\*\*  
NOTE: When the proposed shielded metal-arc welding procedures are reviewed, the voltage and travel speed must be within the limits shown in the following table:

Electrode	Voltage Limits	Travel Speed Limits
E6010	28 - 32	125 - 380 mm/minute (5 - 15 inch/minute)
E6011	28 - 32	150 - 300 mm/minute (6 - 12 inch/minute)
E6013	22 - 26	200 - 360 mm/minute (8 - 14 inch/minute)
E7018	25 - 28	150 - 510 mm/minute (6 - 20 inch/minute)
		200 - 410 mm/minute

Electrode	Voltage Limits	Travel Speed Limits
E7024	26 - 32	(8 - 16 inch/minute)
E8018	22 - 28	200 - 510 mm/minute (8 - 20 inch/minute)
E11018	25 - 30	150 - 410 mm/minute (6 - 16 inch/minute)

These limits are for 3.0 mm (1/8 inch) diameter electrodes and the voltage may vary a small amount (plus or minus 2 volts) with different diameters. The travel speed limits remain constant. The current limits, which are based on coating types and core wire diameter, are as designated in AWS A5.1/A5.1M. The heat input, is measured in Joules per mm (Joules per inch),

$$(\text{Voltage} \times \text{Current} \times 60) / (\text{Travel speed inch/minute}).$$

This should not exceed 2,165 Joules per mm (55,000 Joules per inch) for A36 steel. With higher heat inputs, the weld metal strengths fall below the specification limits. For gas metal-arc welding, the maximum heat input is 1,969 Joules per mm (50,000 Joules per inch).

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### 3.1.1 Requirements

Conform workmanship and techniques for welded construction to the requirements of AWS D1.1/D1.1M and AISC 360. When AWS D1.1/D1.1M and the AISC 360 specification conflict, the requirements of AWS D1.1/D1.1M govern.

### 3.1.2 Identification

Identify all welds in one of the following ways:

- a. Submit written records to indicate the location of welds made by each welder, welding operator, or tacker.
- b. Identify all work performed by each welder, welding operator, or tacker with an assigned number, letter, or symbol to identify welds made by that individual. The Contracting Officer may require welders, welding operators, and tackers to apply their symbol next to the weld by means of rubber stamp, felt-tipped marker with waterproof ink, or other methods that do not cause an indentation in the metal. Place the identification mark for seam welds adjacent to the weld at 1 meter 3 foot intervals. Identification with die stamps or electric etchers is not allowed.

## 3.2 QUALITY CONTROL

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NOTE: The methods of nondestructive testing required must be determined and specified. The specification writer (designer) must decide what

weld defects can be tolerated under service conditions. Next, the type of nondestructive examination (NDE) system to be used must be determined, considering joint design, material thickness, and accessibility to the joint. Every weld joint may not require 100 percent NDE. Joints critical to the structure should be determined. These should be inspected more closely than non-critical joints. Remember, visual inspection is as important to the final quality of the weld as the other methods. The specifications or drawings must clearly indicate which joints require 100 percent NDE, which joints require random inspection, and which method(s) are to be used for each joint. For random inspection, the drawings must indicate the location, number of joints, and minimum increment length of weld which is to be inspected, but must not disclose the exact spot to be examined. Joints not inspected by radiographic, magnetic particle, liquid penetrant, or ultrasonic methods are subject to visual inspections only. If quality control is to be primarily the Contractor's responsibility and the inspection and tests are adequately called out, then acceptance by the Government can rely on the Contractor's work and records -- with some spot checking to verify the results. On projects with only a small amount of welding that needs just visual inspection, acceptance inspection by the Government may be the only quality control required.

Additional requirements may be inserted if necessary. The methods of nondestructive testing required will be determined and specified. If quality control inspection is to be the responsibility of the Government, delete this paragraph.

If the Contractor must do radiographic or nondestructive inspection other than visual, or inspection other than that covered by Section 6 of AWS D1.1/D1.1M, these requirements must be added to this paragraph. The extent of inspection must be clearly shown either on the drawings or by this or other sections of the specifications. The bracketed portion of the paragraph must be edited to define the extent of nondestructive testing required.

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Perform testing using an approved inspection or testing laboratory or technical consultant; or if approved, the Contractor's inspection and testing personnel may be used instead of the commercial inspection or testing laboratory or technical consultant. Perform visual [and] [radiographic,] [ultrasonic,] [magnetic particle,] [and] [liquid penetrant] [dye penetrant] inspections to determine conformance with paragraph STANDARDS OF ACCEPTANCE. Conform procedures and techniques for inspection with applicable requirements of AWS D1.1/D1.1M, ASTM E 165, ASTM E 709, except that in radiographic inspection only film types designated as "fine grain," or "extra fine," are acceptable.

### 3.3 STANDARDS OF ACCEPTANCE

\*\*\*\*\*  
NOTE: Drawings or the text of the contract  
specifications must specify the weld requirements:  
tensile strength, elongation, shear strength, size,  
length, type, and location.  
\*\*\*\*\*

Conform dimensional tolerances for welded construction, details of welds, and quality of welds with the applicable requirements of AWS D1.1/D1.1M and the contract drawings. Perform nondestructive testing by visual inspection [and radiographic,] [ultrasonic,] [magnetic particle,] [or] [dye penetrant] methods. The minimum extent of nondestructive testing must be random [\_\_\_\_\_] percent of welds or joints, as indicated on the drawings.

#### 3.3.1 Nondestructive Examination

The welding is subject to inspection and tests in the mill, shop, and field. Inspection and tests in the mill or shop do not relieve the Contractor of the responsibility to furnish weldments of satisfactory quality. When materials or workmanship do not conform to the specification requirements, the Government reserves the right to reject material or workmanship or both at any time before final acceptance of the structure containing the weldment.

#### 3.3.2 Destructive Tests

Make all repairs when metallographic specimens are removed from any part of a structure. Employ only qualified welders or welding operators, and use the proper joints and welding procedures, including peening or heat treatment if required, to develop the full strength of the members and joints cut and to relieve residual stress.

### 3.4 GOVERNMENT INSPECTION AND TESTING

In addition to the inspection and tests performed by the Contractor for quality control, the Government will perform inspection and testing for acceptance to the extent determined by the Contracting Officer. The costs of such inspection and testing will be borne by the Contractor if unsatisfactory welds are discovered, or by the Government if the welds are satisfactory. The work may be performed by the Government's own forces or under a separate contract for inspection and testing. The Government reserves the right to perform supplemental nondestructive and destructive tests to determine compliance with paragraph STANDARDS OF ACCEPTANCE.

### 3.5 CORRECTIONS AND REPAIRS

If inspection or testing indicates defects in the weld joints, repair defective welds using a qualified welder or welding operator as applicable. Conduct corrections in accordance with the requirements of AWS D1.1/D1.1M and the specifications. Repair all defects in accordance with the approved procedures. Repair defects discovered between passes before additional weld material is deposited. Wherever a defect is removed and repair by welding is not required, blend the affected area into the surrounding surface to eliminate sharp notches, crevices, or corners. After a defect is thought to have been removed, and before re-welding, examine the area by suitable methods to ensure that the defect has been eliminated. Repaired welds shall meet the inspection requirements for the



original welds. Any indication of a defect is regarded as a defect, unless re-evaluation by nondestructive methods or by surface conditioning shows that no unacceptable defect is present.

-- End of Section --