

\*\*\*\*\*  
USACE / NAVFAC / AFCESA / NASA UFGS-05 14 00.13 (November 2010)  
-----  
Preparing Activity: NASA Superseding  
UFGS-05 14 00.13 (July 2007)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated October 2011

\*\*\*\*\*

### SECTION TABLE OF CONTENTS

#### DIVISION 05 - METALS

#### SECTION 05 14 00.13

#### WELDING STRUCTURAL ALUMINUM FRAMING

11/10

#### PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DEFINITIONS
  - 1.2.1 Class A Fabrication
  - 1.2.2 Class B Fabrication
  - 1.2.3 Class C Fabrication
  - 1.2.4 Class D Fabrication
- 1.3 SUBMITTALS
- 1.4 PRE-INSTALLATION MEETING(S)
- 1.5 QUALITY ASSURANCE
  - 1.5.1 Certificates
  - 1.5.2 Predictive Testing And Inspection Technology Requirements

#### PART 2 PRODUCTS

#### PART 3 EXECUTION

- 3.1 EXAMINATION
- 3.2 PREPARATION
  - 3.2.1 Protection
  - 3.2.2 Surface Preparation
  - 3.2.3 Welding Equipment
- 3.3 HEAT INPUT REQUIREMENTS
  - 3.3.1 Preheat
  - 3.3.2 Interpass
  - 3.3.3 Postweld
- 3.4 CONSTRUCTION
  - 3.4.1 Class A Fabrication
  - 3.4.2 Class B Fabrication
  - 3.4.3 Class C Fabrication
  - 3.4.4 Class D Fabrication
- 3.5 INSPECTION/NONDESTRUCTIVE EXAMINATION (NDE)
  - 3.5.1 Inspection
  - 3.5.2 Methods of Non-Destructive Examination (NDE)

- 3.5.2.1 Visual Inspection (VT)
- 3.5.2.2 Liquid Penetrant Inspection (PT)
- 3.5.2.3 Radiographic Inspection (RT)
- 3.5.2.4 Ultrasonic Inspection (UT)
- 3.5.3 Levels of Examination
  - 3.5.3.1 Level I Examination
  - 3.5.3.2 Level II Examination
  - 3.5.3.3 Level III Examination
- 3.5.4 Acceptance Requirements
  - 3.5.4.1 Class A Fabrication
  - 3.5.4.2 Class B Fabrication
  - 3.5.4.3 Class C & D Fabrication
- 3.6 PROTECTION OF ADJACENT MATERIALS

-- End of Section Table of Contents --

\*\*\*\*\*  
USACE / NAVFAC / AFCEA / NASA UFGS-05 14 00.13 (November 2010)  
-----  
Preparing Activity: NASA Superseding  
UFGS-05 14 00.13 (July 2007)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated October 2011

\*\*\*\*\*

### SECTION 05 14 00.13

#### WELDING STRUCTURAL ALUMINUM FRAMING 11/10

\*\*\*\*\*

NOTE: This specification covers the requirements for minimum requirements for qualifying welding procedures, welders, and welding operators for making and inspecting welds in structural and non-structural fabrications of weldable aluminum materials.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. 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, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

\*\*\*\*\*

## PART 1 GENERAL

\*\*\*\*\*

NOTE: This section does not cover welding of aluminum pressure vessels or pressure piping.

\*\*\*\*\*

### 1.1 REFERENCES

\*\*\*\*\*

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

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

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

\*\*\*\*\*

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

#### AMERICAN WELDING SOCIETY (AWS)

AWS D1.2/D1.2M	(2008) Structural Welding Code - Aluminum
AWS QC1	(2007) Standard for AWS Certification of Welding Inspectors
AWS QC7	(1993; Suppl G) Standard for AWS Certified Welders
AWS Z49.1	(2005) Safety in Welding and Cutting and Allied Processes

#### ASTM INTERNATIONAL (ASTM)

ASTM E 165	(2009) Standard Test Method for Liquid Penetrant Examination
------------	--------------------------------------------------------------

#### NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

RCBEA GUIDE	(2004) NASA Reliability Centered Building and Equipment Acceptance Guide
-------------	--------------------------------------------------------------------------

#### NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 51B	(2009; TIA 09-1) Standard for Fire Prevention During Welding, Cutting, and Other Hot Work
----------	-------------------------------------------------------------------------------------------

## 1.2 DEFINITIONS

Establish levels of fabrication using the following classifications:

### 1.2.1 Class A Fabrication

Class A fabrication includes complete penetration weld joints only, and applies to those welds where failure would cause a loss of the system and be hazardous to personnel. Classify welds as a Class A fabrication for highly stressed dynamic and cyclic loading. Characterize welds as a single point of failure with no redundancy for the redistribution of stress into another member.

### 1.2.2 Class B Fabrication

Class B fabrication includes complete and partial penetration groove weld joints and fillet weld joints, and applies to those welds where failure would reduce the overall efficiency of the system but loss of system or hazard to personnel would not be experienced.

### 1.2.3 Class C Fabrication

Class C fabrication includes complete and partial penetration groove weld joints and fillet weld joints, and applies to those welds where failure would not affect the efficiency of the system nor create hazard to personnel. Classify welds as a Class C fabrication for connections of secondary members not subject to dynamic action and low stressed miscellaneous applications.

### 1.2.4 Class D Fabrication

Plug and slot weld joints may be used for subcritical construction joints, when the joints meet all the applicable Sections 2, and[ 8,][ 9,][ 10,][ 11,] design and fabrication requirements of AWS D1.2/D1.2M.

## 1.3 SUBMITTALS

\*\*\*\*\*

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

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

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

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

\*\*\*\*\*

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

#### SD-01 Preconstruction Submittals

Operating Safety Plan[; G][; G, [\_\_\_\_]]

#### SD-07 Certificates

Certified Welding Procedure Specifications (WPS)[; G][; G, [\_\_\_\_]]

Certified Procedure Qualification Records (PQR)[; G][; G, [\_\_\_\_]]

Certified Welder Performance Qualifications (WPQ)[; G][; G, [\_\_\_\_]]

#### 1.4 PRE-INSTALLATION MEETING(S)

Within [30 ][\_\_\_\_] days of Contract Award, submit an operating safety plan to the Contracting Officer indicating all work will conform to the requirements of AWS Z49.1, Annex 'J' of AWS D1.2/D1.2M, and NFPA 51B.

Also submit the following certificates:

- a. Certified Welding Procedure Specifications (WPS)
- b. Certified Procedure Qualification Records (PQR)
- c. Certified Welder Performance Qualifications (WPQ)

#### 1.5 QUALITY ASSURANCE

##### 1.5.1 Certificates

Submit certificates verifying that the welders performing the work hold current certification in accordance with AWS QC7. Do not allow pre-qualified welding procedures. Provide documentation of Qualify the welding procedures, welders and welding inspectors in accordance with Section 5 of AWS D1.2/D1.2M and AWS QC1.

##### 1.5.2 Predictive Testing And Inspection Technology Requirements

\*\*\*\*\*

NOTE: The Predictive Testing and Inspection (PT&I) tests prescribed in Section 01 83 13.07 40 RELIABILITY CENTERED ACCEPTANCE FOR SUPERSTRUCTURE PERFORMANCE REQUIREMENTS are MANDATORY for all [NASA] [\_\_\_\_] assets and systems identified as Critical, Configured, or Mission Essential. If the system is non-critical, non-configured, and not mission essential, use sound engineering discretion to assess the value of adding these additional test and acceptance requirements. See Section 01 83 13.07 40 RELIABILITY CENTERED ACCEPTANCE FOR SUPERSTRUCTURE PERFORMANCE REQUIREMENTS for

additional information regarding cost feasibility of  
PT&I.

\*\*\*\*\*

This section contains systems and/or equipment components regulated by NASA's Reliability Centered Building and Equipment Acceptance Program. This program requires the use of Predictive Testing and Inspection (PT&I) technologies in conformance with RCBEA GUIDE to ensure building equipment and systems installed by the Contractor have been installed properly and contain no identifiable defects that shorten the design life of a system and/or its components. Satisfactory completion of all acceptance requirements is required to obtain Government approval and acceptance of the Contractor's work.

Perform PT&I tests and provide submittals as specified in Section 01 83 13.07 40 RELIABILITY CENTERED ACCEPTANCE FOR SUPERSTRUCTURE PERFORMANCE REQUIREMENTS.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 EXAMINATION

Perform pre-weld inspection of all components. Report in writing all deficiencies or discrepancies to the Contracting Officer. Commencement of welding procedures validates Contractors acceptance of existing conditions.

3.2 PREPARATION

3.2.1 Protection

Protect all adjacent surfaces prior to commencement of welding work, in conformance with NFPA 51B and approved Operating Safety Plan.

3.2.2 Surface Preparation

Prepare all surfaces to be welded in conformance with AWS D1.2/D1.2M.

3.2.3 Welding Equipment

Provide all welding equipment, electrodes, welding wire, fluxes, preparatory tools and equipment, and any other accessories required to perform the work.

3.3 HEAT INPUT REQUIREMENTS

\*\*\*\*\*

NOTE: Welding a material which is at an initial temperature below 38 degrees C 100 degrees F may require localized preheating to remove moisture from the surface of the material.

\*\*\*\*\*

3.3.1 Preheat

Do not weld at an ambient temperature below 0 degrees C 32 degrees F, or

when the surfaces are wet or exposed to rain, snow, or high wind. Verify that the minimum temperature of the metals in the area of welding is 10 degrees C 50 degrees F. When the ambient conditions are such that the normal temperature of the base metal is below 10 degrees C 50 degrees F, preheat the area surrounding the joint to provide a base metal temperature of 38 degrees C 100 degrees F for a distance of at least 75 millimeter 3 inch in all directions from the joint to be welded.

### 3.3.2 Interpass

In a multipass weld, ensure the interpass temperature is the temperature of the weld metal before the next pass is started.

### 3.3.3 Postweld

Postweld heat treatment of weldments is prohibited unless noted in the applicable [NASA] [ ] approved ]Code qualified/certified welding documentation, Certified Welding Procedure Specifications (WPS).

## 3.4 CONSTRUCTION

### 3.4.1 Class A Fabrication

Use complete penetration groove weld joints only. Fabricate weldment in accordance with Section [9 ][10 ] of AWS D1.2/D1.2M.

### 3.4.2 Class B Fabrication

Fabricate weldment in accordance with the requirements of applicable section, Section [8 ][10 ] of AWS D1.2/D1.2M.

### 3.4.3 Class C Fabrication

Fabricate weldment in accordance with the requirements of Section 11 of AWS D1.2/D1.2M.

### 3.4.4 Class D Fabrication

Apply the minimum applicable requirements of Section 2 and[ 8,][ 9,][ 10,][ 11,] of AWS D1.2/D1.2M for welding of plugs and slot joints.

## 3.5 INSPECTION/NONDESTRUCTIVE EXAMINATION (NDE)

\*\*\*\*\*  
NOTE: Inspection and acceptance requirements of these Codes and Standards are the minimum requirements. Additional inspections and tighter acceptance requirements may be used, but the specifier is to note the additional NDE requirements in the specifications/drawings.  
\*\*\*\*\*

\*\*\*\*\*  
NOTE: If the specified system is identified as critical, configured, or mission essential, use Section 01 83 13.07 40 RELIABILITY CENTERED ACCEPTANCE FOR SUPERSTRUCTURE PERFORMANCE REQUIREMENTS to establish predictive and acceptance testing criteria above and beyond that listed below.  
\*\*\*\*\*



\*\*\*\*\*

Perform PT&I tests and provide submittals as specified in Section 01 83 13.07 40 RELIABILITY CENTERED ACCEPTANCE FOR SUPERSTRUCTURE PERFORMANCE REQUIREMENTS.

### 3.5.1 Inspection

Perform fabrication/erection inspection to ensure that materials and workmanship meet the minimum requirements of the contract documents.

Final acceptance of all welded joints will be by the Contracting Officer. [Additional testing and inspection as determined by the Contracting Officer may be done by the Government at the Government's expense.]

Repair all unacceptable welds and make ready for Government reinspection at no additional cost to the Government.

After weld joints have been satisfactorily completed by the Contractor and accepted by the Contracting Officer, clean the joint area to a bright, unpitted, and unscarred surface and protect in accordance with the applicable contract documents.

### 3.5.2 Methods of Non-Destructive Examination (NDE)

Perform NDE examination/inspection of structural aluminum weldments in accordance with AWS D1.2/D1.2M.

#### 3.5.2.1 Visual Inspection (VT)

Enhance Visual Inspection (VT) for cracks and other discontinuities with a magnifying lens of [5X ] [10X ] power wherever required to discern indications or defects otherwise not clear. Measure size and contour of welds with suitable gages.

#### 3.5.2.2 Liquid Penetrant Inspection (PT)

Perform Liquid Penetrant Inspection (PT) of welds in accordance with ASTM E 165.

#### 3.5.2.3 Radiographic Inspection (RT)

Perform Radiographic Inspection (RT) of welds in accordance with the requirements of Section 6.10, AWS D1.2/D1.2M.

#### 3.5.2.4 Ultrasonic Inspection (UT)

When ultrasonic testing is required by the contract documents, specify the extent of testing, the procedure, and the acceptance criteria.

### 3.5.3 Levels of Examination

#### 3.5.3.1 Level I Examination

Level I examination requires 100 percent VT, and 100 percent RT. Where RT is not practical, perform PT of the root pass and the final surface of each weld joint.

Where applicable, each radiograph is to provide a minimum of the following

additional information permanently included in the image:

- a. Agency Weld No. (including repair cycle no.)
- b. Agency Drawing No.
- c. Agency View No.
- d. Agency Contract No.

Final interpretation and acceptance of all radiographs of welded joints is performed by the Contracting Officer.

#### 3.5.3.2 Level II Examination

Level II examination requires 100 percent VT, and PT of the final surface of each weld joint.

#### 3.5.3.3 Level III Examination

Level III examination requires 100 percent VT of each weld joint.

#### 3.5.4 Acceptance Requirements

##### [3.5.4.1 Class A Fabrication

Ensure Class A fabrication receives a Level I examination, requiring weldments in accordance with Section 3 and Section[ 9][ 10], [AWS D1.2/D1.2M](#).

##### ] [3.5.4.2 Class B Fabrication

Ensure Class B fabrication requires a Level II examination, requiring elements in accordance with Section 3 and Section[ 8][ 10], [AWS D1.2/D1.2M](#).

##### ] [3.5.4.3 Class C & D Fabrication

Ensure Class C & D fabrication receives a Level III examination, requiring weldments in accordance with Section 3 and Section 11, [AWS D1.2/D1.2M](#).

#### ] 3.6 PROTECTION OF ADJACENT MATERIALS

Protect equipment adjacent to the welding/brazing operations to prevent any damage from these operations.

-- End of Section --