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USACE / NAVFAC / AFCEC / NASA	**UFGS-05 14 00.13 (November 2019)**

Preparing Activity: NASA	**Superseding**
	UFGS-05 14 00.13 (May 2015)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021

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11/19

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SECTION 05 14 00.13

WELDING STRUCTURAL ALUMINUM FRAMING
11/19

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NOTE: This guide 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 item(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).

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PART 1 GENERAL

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

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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 Reference Identifier (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 WELDING SOCIETY (AWS)

AWS D1.2/D1.2M	(2014; Errata 1 2014; Errata 2 2020) Structural Welding Code - Aluminum
AWS QC1	(2016) Specification for AWS Certification of Welding Inspectors
AWS QC7	(1993; Suppl G) Standard for AWS Certified Welders
AWS Z49.1	(2012) Safety in Welding and Cutting and Allied Processes

ASTM INTERNATIONAL (ASTM)

ASTM E164	(2019) Standard Practice for Contact Ultrasonic Testing of Weldments
ASTM E165/E165M	(2018) Standard Practice for Liquid Penetrant Examination for General Industry
ASTM E1032	(2019) Standard Practice for Radiographic Examination of Weldments Using Industrial X-Ray Film

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

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

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 51B	(2019) 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 in critical applications 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 in semi-critical applications 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 in non-critical applications 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 the design and fabrication requirements of AWS D1.2/D1.2M.

1.3 ADMINISTRATIVE REQUIREMENTS

1.3.1 Pre-Installation Meetings

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, section 1.6 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)

1.4 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's

Quality Control System. Only add a “G” to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification 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[, [____]]]

SD-07 Certificates

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

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

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

1.5 QUALITY CONTROL

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 qualified welding procedures, welders and welding inspectors in accordance with Sections 3 and 5 of AWS D1.2/D1.2M and AWS QC1.

1.5.2 Predictive Testing And Inspection Technology Requirements

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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.

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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 acceptance of existing conditions.

3.2 PREPARATION

3.2.1 Protection

Protect all adjacent surfaces and equipment 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.

3.2.4 Heat Input Requirements

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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.

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3.2.4.1 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 millimeter3 inch in all directions from the joint to be welded.

3.2.4.2 Interpass

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

3.2.4.3 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).

3.3 FIELD QUALITY CONTROL

3.3.1 Class A Fabrication

Use complete penetration groove weld joints only. Fabricate weldment in accordance with AWS D1.2/D1.2M.

3.3.2 Class B Fabrication

Fabricate weldment in accordance with AWS D1.2/D1.2M.

3.3.3 Class C Fabrication

Fabricate weldment in accordance with AWS D1.2/D1.2M.

3.3.4 Class D Fabrication

Apply the requirements of AWS D1.2/D1.2M for welding of plugs and slot joints.

3.3.5 Inspection/Nondestructive Examination (NDE)

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

3.3.5.1 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 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.

3.3.5.2 Methods of Non-Destructive Examination (NDE)

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

If more than [20] [_____] percent of welds made by a welder contain defects identified by testing, then all groove welds made by that welder must be tested by ultrasonic testing, and all fillet welds made by that welder must be inspected by magnetic particle testing (MT) or dye penetrant testing (PT) as approved by the Contracting Officer. When the groove welds made by an individual welder are required to be tested, magnetic particle or dye penetrant testing may be used only in areas inaccessible to ultrasonic testing.Retest all repaired areas. Submit the weld inspection reports.

Review the drawings, weld position, and direction of travel prior to welding. Verify that the materials purchased match the specification and are free from rust, scale, mill or lamination.

Inspect for proper fit, alignment, cleanliness, preparation, size, gaging location, and acceptability of all welds; identification marking; operation and current characteristics of welding sets in use and the use of pre-heat. Inspect the equipment for damage, arc voltage, and amperage in accordance with specifications.

a. Visual Inspection (VT)

A Certified Welding Inspector must perform visual inspection on 100 percent of all welds. Document this inspection in the Visual Weld Inspection Log.

Verify the electrode size, type and storage comply with specifications. During welding, watch each pass paying close attention to root pass for any irregularities.

After completion of welding, use gauges to verify weld sizes, check finish and contour for acceptability, check for any defects including cracks, also look for overlap and undercut.

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. Minimum light level shall be at least 1,000 LUX (100 foot-candles). Measure size and contour of welds with suitable gages.

b. Liquid Penetrant Inspection (PT)

Perform Liquid Penetrant Inspection (PT) of welds in accordance with ASTM E165/E165M.

c. Radiographic Inspection (RT)

Perform Radiographic Inspection (RT) of welds in accordance with the requirements of ASTM E1032.

d. Ultrasonic Inspection (UT)

When ultrasonic testing is required by the contract documents, specify the extent of testing, the procedure, and the acceptance criteria in accordance with ASTM E164.

3.3.5.3 Levels of Examination

a. 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:

(1) Agency Weld No. (including repair cycle no.)

(2) Agency Drawing No.

(3) Agency View No.

(4) Agency Contract No.

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

b. Level II Examination

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

c. Level III Examination

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

3.3.5.4 Acceptance Requirements

[a. Class A Fabrication

Ensure Class A fabrication receives a Level I examination, requiring weldments in accordance with AWS D1.2/D1.2M.

][b. Class B Fabrication

Ensure Class B fabrication requires a Level II examination, requiring weldments in accordance with AWS D1.2/D1.2M.

][c. Class C & D Fabrication

Ensure Class C & D fabrication receives a Level III examination, requiring weldments in accordance with AWS D1.2/D1.2M.

] -- End of Section --