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DIVISION 05 - METALS

SECTION 05095

WELDING STEEL CONSTRUCTION

06/04

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NASA-05095 (June 2004)  
NATIONAL AERONAUTICS NASA  
AND SPACE ADMINISTRATION Superseding NASA-05095  
(December 2003)  
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SECTION 05095

WELDING STEEL CONSTRUCTION  
06/04

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NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This guide specification covers (1) the requirements for qualifying welding procedures, welders and welding operators, and (2) the minimum requirements for 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 and non-structural use.

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PART 1 GENERAL

1.1 DEFINITIONS

The following classification [Class 1 (highest class) to Class 6 (lowest class)] shall indicate the project's class(es) of weld joints.

1.1.1 Class 1 Weld Joints

This covers complete penetration weld joints only. These are weld joints 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.

1.1.2 Class 2 Weld Joints

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

1.1.3 Class 3 Weld Joints

This covers both complete and partial penetration groove weld joints and fillet weld joints. These are weld joints 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.

1.1.4 Class 4 Weld Joints

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

1.1.5 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.

1.1.6 Class 6 Weld Joints

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

1.2 REFERENCES

\*\*\*\*\*  
**NOTE: The following references should not be manually edited except to add new references. References not used in the text will automatically be deleted from this section of the project specification.**  
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The publications listed below form a part of this section to the extent referenced:

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2004) Structural Welding Code - Steel
AWS D1.3	(1998) Structural Welding Code - Sheet Steel
AWS D1.4	(1998) Structural Welding Code - Reinforcing Steel
AWS D14.1	(1997) Welding of Industrial and Mill Cranes and Other Material Handling Equipment
AWS D14.4	(1997) Classification and Application of Welded Joints for Machinery and Equipment
AWS Z49.1	(1999) Safety in Welding and Cutting

ASTM INTERNATIONAL (ASTM)

ASTM E 165	(2002) Standard Test Method for Liquid Penetrant Examination
ASTM E 709	(2001) Standard Guide for Magnetic Particle Examination

1.3 SUBMITTALS

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NOTE: Review submittal description (SD) definitions in Section 01330 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. Include a columnar list of appropriate products and tests beneath each submittal description.

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The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-06 Test Reports

All records of Non-Destructive Examination shall be submitted in accordance with paragraph entitled, "Acceptance Requirements," of this section.

SD-07 Certificates

The following items shall be submitted in accordance with paragraph entitled, "Other Applications," of this section:

- 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)

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

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

Safe welding practices shall be adhered to as per AWS Z49.1.

1.4.2 Welding Documentation

[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.]

1.4.2.1 Structural Projects

Component Thickness 1/8 inch 3 millimeter and greater: Qualification documents (WPS, PQR, and WPQ) shall be in accordance with AWS D1.1/D1.1M.

Component Thickness Less than 1/8 inch 3 millimeter: Qualification documents (WPS, PQR, and WPQ) shall be in accordance with AWS D1.3.

Reinforcing Steel: Qualification documents (WPS, PWR, and WPQ) shall be in accordance with AWS D1.4.

1.4.2.2 Other Applications

The Contractor shall 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.

Cranes: Qualification documents (WPS, PQR, and WPQ) shall be in accordance with AWS D14.1.

The Contractor shall submit for [approval] [review] to the Contracting Officer [two] [ ] copies of Certified Welder Performance Qualifications (WPQ) and Certified Brazer Performance Qualifications (BPQ) within [fifteen] [ ] calendar days prior to any employee welding on the project material.

Machinery: Qualification documents (WPS, PQR, and WPQ) shall be in accordance with AWS D14.4.

1.5 HEAT INPUT REQUIREMENTS

1.5.1 Preheat

Welding shall not be done at ambient temperature below 32 degrees F 0 degrees C, or when the surfaces are wet or exposed to rain, snow, or high wind. Temperature of the metals in the area where the welding is to be done shall be not less than 50 degrees F 10 degrees C. When the ambient conditions are such that the normal temperature of the base metal is below 50 degrees F 10 degrees C, the area surrounding the joint shall be preheated to provide a base metal temperature of 100 degrees F 38 degrees C for distance of at least 3 inches 75 millimeter in all directions from the joint to be welded. For ambient temperatures above 50 degrees F 10 degrees C, see Table 1 for specific preheat requirements.

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

In a multipass weld, the interpass temperature is the temperature of the weld metal before the next pass is started. See Table 1 for the specific interpass requirements.

TABLE 1  
 PREHEAT AND INTERPASS TEMPERATURES

PLATE THICKNESS [inches]	PREHEAT	INTERPASS
Up to [1,] [25] incl.	50 degrees F	-----
Over [1 to 2], [25-51] incl.	150 degrees F	250 degrees F

TABLE 1  
PREHEAT AND INTERPASS TEMPERATURES

Over [2] [51]	200 degrees F	400 degrees F
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TABLE 1  
PREHEAT AND INTERPASS TEMPERATURES

PLATE THICKNESS (millimeter)	PREHEAT	INTERPASS
Up to [25] [635] incl.	10 degrees C	-----
Over [25 to 50], [635-1295] incl.	65.6 degrees C	121.1 degrees C
Over [50] [1295]	93.3 degrees C	204.4 degrees C

1.5.3 Postweld

Weldments shall not be given a postweld heat treatment unless noted in the applicable [NASA approved] code qualified/certified welding documentation, WPS and PQR.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 ERECTION

3.1.1 Structural Projects

3.1.1.1 Grade A Fabrication

Weldment shall have Class 1 weld joints and be fabricated in accordance with the requirements of the following applicable section: Dynamically Loaded Structures (Section 9) or Tubular Structures (Section 10) of AWS D1.1/D1.1M.

3.1.1.2 Grade B Fabrication

Weldment shall have Class 2 or higher class weld joints and be fabricated in accordance with the requirements of the following applicable section: Statically Loaded Structures (Section 8) or Tubular Structures (Section 10) of AWS D1.1/D1.1M.

3.1.1.3 Grade C Fabrication

Weldment shall have Class 3, or higher class weld joints and be fabricated in accordance with the requirements of the following applicable code: [AWS D1.1/D1.1M] [AWS D1.3].

Component Thickness 1/8 Inch 3 Millimeter and Greater: Weld joints and

fabrication shall be in accordance with the requirements of AWS D1.1/D1.1M.

Component Thickness Less than 1/8 Inch 3 Millimeter: Weld joints and fabrication shall be in accordance with the requirements of AWS D1.3.

3.1.1.4 Grade D Fabrication

Weld joints shall be Class 4 or higher class weld joints and shall meet the requirements of AWS D1.1/D1.1M.

3.1.1.5 Grade E Fabrication

Weld joints shall be Class 5 or higher class weld joints and shall meet the requirements of AWS D1.4.

3.1.1.6 Grade F Fabrication

Weld joints shall be Class 6 or higher class weld joints and shall meet the applicable code, AWS D1.1/D1.1M, AWS D1.3, and AWS D1.4 requirements.

3.1.2 Other Applications

3.1.2.1 Cranes

Weld joints and fabrication shall be in accordance with the requirements of AWS D14.1.

3.1.2.2 Machinery

Weld joints and fabrication shall be in accordance with the requirements of AWS D14.4.

3.2 INSPECTION/NON DESTRUCTIVE EXAMINATION (NDE)

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**NOTE: Inspection and acceptance requirements of these codes and standards are minimum requirements, additional inspections and tighter acceptance requirements may be used, but the specifier must note the additional NDE requirements on the specifications/drawings.**  
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3.2.1 Inspection, Repair and Cleaning Schedule

Contractor shall perform fabrication/erection inspections as necessary prior to assembly, during assembly, during welding, and after welding to ensure that materials and workmanship meet the requirements of the contract documents.

Final acceptance of all welded/brazed joints shall be by the Contracting Officer.

Prior to the Contracting Officer's inspection, all slag and scale shall be removed from all welds. Procedure employed shall not produce notches in either the weld metal or adjacent base metal.

Unacceptable welds shall be immediately repaired and made 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, the joint area shall be cleaned to a bright, unpitted, and unscarred surface and then protected in accordance with [Section 09970 COATINGS FOR STEEL] [Section 09920 ARCHITECTURAL PAINTING] [\_\_\_\_\_].

### 3.2.2 Methods of NDE

Examination/inspection of structural steel weldments shall be performed in accordance with the applicable section of [AWS D1.1/D1.1M] [AWS D1.3].

#### 3.2.2.1 Visual Inspection (VT)

Visual Inspection (VT) for cracks and other discontinuities shall be aided by a magnifying lens of [5X] [10X] [5X-10X] power to discern indications or defects. Size and contour of welds shall be measured with suitable gages.

#### 3.2.2.2 Liquid Penetrant Inspection (PT)

Liquid Penetrant Inspection (PT) of welds shall be performed in accordance with the requirements of ASTM E 165.

#### 3.2.2.3 Magnetic Particle Inspection (MT)

Magnetic Particle Inspection (MT) of welds shall be performed in accordance with the requirements of ASTM E 709.

#### 3.2.2.4 Radiographic Inspection (RT)

Radiographic Inspection (RT) of welds shall be performed in accordance with the requirements of PART B, "Radiographic Testing of Groove Welds in Butt Joints," of AWS D1.1/D1.1M.

#### 3.2.2.5 Ultrasonic Inspection (UT)

Ultrasonic Inspection (UT) of welds shall be performed in accordance with the requirements of PART C, "Ultrasonic Testing of Groove Welds," of AWS D1.1/D1.1M.

### 3.2.3 Levels of Examination

Following requirements shall apply to specific welds as specified herein or on the contract drawings.

#### 3.2.3.1 Level I Examination

Level I Examination shall require 100 percent visual (VT), and 100 percent radiographic (RT) inspection unless specified herein or approved by the Contracting Officer. Where RT is not practical, [MT] [PT] [UT] of the root pass and the final surface of each weld joint shall be performed.

Each radiograph shall have the following additional information permanently included in the image:

Agency Weld No. (including repair cycle no.)

Agency Drawing No.

Agency View No.

Agency Contract No.

Final interpretation and acceptance of all radiographs of welded joints will be by the Contracting Officer.

### 3.2.3.2 Level II Examination

Level II examination shall require 100 percent visual (VT), and [MT] [PT] [UT] inspection of the final surface of each weld joint.

### 3.2.3.3 Level III Examination

Level III examination shall require 100 percent visual (VT) inspection of each weld joint.

### 3.2.4 Acceptance Requirements

Contractor shall provide all records of Non-Destructive Examination, including radiographic film, to the government for [approval] [review], [seven] [\_\_\_\_\_] calendar days after the examination.

#### 3.2.4.1 Structural Projects

Grade A Fabrication: Grade A fabrication shall receive a Level I examination. Weldments shall meet the requirements of Section 3, "Workmanship," Section 9, "Dynamically Loaded Structures" or Section 10, "tubular structures," of AWS D1.1/D1.1M.

Grade B Fabrication: Grade B fabrication shall receive a Level II examination. Weldments shall meet the requirements of Section 3, "Workmanship," [Section 8 "Statically Loaded Structures"] [Section 10, "Tubular Structures" of AWS D1.1/D1.1M].

Grade C Fabrication: Grade C fabrication shall receive a Level III examination. Weldments shall meet the requirements of the applicable code.

- a. Component Thickness 1/8 Inch 3 Millimeter and Greater: Weldments shall meet the requirements of the applicable section, 8, 9, or 10, of AWS D1.1/D1.1M.
- b. Component Thickness Less Than 1/8 Inch: 3 Millimeter: Weldments shall meet the requirements of Section 4, "Workmanship," of AWS D1.3.

Grade D, E, and F Fabrication: Grade D, E, and F fabrication shall receive a Level III examination. Weldment shall meet the acceptance requirements of [AWS D1.1/D1.1M] [AWS D1.3] [AWS D1.4].

#### 3.2.4.2 Other Applications

Cranes: Weldments shall meet the requirements of Section 5, "Workmanship," and Section 8, "Weld Quality and Inspection," of AWS D14.1.

Machinery: Weldments shall meet the requirements of Paragraph 4, "Workmanship," and Paragraph 5, "Quality Control Requirements and Procedures," of AWS D14.4.

### 3.3 PROTECTION

Contractor shall sufficiently protect machinery, materials, floor, equipment and finishes, adjacent to the welding/brazing operations to prevent any damage from these operations.

-- End of Section --