# Chapter 11.2
# Volume II

# WELDING PROCEDURE SPECIFICATION REVIEW AND APPROVAL PROCESS

## 11.2.1 PURPOSE

This procedure provides guidance to the fabricators for the review and approval of the fabrication facilities' welding procedure specifications.

## 11.2.2 AUTHORITY

Sections 20.23(3)(a) and 334.048(3), Florida Statutes (F.S.)

## 11.2.3 REFERENCES

American Association of State Highway Transportation Officials/National Steel Bridge Alliance (AASHTO/NSBA) Steel Bridge Collaboration, Steel Bridge Fabrication QC/QA Guide Specification S4.1

American Welding Society (AWS) AASHTO/AWS D1.5/D1.5M, Bridge Welding Code

American Welding Society (AWS) D1.1/D1.1M, Structural Welding Code – Steel

American Welding Society (AWS) D1.2/D1.2M,Structural Welding Code-Aluminum

American Welding Society (AWS) D1.3/D1.3M, Structural Welding Code-Sheet Steel

American Welding Society (AWS) D1.4/D1.4M, Structural Welding Code-Reinforcing Steel

American Welding Society (AWS) D1.6/D1.6M, Structural Welding Code-Stainless Steel

## 11.2.4 SCOPE

This procedure affects the fabrication facilities, the Florida Department of Transportation's (FDOT or Department) State Materials Office, and the consultants who are involved in the verification and other quality assurance

inspection and testing of the steel and miscellaneous metal products.

## 11.2.5 GENERAL INFORMATION

Each fabrication facility is required to perform welding in accordance with Department approved Welding Procedure Specifications (WPS). All WPSs shall be submitted on FDOT forms where those forms are available. Any forms not available as FDOT forms may be submitted on the fabricator's own form. Any welding performed without Department approved WPSs may be subject to rejection.

## 11.2.6 WPS REVIEW AND APPROVAL PROCESS

### 11.2.6.1 Review of Proposed WPSs

The fabrication facility's AWS Certified Welding Engineer or AWS Certified Welding Inspector will review, sign, and stamp the proposed WPSs. Upon completion of each WPS, submit one stamped electronic copy in PDF format or hard copy to the Department's responsible verification inspection consultant. WPSs that require qualification testing shall be submitted with supporting documentation in accordance with the appropriate code. Contact the State Materials Office to determine the name of the verification inspection consultant that is responsible for the review of the proposed Welding Procedure Specifications.

The responsible verification inspection consultant reviews the submitted WPSs and any associated ***Procedure Qualification Records (PQR).*** The original, stamped welding procedures will be sent within two weeks of receipt of the documents to the State Materials Office. The responsible verification inspection consultant will place the review stamp on the front of each WPS indicating its disposition. This disposition will be either "approved" or "revise and resubmit".

If additional information is required for the review or if the WPS is rejected, the responsible verification inspection consultant will contact the fabrication facility in writing to request clarification, additional information, or resubmission of the rejected procedure. The two-week review time clock will be reset after the submittal of the additional information.

### 11.2.6.2 Maintaining Records of Approved Welding Procedure Specifications

The State Materials Office will store electronic copies of welding procedures stamped "approved" on a secured limited access FDOT site maintained by the State Materials Office.

## 11.2.7 UTILIZATION OF THE APPROVED WPSs

The approved WPSs must be used on any applicable Department projects. Submittals of WPSs on a per project basis are not necessary, unless the project requires additional information that is not available in the current WPSs. WPSs may be given an expiration date based on their ***PQRs*** or in accordance with the appropriate AWS code. Approved WPSs may be used by the submitting fabrication facility until they expire.

A list of the approved WPSs that the fabricator proposes for use on the project must be provided with the submittal of shop drawings. The same list must also be provided during the prefabrication meetings. At the completion of the project the list of the Welding Procedure Specifications must be revised and resubmitted to include the actual WPSs that were used.

If additional welding procedures are required for a particular project, or as existing procedures expire, additional or new WPSs must be submitted to the responsible verification inspection consultant for review as stated in ***Section 11.2.6.1***.

The fabricator shall provide a stamped copy of each approved WPS when requested by a Department representative. Copies of approved WPSs must be posted in the fabrication shop for reference by shop personnel performing welding.

## 11.2.8 PRODUCERS WITH ACCEPTED QUALITY CONTROL PLANS

All fabricators working on FDOT projects involving welding shall have applicable WPSs approved by the Department prior to the commencement of welding, whether or not the materials and welds are subject to inspection by the Department..

## 11.2.9 TRAINING

No training is required for the implementation of this document.

## 11.2.10 FORMS

The fabricator is responsible to make sure that they are using the most current version of the following FDOT forms:

Fillet Weld Soundness Test D1.1/D1.1M-D1.5/D1.5M (Form 675-070-01)

Weld Procedure Qualification Record D1.2/D1.2M (Form 675-07-04)

Weld Procedure Qualification Record D1.5/D1.5M (Form 675-07-03)

Welding Procedure Specification D1.1/D1.1M (Form 675-070-05)

Welding Procedure Specification D1.2/D1.2M (Form 675-070-06)

Welding Procedure Specification D1.5 (Form 675-070-02)

# APPENDIX A

# FDOT FORM SAMPLES

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

# FILLET WELD SOUNDNESS TEST (FWST)

675-070-01
MATERIALS
08/11

**AWS D1.1 ☐ AWS D1.5 ☐**

| Fabricator Contact Information | |
|---|---|
| Facility Name: | |
| Facility Location: | |

| | |
|---|---|
| FWST No: | Date Welded: |
| Welding Process(es): | |
| Supporting PQR No. (s): | |
| Material Spec: | Type or Grade: |

| | |
|---|---|
| Prepared By: | |
| T1 Thickness: | T2 Thickness: |
| Filler Metal Specification: | |
| Filler Metal Classification: | |
| Shielding Gas (Composition %): | |
| Electrode Manufacturer: | Electrode Brand Name: |
| Flux Manufacturer: | Flux Brand Name: |
| Voltage: | (use mean voltage of WPS to be qualified) |
| Amperage/WFS*: | (use mean amperage/WFS* of WPS to be qualified) |
| Polarity: | |
| Position of Welding: ☐ 1F ☐ 2F ☐ 3F ☐ 4F | |

* wire feed may be used in lieu of current when a correlation curve is provided for the same electrode diameter and electrode extension

| TEST RESULTS (PER AWS D1.1 4.9.4 or AWS D1.5 5.19.3) 3 MACROTECH TESTS REQUIRED | | | FOR FDOT CONSULTANT USE ONLY |
|---|---|---|---|
| | Maximum Size Single Pass Test Size | Minimum Size Multiple Pass Test Size | |
| | Pass/Fail | Pass/Fail | |
| Weld Size: | ☐ Pass ☐ Fail | ☐ Pass ☐ Fail | |
| Cracking: | ☐ Pass ☐ Fail | ☐ Pass ☐ Fail | |
| Fusion: | ☐ Pass ☐ Fail | ☐ Pass ☐ Fail | |
| Weld Profile per 3.6: | ☐ Pass ☐ Fail | ☐ Pass ☐ Fail | |
| Undercut > 1/32 inch: | ☐ Pass ☐ Fail | ☐ Pass ☐ Fail | |



Notes:
1. Fillet weld soundness tests are required in addition to groove weld PQRs to qualify fillet welds.
2. A fillet weld macrotech test shall be made for each WPS and position to be used in construction.
3. AWS D1.1 Figure 4.19 or AWS D1.5 Figure 5.8 Test Plate D shall be used.

| Comments: | | | |
|---|---|---|---|
| | | | |
| Preparer's Signature (Authorized Representative of Contractor (Fabricator)) | | | Date |
| Witness | Agency | Signature | Date |

**Return this completed form to the FDOT State Materials Office Structural Materials Systems Field Operations Office.**

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

# PROCEDURE QUALIFICATION RECORD (PQR)

675-070-04
MATERIALS
09-11

## AWS D1.2 - ALUMINUM

**FABRICATOR CONTACT INFORMATION**

| | |
|---|---|
| Facility Name: | Prepared By: |
| Facility Location: | Welder's Name: |
| FCM: ☐ Non FCM: ☐ PQR #: | PQR Date: Weld Date: |
| Structural Class & Type: Type I: ☐ Type II: ☐ Non-Tubular: ☐ Tubular: ☐ | PQR Type: Groove: ☐ Fillet: Option 1: ☐ Option 2: ☐ |
| Process(es): GTAW: ☐ GMAW: Transfer Mode: ☐ PAW-VP: ☐ Position: ☐ | Direction of Welding: Forehand: ☐ Backhand: ☐ Vertical Upward: ☐ Vertical Downward: ☐ |
| Initial Cleaning Oxide: | AWS A5.10 Filler Classification: |
| Initial Dirt & Oil Cleaning: | Filler F-Number: |
| Interpass Cleaning: | Shielding Gas: |
| Dye Penetrant Removal: | Flow Rate: (chf): Dew Point (°F): |
| Bead Type: Stringer: Weave: | Preheat Temp. (°F): |
| Bead Type: Welding Current: | Interpass Temp (°F): Min: Max: |
| Bead Type: Polarity: | Postheat Treatment? YES: ☐ NO: ☐ |
| Bead Type: Pulsed: | IF YES: |
| M Number: to | Original Temper: Final Temper: |
| Alloy & Temper: to | Temp: Time: Quench: |
| Base Metal Thickness: to | Backing/Type Alloy: |
| Base Metal & Backing Specification and Heat Nos.*: | |
| *Attach Certified Copies of Mill Test Reports | |

| Weld Size (in) | Pass No(s) | Electrode Size (in) | Welding Process Variable AMPS/WFS* | Welding Process Variable VOLTS | Travel Speed (IPM) |
|---|---|---|---|---|---|
| | | | | | |
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* wire feed speed may be used along with amperage (include chart)

**PHYSICAL AND NONDESTRUCTIVE TEST RESULTS: (Complete Below And Attach Laboratory Reports)**

| Tests for Aluminum Welds | Test Results | | | |
|---|---|---|---|---|
| Visual (Accept/Reject): | Weld Size: | | Contour: | |
| Reduced/Full Section Tension (PSI) | 1. | 2. | | |
| Root Bend (Accept/Reject): | 1. | 2. | | |
| Face Bend (Accept/Reject): | 1. | 2. | | |
| Sind Bend (Accept/Reject): | 1. | 2. | 3. | 4. |
| Nick-Break (Castings) (Accept/Reject): | 1. | 2. | | |
| Macro Weld Size (PJP Groove/Fillet): | 1. | 2. | | |
| Fracture (Accept/Reject) (Fillet): | 1. | 2. | 3. | 4. |

| Comments: | JOINT DETAIL: Show Relevant Dimensions and AWS Symbols |
|---|---|
| | |

Preparer's Signature (Authorized Representative of Contractor (Fabricator)) Date

Witness Agency Signature Date

**Return this completed form to the FDOT State Materials Office Structural Materials Systems Field Operations Office.**

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

# PROCEDURE QUALIFICATION RECORD (PQR)

675-070-03
MATERIALS
09-11

**AWS D1.5**

| FABRICATOR CONTACT INFORMATION |
|---|
| Facility Name: |
| Facility Location: |
| FCM: ☐ Non FCM: ☐ PQR #: PQR Date: Weld Date: |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Prepared By: | | | | | | | |
| Qualified Per: 5.12.1 ☐ 5.12.2 ☐ 5.12.4 ☐ Welder's Name: | | | | | | | |
| Process: AWS Electrode Specification: | | | | | | | |
| Position: 1G ☐ 2G ☐ 3G ☐ 4G ☐ AWS Electrode Classification: | | | | | | | |
| Electrodes (S) Manufacturer: Electrode Brand Name: | | | | | | | |
| Electrode Extension: SAW Flux Type: Active: ☐ Neutral: ☐ Alloy: ☐ | | | | | | | |
| Flux Manufacturer: Flux Brand Name: | | | | | | | |
| Electrode | Dia. (Inch) | Current (Amps) | WFS* (IPM) | Voltage (Volts) | Current & Polarity | Travel Speed (IPM) | Electrode Angle (Multi-Elec. SAW) |
| 1 | | | | | | | |
| 2 | | | | | | | |
| 3 | | | | | | | |

*wire feed may be used in lieu of current when a correlation curve is provided for the same electrode diameter and electrode extension.

| | | |
|---|---|---|
| Multiple Electrode Arc Spacing (SAW): Longitudinal | | Lateral |
| Calculated Heat Input (KJ/In): | | |
| AWS Joint Detail Used: | | |
| Shielding Gas (Attach Cert.): | Flow Rate (cfph): | Composition: |
| | Dew Point (°F): | Gas Cup Size: |
| Base Metal: Carbon Equivalent (See 5.4.2): | | Carbon Content: |
| Backing Metal: Carbon Equivalent (See 5.4.2): | | Carbon Content: |
| Base Metal Thickness (In): | | Backing Thickness (in): |
| Base Metal Specification & Heat No. (Attach MTR): | | |
| Backing Specification & Heat No. (Attach MTR): | | |
| Preheat Temp. (°F): Interpass Temp. (°F): Min: | | Max: |

**PHYSICAL AND NONDESTRUCTIVE TEST RESULTS**
**(Complete Below And Attach Laboratory Reports)**

| Specimen | Test Results | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| All Weld Metal Tension (AWMT) | Tensile Strength (PSI): | | | | | | | |
| | Yield Strength (PSI): | | | | | | | |
| | Elongation In 2 In. (%): | | | | | | | |
| | Reduction In Area (%): | | | | | | | |
| Side Bends (Accept/Reject): | 1. | | 2. | | 3. | | 4. | |
| Reduced Section Tension (PSI): | Tensile Strength: | 1. | | Location of Break: | 1. | | | |
| | | 2. | | | 2. | | | |
| Charpy V-Notch Impact: ( ) | | | | | | | | |
| Toughness Of Weld Metal (Ft.Lbs.): | Avg. ft.lb. ** | @ °F | | | | | | |
| ** Discard the Highest and Lowest Values and Average the Remaining Values | | | | | | | | |
| Visual Acceptable? | Radiographic Test Acceptable?: | (Attach RT Report) | | | | | | |
| Expiration Date (5 Years For Non Fracture Critical): | (3 Years For Fracture Critical): | | | | | | | |
| Comments: | | | | | | | | |

| | | | |
|---|---|---|---|
| Preparer's Signature (Authorized Representative of Contractor (Fabricator)) | | | Date |
| Witness | Agency | Signature | Date |

**Return this completed form to the FDOT State Materials Office Structural Materials Systems Field Operations Office.**

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

## WELDING PROCEDURE SPECIFICATION (WPS)

675-070-05
MATERIALS
08/11

**(D1.1) PREQUALIFIED ☐ QUALIFIED BY TESTING ☐**

| | |
|---|---|
| Contractor/Organization: | Identification #: |
| Welding Process(es): | Revision: Date: By: |
| Supporting PQR No. (s): | Authorized By: Date: |
| **JOINT DESIGN USED** | Type: Manual ☐ Mechanized ☐ Semiautomatic ☐ Automatic ☐ |
| Single ☐ Double Weld ☐ | **ELECTRICAL CHARACTERISTICS** |
| Backing: Yes ☐ No ☐ | Transfer Mode (GMAW): Short-Circuiting ☐ |
| Backing Mat'l: | Globular ☐ Spray ☐ |
| Root Opening: Root Face Dimension: | Current: AC ☐ DCEP ☐ DCEN ☐ Pulsed ☐ |
| Groove Angle: Radius (J-U): | Power Source: CC ☐ CV ☐ |
| Backgouging: Yes ☐ No ☐ Method | Other: |
| Root Treatment: | Tungsten Electrode (GTAW) |
| **POSITION** | Size: Type: |
| Position of Groove: Fillet: | **TECHNIQUE** |
| Vertical Progression: Up ☐ Down ☐ | Stringer or Weave Bead: |
| **BASE METALS** | Multi-Pass or Single Pass (per side): |
| Material Spec: | Number of Electrodes: |
| Type or Grade: | Electrode Spacing: Longitudinal |
| Thickness: Groove Fillet | Lateral: Angle: |
| Diameter (Pipe): | Contact Tube to Work Distance: |
| **FILLER METALS** | Peening: Interpass Cleaning: |
| AWS Specification: | **PREHEAT AND INTERPASS TEMPERATURE CHART** |
| AWS Classification: | Base Metal Thickness Range / Min Preheat & Interpass (°F) / Max Preheat & Interpass (°F) |
| Mfg. Trade Name: | |
| **SHIELDING** | |
| Flux: | |
| Gas: Composition: | |
| Electrode Flux Class: | |
| Flow Rate: Gas Cup Size: | |
| **POSTWELD HEAT TREATMENT** | |
| Temp: Time: | |

**WELDING PROCESS**

| Pass or Weld Layer(s) | Filler Metal Diam | Current | Volts | Travel Speed |
|---|---|---|---|---|
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**FOR FDOT USE ONLY**

**FOR CERTIFIED WELDING INSPECTOR (CWI) USE ONLY**

Signature

Date

**JOINT DETAILS**

**FOR FDOT CONSULTANT USE ONLY**

Comments:

**Return this completed form to the FDOT State Materials Office Structural Materials Systems Field Operations Office.**

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

## WELDING PROCEDURE SPECIFICATION (WPS)

675-070-06
MATERIALS
08/11

**(D1.2 ALUMINUM) PREQUALIFIED ☐ QUALIFIED BY TESTING ☐**

| | |
|---|---|
| Contractor/Organization: | **WELDING PROCEDURE** |
| **BACKING** | Specification No: Date: By: |
| Type: Permanent: | Revision: Date: By: |
| Removed: Other: | Authorized By: Date: |
| **WELDING PROCESS(ES)** | Supporting PQR No(s): |
| Process: *Type: | **POSITION** |
| Process: *Type: | Position of Groove: Fillet: |
| Electrode: (GTAW): | Welding Progression (Forehand/Backhand): |
| *Manual, Automatic, Polarity Pulsed, etc. | Vertical Welding (Upward/Downward): |
| **BASE METALS** | **TECHNIQUE** |
| M No.: Thickness: to | Stringer or Weave Bead: |
| Alloy & Temper: | Orifice or Gas Cup Size: |
| **FILLER METAL** | Oscillation: |
| F-No.: AWS No. (Class): | Contact Tube to Work Distance: |
| Size of Electrode: | Single Pass or Multipass (per side): |
| Type of Electrode: | Tungsten Extension: |
| Mfg. Trade Name: | Method of Backgouging: |
| **SHIELDING GAS** | Other: |
| Shielding Gas(es): | **POSTWELD HEAT TREATMENT** |
| Percent Composition: | Original Temper: |
| Flow Rate: | Final Temper: |
| Other: | Temp: Time: |
| **CLEANING** | Quench: |
| Initial Cleaning Oxide: | **PREHEAT** |
| Initial Cleaning Oil & Dirt: | Preheat Temperature: |
| Interpass Cleaning: | Interpass Temperature: |

**WELDING PROCESS**

| Pass No. | Welding Process | Amps | Volts | Travel Speed |
|---|---|---|---|---|
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**FOR FDOT CONSULTANT USE ONLY**

**FOR CERTIFIED WELDING INSPECTOR (CWI) USE ONLY**

Signature

Date

| JOINT GROOVE DESIGN SKETCH | WELDING SEQUENCE SKETCH | FOR FDOT USE ONLY |
|---|---|---|
| | | |

Comments:

**Return this completed form to the FDOT State Materials Office Structural Materials Systems Field Operations Office.**

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

675-070-02
MATERIALS
08/11

## WELDING PROCEDURE SPECIFICATION (WPS)

**PREQUALIFIED ☐ QUALIFIED BY TESTING ☐**
**AASHTO/AWS D1.5 Qualification Type 5.12.1 ☐ - 5.12.2 ☐ - 5.12.4 ☐**

| | |
|---|---|
| Contractor/Organization: | Identification : |
| Welding Process(es): | Revision: Date: By: |
| Type: Manual ☐ Mechanized ☐ Tandem ☐ | Authorized By: Date: |
| Semiautomatic ☐ Automatic ☐ Parallel ☐ | Supporting PQR No. (s): |
| **JOINT DESIGN USED** | **POSITION** |
| Single ☐ Double Weld ☐ | Position of Groove: Fillet: |
| Backing: Yes ☐ No ☐ | Vertical Progression: Up ☐ Down ☐ |
| Backing Mat'l: | **ELECTRICAL CHARACTERISTICS** |
| Root Opening: Root Face Dimension: | Transfer Mode (GMAW): Globular ☐ Spray ☐ |
| Groove Angle: Radius (J-U): | Current: AC ☐ DCEP ☐ DCEN ☐ Pulsed ☐ |
| Backgouging: Yes ☐ No ☐ Method: | Electrical Stick Out: |
| Root Treatment: | Other: |
| **BASE METALS** | **TECHNIQUE** |
| Material Spec: | Stringer or Weave Bead: |
| Type or Grade: | Multi-Pass or Single Pass (per side): |
| Thickness: Groove Fillet | Number of Electrodes: |
| **FILLER METALS** | Electrode Spacing: Longitudinal |
| AWS Specification: | Lateral: Angle: |
| AWS Classification: | Interpass Cleaning: |
| Mfg. Trade Name: | **PREHEAT AND INTERPASS TEMPERATURE CHART** |
| **SHIELDING** | Base Metal Thickness Range / Min Preheat (°F) / Max Preheat & Interpass (°F) |
| Flux: Mfg. Trade Name: | |
| Electrode Flux Class: | |
| Gas Composition: | |
| Flow Rate: Gas Cup Size: | |
| **POSTWELD HEAT TREATMENT** | |
| Temp.: Hold Time: | **QUALIFIED HEAT INPUT FROM PQR** |
| Heating/Cooling Rate: | Max. Heat Input: Min. Heat Input: |

**WELDING PROCESS**

| Pass or Weld Layer(s) | Filler Metals Diam. | Current ☐Amps ☐Wire Feed Speed | Volts | Travel Speed |
|---|---|---|---|---|
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**FOR FDOT USE ONLY**

**FOR CERTIFIED WELDING INSPECTOR (CWI) USE ONLY**

Signature

Date

**JOINT DETAILS**

**FOR FDOT CONSULTANT USE ONLY**

Comments:

**Return this completed form to the FDOT State Materials Office Structural Materials Systems Field Operations Office.**