



Evaluation of Prequalified Procedures for Naval Construction

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Evaluation of Prequalified Procedures for Naval Construction

- NSRP Welding Technology Panel Project
- Contract Number 2008-339
- Program Technical Representative (PTR):
 - Mike Ludwig, BIW
- Program Technical POC:
 - Luke Blessinger, ATI
- Period of Performance:
 - Dec. 5, 2007 to Nov. 30, 2008



Evaluation of Prequalified Procedures for Naval Construction

Background:

- Requirements for vendors and suppliers to prepare, qualify, and submit welding procedures for approval adds significant cost and construction time to Navy ships.

Project Objective:

- Investigate the use of prequalified welding procedures for Navy ship construction.
- Estimate cost savings to the Navy
- Recommend an approach for implementation.



Evaluation of Prequalified Procedures for Naval Construction

Status:

- Developed a list of materials, processes, and applications where prequalified procedures will be most beneficial to shipbuilders.
- Estimated annual cost savings to be \$6.6 million for use of prequalified procedures.
- Developed five implementation options.
- Compared AWS standard procedures to essential variables in TP248.
- Drafted requirements for integration of standard procedures with existing specifications (TP248/278).
- Reviewed progress with key shipyards and NAVSEA 05P24.



Shipyard Input

- Common materials: S-1, S-8, and S-34.
- Common processes: GTAW, SMAW, GMAW, FCAW.
- Common applications: M-2, P-2, A-4 machinery and piping systems covered by Tech Pub 278.
- Procedures processed per year: 50 to 750
- Time per review: 2 to 4 hours
- Review Cycles per procedure: 1 to 3 times



Preliminary Cost/Benefit Analysis

Organization	1	2	3	4	5*	6*	Total
Vendor Procedures Reviewed Per Year	250	50	100	750 - 3000	300	150	
Shipyards Hours Per Review	2	4	4	10 - 20	4	4	
Review Cycles	3	2 - 3	2 - 3	2 - 3	2 - 3	2 - 3	
Total Shipyards Review Hours Per Year	6 X 250 = 1500	10 X 50 = 500	1/3 person = 666	4 persons = 7,200	6 x 300 = 1800	6 x 150 = 900	
Shipyards Cost Per Year	1500 X \$75 = \$112,500	500 X \$75 = \$37,500	666 X \$75 = \$49,950	7,200 X \$75 = \$540,000	1800 X \$75 = \$135,000	900 X \$75 = \$67,500	\$942,450
Government Review Hours	2	2	2	2	2	2	
Government Cost Per Year	2 X 250 X \$75 = \$37,500	2 X 50 X \$75 = \$7,500	2 X 100 X \$75 = \$15,000	2 X 750 X \$75 = \$112,500	2 X 300 X \$75 = \$45,000	2 X 150 X \$75 = \$22,500	\$240,000
Vendor Labor Hours and Cost To Prepare WPS (\$50/hr)	4 - 24 \$250 ave.						
Vendor Labor Hours and Cost to Perform PQ (\$75/hr)	2 - 8 \$1,050 ave.						
Cost to Test PQ	\$1250 - \$3000 \$2,125 ave.						
Material Cost	\$ 50 - \$500 \$300 ave.						
Labor Hours to Submit and Re-submit	6 \$450						
Total Vendor Cost	\$4,175 x 250 = \$1.04M	\$4,175 x 50 = \$208,750	\$4,175 x 100 = \$417,500	\$4,175 x 750 = \$3.1M	\$4,175 x 300 = \$1.25M	\$4,175 x 150 = \$626,250	\$6.6M



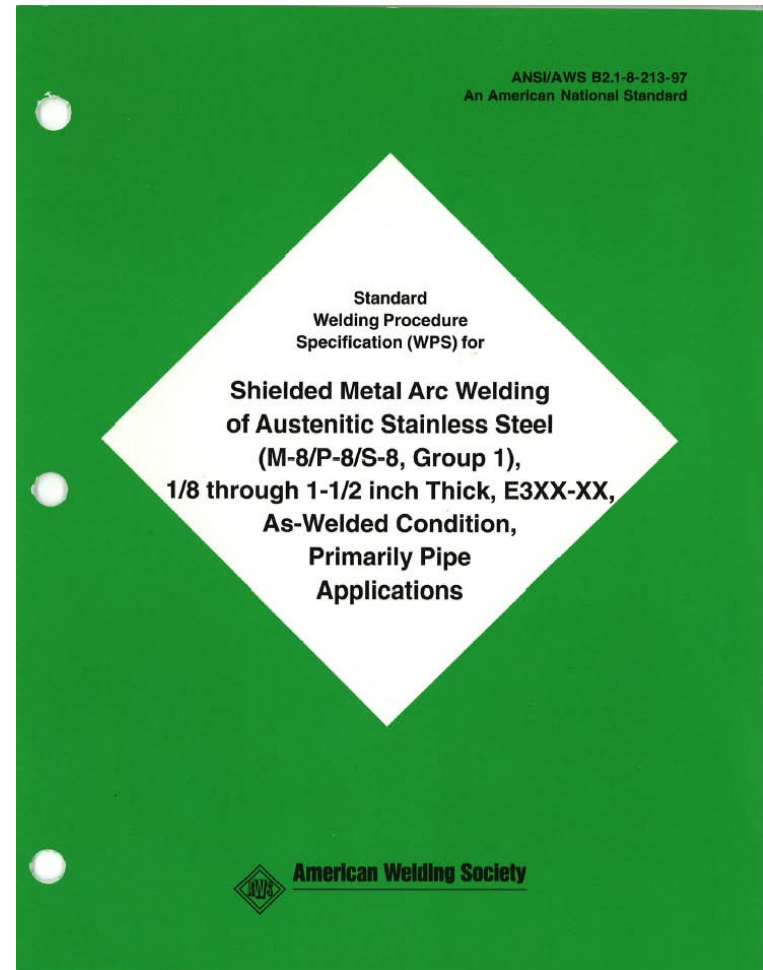
Existing Standard Procedures

- **AWS Standard Welding Procedure Specifications (SWPS)**
 - American National Standards produced by the AWS B2 committee.
 - Supported by PQRs referenced in the document.
- **The Naval Shipyard “WP278 Corporate Standard Naval Shipyard Procedures for Fabrication Welding and Inspection for Machinery, Piping and Pressure Vessels.”**
 - Based on procedures and qualifications shared by Naval shipyards
 - Maintained by Puget Sound



AWS Standard Welding Procedure Specifications

- Scope and User Responsibility
- Welding Process, Method of Application
- Base Metal, Thickness
- Filler Metal Spec, Class, Deposit Thickness
- Joint Designs, backing
- Positions, Vertical progression
- Preheat and Interpass Temperatures
- Electrical Characteristics, current, polarity
- Filler metal diameter per layer
- Postweld Heat Treatment
- Weave or Stringer bead
- Peening and backgouging
- Initial and interpass cleaning
- Single or Multiple pass
- Maximum bead thickness



AWS Procedure vs Navy Essential Variables

Essential Elements of a Welding Procedure (Ref. TP 248, Table V)	AWS B2.1-8-215-2000 GTAW of Austenitic Stainless Steel with Consumable Inserts Primarily Pipe
Welding Process(es) Machine, SA, manual TP248(4.7.4) Metal transfer mode Single or multiple arc	GTAW Manual
Base Material	Austenitic Stainless Steel M-8, P-8, S-8 Gr. 1 to M-8, P-8, S-8 Gr. 1
Base Material Thickness Range	1/8 in. through 1-1/2 in. for groove welds
Base Material Diameter	All diameters
Filler material specification, type, diameter	<ul style="list-style-type: none"> • ANSI/AWS A5.9 filler metal • 1/16 in. to 1/8 in. diameter ER3XX filler metals. • ANSI/AWS A5.30 for consumable inserts • 5/64, 1/8, 5/32 IN3XX, Class1 through Class 5 inserts. • A Number 8, F Number 6
Electrodes and Flux	Tungsten electrodes AWS A5.12 EWth-2, EWCe-2 or EWLa-1, 0.060 through 0.125 in diameter sharpened to a blunt point.



AWS Procedure vs Navy Essential Variables

Essential Elements of a Welding Procedure (Ref. TP 248, Table V)	AWS B2.1-8-215-2000 GTAW of Austenitic Stainless Steel with Consumable Inserts Primarily Pipe
Base Material Cleaning	Chemical or mechanical; joint shall be dry prior to welding.
Applicable Joint Designs Backing TP 248 (4.7.3.1) Backing Material	<ul style="list-style-type: none"> • Sketches included in document. Those applicable comply with MIL-STD 22 • Consumable inserts only • Nonmetallic or nonfusing metal retainers are not permitted.
Machine, model or type (semiautomatic and automatic)	NA
Electrical Characteristics: Polarity, current range, voltage, Pulsation	<ul style="list-style-type: none"> • DCEN • Amperage ranges listed for root and fill passes and 1/16 in. to 1.8 in. filler metal sizes. Pulsing current not permitted
Travel Speed (when heat input limits apply)	Travel speed not listed
Position	All positions Uphill progression vertical
Torch shielding gas type and flow rate	Welding grade argon 15 to 15 CFH



AWS Procedure vs Navy Essential Variables

Essential Elements of a Welding Procedure (Ref. TP 248, Table V)	AWS B2.1-8-215-2000 GTAW of Austenitic Stainless Steel with Consumable Inserts Primarily Pipe
Purge gas type and flow rate	Welding grade argon. Details of root shielding and purge or use of oxygen analyzer described in document. 5 to 15 CFH No trailing gas required
Postheat treatments	None
Torch Type	---
Preheat and Interpass temperature limits	<ul style="list-style-type: none"> •50F Minimum •350F maximum •Continuous or special heating not required.
Torch Oscillation (automatic)	NA
Torch Position (automatic)	NA
Electrode Lead or trail angle (automatic)	NA
Gas Cup Size	1/4 to 3/4 in inside diameter
TP248 (4.7.9.1-f)	Weave or stringer
	Peening not permitted
	Mechanical interpass cleaning



AWS Procedure vs Navy Essential Variables

Essential Elements of a Welding Procedure (Ref. TP 248, Table V)	AWS B2.1-8-215-2000 GTAW of Austenitic Stainless Steel with Consumable Inserts Primarily Pipe
TP 278 (7.4)	NA
	Multiple
	Maximum bead thickness: ¼ in.
Other Limitations	Not qualified for notch toughness applications Not applicable to fillet welds
Company Name	To be completed by user
Certification Statement	To be completed by user
Signature	To be completed by user
Fabrication Document	To be completed by user
Date	To be completed by user



Standard AWS Procedures and Navy Requirements

- Procedures for S-1, S-8, and S-1 to S-8 materials welded with GTAW, SMAW, GMAW, FCAW.
 - 17 for pipe and 8 for plate or pipe
- None for S-34 materials.
- Do not include notch toughness
- Include all essential elements required by TP 148
- Do not “include all Navy requirements” of fabrication documents
 - AWS commercial electrodes and filler metals
 - Reference “P” and “M” materials
 - 50F versus 60F minimum preheat for S-1 materials
 - 3/16” minimum wall thickness for fillets on socket welds
 - Reference to fabrication document for cleaning, etc



Options for Implementation

- Permit use of written procedures that meet all fabrication document requirements for common processes and materials without qualification testing.
- Permit the use of written AWS Standard Welding Procedure Specifications (SWPS).
- Permit Prime Contractors to Provide Qualified Welding Procedure Specifications to Vendors and Subcontractors
- Permit use of Standard Naval Shipyard Welding Procedure Specifications
- Develop Navy Standard Welding Procedure Specifications from data supplied by shipyards or others.



Option 1

- Permit use of written procedures that meet all fabrication document requirements for common processes and materials without qualification testing.
 - NAVSEA Technical Publication S9074-AQ-GIB-010/278 paragraph 4.2.1.1 does not require procedure qualification for common welding processes and assemblies the failure of which is remote and would not result in danger to personnel.
 - This option would expand this exemption to S-1 and S-8 materials welded with GTAW, SMAW, GMAW, FCAW.
 - NAVSEA does not support expansion of the current requirement.



Option 2

- Permit the use of written AWS Standard Welding Procedure Specifications (SWPS).
 - NAVSEA supports this concept and activity was underway to work with AWS B2 committee several years ago
 - AWS committee would control process and distribute procedures as American National Standards
 - Available to any organization
 - Requires developing draft documents to “include Navy requirements” and process through B2 committee
 - Begin with existing standards
 - Build on drafts previously created
 - Expand to include additional procedures
 - Toughness
 - Other processes and materials



Option 3

- Permit Prime Contractors to Provide Qualified Welding Procedure Specifications to Vendors and Subcontractors
 - Requires change of wording in TP 248
 - Implemented directly by prime contractors
 - NAVSEA supports concept with restrictions on which contractors are approved
 - Subcontractors may need multiple procedures when working for multiple contractors



Option 4

- Permit use of Standard Naval Shipyard Welding Procedure Specifications
 - Preliminary discussions with NSY Puget Sound indicate potential for sharing with industry
 - NAVSEA indicated they would need to be edited and revised to make them usable by industry
 - Could be used as a resource to support expansion of AWS SWPS



Option 5

- Develop Navy Standard Welding Procedure Specifications from data supplied by shipyards or others.
 - Assemble procedures and revise to standard format
 - Review and approve
 - Prepare for distribution
 - Printed documents
 - Computer database



Steps To Implementation

- Down-select single or multiple options
 - AWS SWPS
 - Prime Contractor WPS
 - Naval Shipyard WPS
 - Combination
- Prime Contractor WPS can be implemented by each organization
- Other options require effort to assemble, revise, review and approve
 - Prepare for distribution
- Revise NAVSEA and NVR documents to permit use
- Funding opportunities to support effort being explored.



Future Work

Next Steps:

- Seek additional input on procedures, review cycles, and costs
- Comments and suggestions on approach
- Further detail steps to implementation
 - Funding
 - Partners





Questions

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