

# Quality Assurance Welding and Brazing Requirements

## Quality Clauses 273 and 275

# Important Notes

- The information contained herein falls within the scope of current terms and conditions and does not authorize or imply a change or waive a contractual requirement under any open Purchase Order (PO)
- Remember to contact your GA Purchasing Representative about any questions regarding open POs or your continued performance
- GA's current quality clause document and other requirements are available on GA's procurement website:  
<https://www.ga.com/procurement/quality-assurance>

If you have any questions regarding this training  
please contact us at: [SM-QA@GA.com](mailto:SM-QA@GA.com)

# Agenda

- **Quality Clause Key Takeaways:**
  - Quality Clause 275: Weld/Brazing Requirements for Procedures & Repairs
  - Quality Clause 273: Welding/Brazing Requirements for Commercial Products
- **Welding/Brazing Documentation Overview**
- **Tips to Avoid Common Issues**
- **Welding Code Requirements**

# QC 275

- **QC 275 – “Weld/Brazing Requirements for Procedures & Repairs”**
  - Captures NAVAIR welding/brazing requirements for procedures, repairs and material records
  - Most NAVAIR welding will be specified to AWS or ASME codes
  - Work cannot begin until documentation is approved by GA
- **This Guide is intended to aid, not direct, Suppliers toward successful completion and approval of weld documentation**
  - Suppliers are required to ensure all PO requirements are met
  - All contractual direction comes from GA’s Purchasing Representative
- **Suppliers are requested to provide documentation 90 days prior to commencement of work**

# 275 – Frequently Asked Questions (FAQ)

- **FAQs:**

- What is a PQR, WPS and WPQR?

- A Procedure Qualification **Record** (PQR) is the *record* of [actual] welding variables used to produce an acceptable test weldment and the results of tests conducted [in accordance with the specified code] on the weldment to qualify a WPS
- A Welding Procedure **Specification** (WPS) is the [working] document providing the required welding variables [and their limitations] for a specific application to assure repeatability by properly trained welders and welding operators
- A Welder/Welding Operator Performance Qualification **Record** (WPQR) is the demonstration of a welder's or welding operator's ability to produce welds meeting prescribed standards
  - The welder's "certificate" [or WPQR] is the written verification that a welder has produced welds meeting a prescribed standard of welder performance

- What format should be used for PQR, WPS and WPQR?

- Recommended templates are available in the welding codes, but any format is acceptable as long as the "essential variables" (EV) are specified within the document



# 275 – PQR/WPS/WPQR & WOPQQR Interaction

WPQR/WOPQQR

Jane

John

Joe

WPS 1

WPS 2

WPS 3

PQR 123

WPS(s) 1,2,3 are all supported by PQR 123, but the parameters are further restricted for specific joint configurations for quality control

WPS 4

PQR 456

WPS 4 is supported by 2 PQRs (PQR 123 (2G) and PQR 456 (3G)) for the same material and joint configuration

WPQRs for Jane, John and Joe are in accordance with qualified WPS(s). Welder Continuity must be monitored (AWS = 6 months; ASME = 6 months; NAVSEA = 6 months)

# 275 – PQR Data

- Supporting documentation is critical for the quality and integrity of the PQR
- GA's welding and brazing requirements include submission of supporting documentation

- d) All PQRs or BPQRs supporting the WPSs or BPSs qualified after January 1, 2017 shall include the following:
- i. All supporting documentation for the PQR and BPQR
    - Inspection reports (e.g., visual, radiographic, ultrasonic, magnetic particle, penetrant inspections)
    - Original records/reports of test results in conformance with the applicable code or specification (i.e. – actual laboratory report, not transcription of data)
    - Laboratory test result reports may include tensile tests, bend tests, hardness tests, chemical analysis, Non-destructive tests, or other tests required by the applicable Code or Standard.
    - Material certification for the following:
      - Test plate/pipe base material
        - (i) To include heat treat certification and furnace chart for any heat treating performed
        - (ii) Base material heat lot traceability
      - Filler material

# 275 - PQR Data (Cont'd)

- Welding Codes have always required “specific values”

AWS D1.1:2020

## 6.3 Common Requirements for WPS and Welding Personnel Performance Qualification

**6.3.1 Qualification to Earlier Editions.** Qualifications performed to and having met the requirements of earlier editions of AWS D1.1 or AWS D1.0 or AWS D2.0 while those editions were in effect are valid and may be used. The use of earlier editions shall be prohibited for new qualifications in lieu of the current editions, unless the specific early edition is specified in the contract documents.

**6.3.2 Aging.** When allowed by the filler metal specification applicable to weld metal being tested, fully welded qualification test specimens may be aged at 200°F to 220°F [95°C to 105°C] for 48 ± 2 hours.

**6.3.3 Records.** Records of the test results shall be kept by the manufacturer or Contractor and shall be made available to those authorized to examine them.

## 6.7 Preparation of WPS

The manufacturer or Contractor shall prepare a written WPS that specifies all of the applicable essential variables referenced in 6.8. The specific values for these WPS variables shall be obtained from the procedure qualification record (PQR), which shall serve as written confirmation of a successful WPS qualification.

For the PQR, the actual joint details and the values of essential variables used in the testing should be recorded. An example of a completed PQR form is provided for guidance in filling out the form. A copy of the Mill Test Report for the material tested should be attached. Also, Testing Laboratory Data Reports may also be included as backup information or a PQR Test Result Form similar to the example in this annex may be used. Cross references to the required mechanical tests as applicable to the WPS being qualified are provided on the form for ready reference. Note that not all tests referenced are required.

AWS D1.2:2014

**3.12.1 Procedure Qualification Record (PQR).** The specific values of conditions involved in qualifying a WPS shall be recorded in a form called the Procedure Qualification Record (PQR). On this form shall be recorded the essential variables for the specific welding process (see Annex E for sample PQR).

Reference: American Welding Society (AWS) Standards

## 275 – PQR Data (Cont'd)

- **Actual values are required by welding standards (Code)**
- **A Procedure Qualification Record (PQR) is the record of [actual] welding variables used to produce an acceptable test weldment and the results of tests conducted [in accordance with the specified Code] on the weldment to qualify a WPS**
  - Actual variables include Material Certificates confirming the precise material *alloy/properties/condition* (Base Metals and Filler Metals)
  - Actual *Test Results*, not a transcription of test results on a Supplier's form
    - Lab results or, if the Supplier has internal testing capabilities, the test record
  - Actual *welding parameters* (volts, amps, electrode, gas, weld position, material thickness, joint configuration, etc.)
  - *Date* of qualification test and certification statements with signatures
- **The best way to know what to record is to reference the essential variables in the applicable welding Code**

# 275 – Essential Variables

- Essential Variables are Code-specific and can include multiple requirements
- For example, AWS D1.1: 2020 Table 6.5, includes 37 items

CLAUSE 6. QUALIFICATION		AWS D1.1/D1.1M:2020				
Table 6.5 PQR Essential Variable Changes Requiring WPS Requalification for SMAW, SAW, GMAW, FCAW, and GTAW (see 6.8.1)						
Essential Variable Changes to PQR Requiring Requalification	Process					
	SMAW	SAW	GMAW	FCAW	GTAW	
(1) Increase in filler metal classification strength	X		X	X		
(2) Change from iron-hydrogen to nickel-hydrogen SMAW electrode	X					
(3) Change from one electrode or flux-electrode classification to any other electrode or flux-electrode classification		X		X	X	
(4) Change to an electrode or flux-electrode classification not covered in:	AWS A5.1 or A5.5	AWS A5.17 or A5.23	AWS A5.18, A5.28, or A5.36	AWS A5.29, A5.38, or A5.39	AWS A5.14 or A5.28	
(5) Addition or deletion of filler metal					X	
(6) Change from cold wire feed to hot wire feed or vice versa					X	
(7) Addition or deletion of supplemental powdered or granular filler metal or cut wire		X				
(8) Increase in the amount of supplemental powdered or granular filler metal or wire		X				
(9) If the alloy system of the weld metal is largely dependent on supplemental powdered filler metal, any WPS change that results in a weld deposit with the required alloy elements not meeting the WPS chemical composition requirements		X				
(10) Change in nominal filler metal diameter by:	> 1/32 in (0.8 mm) increase	Any increase	Any increase or decrease	Any increase	> 1/16 in (1.6 mm) increase or decrease	
(11) Change in number of electrodes	X	X	X	X	X	
<b>Process Parameters</b>						
(12) A change in the amperage for each diameter used by:	To a value not recommended by manufacturer	> 10% increase or decrease	> 10% increase or decrease	> 10% increase or decrease	> 25% increase or decrease	
(13) A change in type of current (ac or dc) or polarity (electrode positive or negative for dc current)	X	X	X	X	X	
(14) A change in the mode of transfer			X			
(15) A change from CV to CC output			X			
(16) A change in the voltage for each diameter used by:	> 7% increase or decrease	> 7% increase or decrease	> 7% increase or decrease	> 7% increase or decrease	> 7% increase or decrease	
(17) An increase or decrease in the wire feed speed for each electrode diameter (if not automatic controlled) by:	> 10%	> 10%	> 10%	> 10%	> 10%	

AWS D1.1/D1.1M:2020		CLAUSE 6. QUALIFICATION				
Table 6.5 (Continued) PQR Essential Variable Changes Requiring WPS Requalification for SMAW, SAW, GMAW, FCAW, and GTAW (see 6.8.1)						
Essential Variable Changes to PQR Requiring Requalification	Process					
	SMAW	SAW	GMAW	FCAW	GTAW	
(18) A change in the travel speed by:		> 15% increase or decrease	> 25% increase or decrease	> 25% increase or decrease	> 50% increase or decrease	
<b>Shielding Gas</b>						
(19) A change in shielding gas from a single gas to any other single gas or mixture of gas, or in the specified nominal percentage composition of a gas mixture, or to no gas			X	X	X	
(20) A change in total gas flow rate by:			Increase > 50% Decrease > 20%	Increase > 50% Decrease > 20%	Increase > 50% Decrease > 30%	
(21) A change from the actual classification shielding gas not covered in:			AWS A5.18, A5.28, or A5.36 For A5.36 fixed and open classifications, variations in the shielding gas classification range shall be limited to the specific shielding gas tested or the designator used for the electrode classification.	AWS A5.29, A5.38, or A5.39 For A5.38 fixed and open classifications, variations in the shielding gas classification range shall be limited to the specific shielding gas tested or the designator used for the electrode classification.		
<b>SAW Parameters</b>						
(22) A change of > 10%, or 1/8 in (3 mm), whichever is greater, in the longitudinal spacing of the arcs		X				
(23) A change of > 10%, or 1/8 in (3 mm), whichever is greater, in the lateral spacing of the arcs		X				
(24) An increase or decrease of more than 10° in the angular orientation of any parallel electrode		X				
(25) For mechanized or automatic SAW, an increase or decrease of more than 3° in the angle of the electrode		X				
(26) For mechanized or automatic SAW, an increase or decrease of more than 8° around in the direction of travel		X				

CLAUSE 6. QUALIFICATION		AWS D1.1/D1.1M:2020				
Table 6.5 (Continued) PQR Essential Variable Changes Requiring WPS Requalification for SMAW, SAW, GMAW, FCAW, and GTAW (see 6.8.1)						
Essential Variable Changes to PQR Requiring Requalification	Process					
	SMAW	SAW	GMAW	FCAW	GTAW	
(27) A change in position not qualified by Table 6.1 or 6.10	X	X	X	X	X	
(28) A change in diameter, or thickness, or both, not qualified by Table 6.2 or 10.9	X	X	X	X	X	
(29) A change in base metal or combination of base metals not listed in the PQR or qualified by Table 6.8	X	X	X	X	X	
(30) Vertical Welding: For any pass from uphill to downhill or vice versa			X	X	X	
(31) A change in groove type (e.g., single-V to double-V), except qualification of any CJP groove weld qualifies for any groove detail conforming with the requirements of 5.6.1, 5.6.2, 10.5, or 10.10	X	X	X	X	X	
(32) A change in the type of groove to a square groove and vice versa	X	X	X	X	X	
(33) A change exceeding the tolerances of 5.6.1, 5.6.2, 7.2.2.1, 10.9, 10.10, and 10.22.2.1 involving:	X	X	X	X	X	
a) A decrease in the groove angle						
b) A decrease in the root opening						
c) An increase in the root face for CJP groove welds						
(34) The omission, but not inclusion, of backing or backgouging	X	X	X	X	X	
(35) Decrease from preheat temperature* by:	> 25°F (15°C)	> 25°F (15°C)	> 25°F (15°C)	> 25°F (15°C)	> 100°F (55°C)	
(36) Decrease from interpass temperature* by:	> 25°F (15°C)	> 25°F (15°C)	> 25°F (15°C)	> 25°F (15°C)	> 100°F (55°C)	
(37) Addition or deletion of PWHT	X	X	X	X	X	

The filler metal strength may be decreased without WPS requalification.  
AWS A5.1 (Stainless) electrodes of the same classification may be used in lieu of the AWS A5 (U.S. Customary Units) electrode classification.  
For WPS using alloy flux, any increase or decrease in the electrode diameter shall require WPS requalification.  
Travel speed ranges for all sizes of filler welds may be determined by the largest single pass fillet weld and the smallest multiple-pass fillet weld qualification tests.  
The production welding preheat or interpass temperature may be less than the PQR preheat or interpass temperature provided that the provisions of 2.6 are met, and the base metal temperature shall not be less than the WPS temperature at the time of subsequent welding.  
Note: An "X" indicates applicability for the process; a shaded block indicates nonapplicability.

Reference: American Welding Society (AWS) Standards

# 275 – Essential Variables (Cont'd)

- Ensure your WPS is properly prequalified or supported by a PQR

**Note:** Special attention to any existing WPS changes must be given when trying to resubmit previously approved documents

**Step 1:** Identify the welding process selected for qualification

**Step 2:** Identify the EV(s) applicable to the selected process

**Table 6.5**

**Essential Variable Changes Requiring WPS Requalification for SMAW, SAW, GMAW, FCAW, and GTAW (see 6.8.1)**

Essential Variable Changes to PQR Requiring Requalification	Process				
	SMAW	SAW	GMAW	FCAW	GTAW
<b>Filler Metal</b>					
(1) Increase in filler metal classification strength	X		X	X	
(2) Change from low-hydrogen to nonlow-hydrogen SMAW electrode	X				

**Step 3:** Ensure your WPS EV(s) are within the specified limits

Reference: American Welding Society (AWS) Standards

# 275 – Essential Variables (Cont'd)

## Essential Variable Checklists (Code Specific):

- It is helpful to use a checklist to ensure all essential variables have been accounted for and are compliant with the applicable Code
- Conducting an internal review of your documents will greatly improve First Time Acceptance by GA
- Exercise caution when using a universal WPS, PQR, or WPQR form for all Codes as the EV(s) required to be stated in the documents may differ

GENERAL ATOMICS ELECTROMAGNETICS

AWS D1.1 WPS Essential Variable Checklist Reference EMS-OPP-56

AWS D1.1:2015

GA-EMS Document Number	BWS-xxxxxx		
Review Date	9/13/2016	Previous Review Date(s), if any:	
Company Name	The Best Welding Supplier		
Part Number	340000xxxxxxx_F		
WPS	WPS 123, Rev A		
PQR	PQR 123, Rev A		
General Statement	Qualified with GTAW only		
WPS Essential Variables (Table 4.5)			
Item	Code Reference/ Note	Vote	Comment
Filler Metal			
1	Table 4.5 (Classification Strength)	Acceptable	
2	Table 4.5, SMAW only	N/A	
3	Table 4.5, (footnote e)	Acceptable	
4	Table 4.5, (footnote e)	Acceptable	
5	Table 4.5, GTAW only	Acceptable	
6	Table 4.5, GTAW only	Acceptable	
7	Table 4.5, SAW only	N/A	
8	Table 4.5, SAW only	N/A	
9	Table 4.5, SAW only	N/A	
10	Table 4.5 (change in Size)	Acceptable	
11	Table 4.5 (change in Qty)	Unacceptable	Not specified on PQR or WPS
Process Parameters			
12	Table 4.5 (Amperage)	Acceptable	Ranges are within the code limits.
13	Table 4.5 (Current Type/Polarity)	Acceptable	DCEN
14	Table 4.5, GMAW only (SPF w/ globular, short circuit)	N/A	
15	Table 4.5, GMAW and FCAW only (CV to CC)	N/A	
16	Table 4.5 (voltage)	N/A	
17	Table 4.5 (Wire Feed Speed or Amperage)	N/A	
18	Table 4.5 (Travel Speed) (footnote c)	Acceptable	
Shielding Gas			
19	Table 4.5 (Gas Composition)	Acceptable	
20	Table 4.5 (Flow Rate)	Acceptable	20 CFH
21	Table 4.5 (Gas Classification)	N/A	
Submerged Arc Welding (SAW)			
22	Table 4.5 (Long Spacing)	N/A	
23	Table 4.5 (Lat. Spacing)	N/A	
24	Table 4.5, Auto/Mech only, (Angular Orientation)	N/A	
25	Table 4.5, Auto/Mech only, (Angular Orientation)	N/A	
26	Table 4.5, Auto/Mech only, (Angular Orientation)	N/A	
General			

EMS-0321 Revision: A 2016/05/19

GENERAL ATOMICS ELECTROMAGNETICS

AWS D1.1 WPS Essential Variable Checklist Reference EMS-OPP-56

27	Table 4.1 or 9.9 (Position)	Acceptable	5D
28	Table 4.2 or 9.10 (Diameter or Thickness of Base Metal)	Acceptable	3/8" Plate
29	Table 4.8 (Base Metal Type(s))	Acceptable	A1011 Gr50
30	Table 4.3 (Vertical Welding Progression)	Acceptable	
31	Table 4.5 (Groove Type)	Acceptable	
32	Table 4.5 (groove Type vs. Square Groove)	Acceptable	
33	Joint Design (Groove Angle, Root Opening, Root Face)	Acceptable	
34	Backing or Backgouging	Acceptable	
35	Preheat Temp (footnote d)	Acceptable	
			GTAW PQR Value 70.00 Min. 30.00 Max. FALSE
36	Interpass Temp (footnote d)	Acceptable	
			GTAW PQR Value 300.00 Min. 200.00 Max. FALSE
37	Postweld Heat Treatment (PWHT)	N/A	
Records & Quality Clause (273 or 279)			
38	Revision Control	Acceptable	
39	Material Certifications (Base and Filler Metal)	Acceptable	
40	Inspection Results (4.9)	Acceptable	
41	Lab Test Results (4.3.3)	Acceptable	
42	Certification Statements	Acceptable	
43	Signatures	Acceptable	
44	Furnace Chart and Certification (for PWHT only)	N/A	

EMS-0321 Revision: A 2016/05/19

## 275 – Essential Variables (Cont'd)

- **Welding Procedure Essential Variable References:**
  - AWS (NOTE: This is not a comprehensive list):
    - D1.1:2020 – Structural Steel (Table 6.5)
    - D1.2:2014 – Structural Aluminum (Table 3.1)
    - D1.3:2018 – Structural Sheet Steel (Table 6.2)
    - D1.6:2017 – Structural Stainless Steel (Table 6.1)
    - D9.1:2018 – Sheet Metal [non-structural] (Section 5.3)
  - ASME Section IX:
    - Tables QW-252 thru QW-265
  - NAVSEA S9074-AQ-GIB-010/248 Rev. 1 (Table 7-5)

## 275 – Essential Variables (Cont'd)

- **Actions for the reviewer:**
  - Develop an essential variable checklist per the applicable Code (templates are available from the GA.com website or upon request)
    - Review all essential variables and verify them against the code limitations
- **Suppliers should review their documentation and their sub-contractor's documentation for errors prior to submittal to GA.**
  - Documentation with errors may be subject to rejection by GA.
  - Rework may add significant costs and impact to delivery schedules.

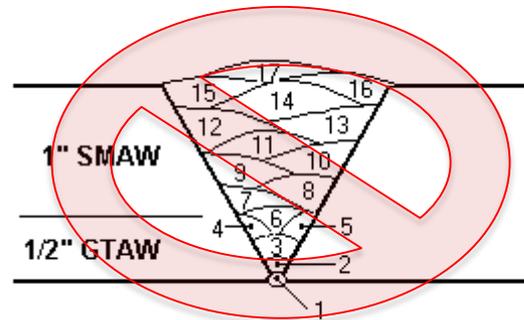
## 275 – Essential Variables (Cont'd)

- **Multi-process qualifications are not permissible if Quality Clause 275 is specified on your PO**

– From QC-275:

- f) Multi-process PQR's are not permitted (i.e., each PQR must be for one welding process only)
- Multiple PQR's may be referenced on a single WPS, allowing multiple welding processes in a single joint, in accordance with the applicable welding code.

For Example:



## 275 – Essential Variables (Cont'd)

- Checklists are available for download on GA's Purchasing website:

<https://www.ga.com/procurement/supplier-quality-assurance-tools-and-resources>

### QA RESOURCES



- Suppliers are encouraged to use these checklists because they reflect the same information GA welding experts will use to review your documentation submittals
- If additional guidance is needed, please contact your GA Buyer Representative



## 275 – Navy Approval Letter(s)

- **GA will consider acceptance of approval letters issued by the Navy for WPS/PQR/WPQR in accordance with NAVSEA S9074-AR-GIB-010/278**
  - However, GA will still review any Navy approved weld documentation for applicability to the GA PO
- **Include the following when requesting to apply any Navy approved WPS/PQR/WPQR to your PO:**

- v. Pertinent copies of Navy approval letters for WPSs, PQRs, BPSs, and BPQRs that have been previously approved for work related to NAVSEA S9074-AR-GIB-010/278.
- vi. Submit approval letters received regardless of the contract they were issued under and how Seller intends to apply them during fulfillment of the requirements of the Order.

**NOTE:** Procedures that were conditionally approved by the Navy for other contract will not be accepted by Buyer.

# 275 – Welder Training Program (NAVSEA S9074-AW-GIB-020/248)

- **The following must be included for submission of Suppliers' training program for NAVSEA S9074-AW-GIB-020/248 Rev 1.**
  - The training program is not required for AWS welding activities.

- a) If no Navy approval letter has been issued approving Seller's W/WO and/or B/BO operator workmanship training program please submit the following documentation.
  - i. A copy of Sellers' W/WO and/or B/BO workmanship training program/presentation.
  - ii. Evidence of satisfactory W/WO and/or B/BO workmanship training.
    - A copy of the training program/presentation attendance sheet.
    - A copy of the training exam for each welder with a minimum passing grade of 75%.
  - iii. A copy of the Level III examiner approval of the W/WO and/or B/BO workmanship training program.
  - iv. A summary table listing each W/WO and/or B/BO, the processes they are qualified to weld, when they were initially qualified and their most recent qualification maintenance or continuity date.

# 275 – PQR & WPS Requirements (NAVSEA S9074-AW-GIB-020/248)

- **Weld documentation required to be in conformance with NAVSEA S9074-AW-GIB-020/248 Rev.**
  - Should include, but is not be limited to, the components identified in QC 275

- g) NAVSEA S9074-AR-GIB-010/278, Critical Safety Item (CSI), Critical Application Items (CAI), High Yield (HY) steel and High Strength Low Alloy (HSLA) steel Welding Procedures, if specified in the contract documents, require the following in addition to requirements "a" through "f" above:
- i. Joint geometry sketch or reference to other governing joint geometry requirements (e.g., MIL-STD-22, AWS D1.1:2015, Figures 3.2-3.6).
  - ii. When required by the weld type, purge setup diagram and volume turnover rate.
  - iii. Supporting photographs as required to define unusual qualification setups and fixtures.
  - iv. For NAVSEA S9074-AR-GIB-010/278 welding, all WPS's, PQR's, BPS's, and BPQR's shall contain a certification statement, certifying to the requirements of NAVSEA S9074-AR-GIB-010/248 and be signed by a responsible official identified in the contractors' standard operating procedures.

# 275 – Weld Maps

- **Weld Map Benefits:**

- Ensures accurate WPS/BPS application
- Provides better direction to the welder
- Facilitates a more efficient review of weld documentation
- Ensures proper weld and inspection planning
- Required for inspection

A "Weld Map" is a non-standard term, but the welding Codes require them

2) Weld/braze map identifying the WPS or BPS to be used to weld or braze each specific joint on the drawing supplied by Buyer.

- a) The WPS or BPS identification shall be shown in a contrasting color text (e.g., red WPS identification text on a black line/text drawing) next to the weld/braze symbol on the drawing supplied by Buyer

AWS D1.1 – Steel

AWS D1.6 – Stainless Steel

## 8.5 Inspection of Work and Records

**8.5.1 Size, Length, and Location of Welds.** The Inspector shall ensure that the size, length, and location of all welds conform to the requirements of this code and to the detail drawings and that no unspecified welds have been added without the approval of the Engineer.

**8.5.2 Scope of Examinations.** The Inspector shall, at suitable intervals, observe joint preparation, assembly practice, and the welding techniques, and performance of each welder, welding operator, and tack welder to ensure that the applicable requirements of this code are met.

**8.5.3 Extent of Examination.** The Inspector shall examine the work to ensure that it meets the requirements of this code. Other acceptance criteria, different from those described in the code, may be used when approved by the Engineer. Size and contour of welds shall be measured with suitable gages. Visual inspection for cracks in welds and base metal and

AWS D1.3 – Sheet Steel

**8.1.1.6 Contract Document Conformance.** Location, size, and length of weld shall be in conformance with drawings or other contract document requirements. Welds that exceed the minimum length or size shall be permitted.

## 8.5 Inspection of Work and Records

**8.5.1 Size, Type, Length, and Location of Welds.** The Inspector shall ensure that the size, type, length, and location of all welds conform to the requirements of this code and to the detail drawings and that no unspecified welds have been added without approval of the Engineer.

**8.5.2 Scope of Inspection.** The Inspector shall, at suitable intervals, observe joint preparation, assembly practice, welding techniques, and welder's and welding operator's performance, to ensure that the applicable requirements of this code are met.

AWS D1.2 - Aluminum

## 5.5 Inspection of Work and Records

**5.5.1** The Inspector shall make certain that the size, length, and location of all welds conform to the requirements of this code, and to the detail drawings, and that no unspecified welds have been added without approval.

**5.5.2** The Inspector shall make certain that only WPSs are employed which meet the requirements of 3.1 and are qualified in conformance with 3.2.

**5.5.3** The Inspector shall, at regular intervals, observe joint preparation, assembly practice, the welding technique and performance of each welder, welding operator, and tack welder to make certain that the applicable requirements of this code are met.

Reference: American Welding Society (AWS) Standards

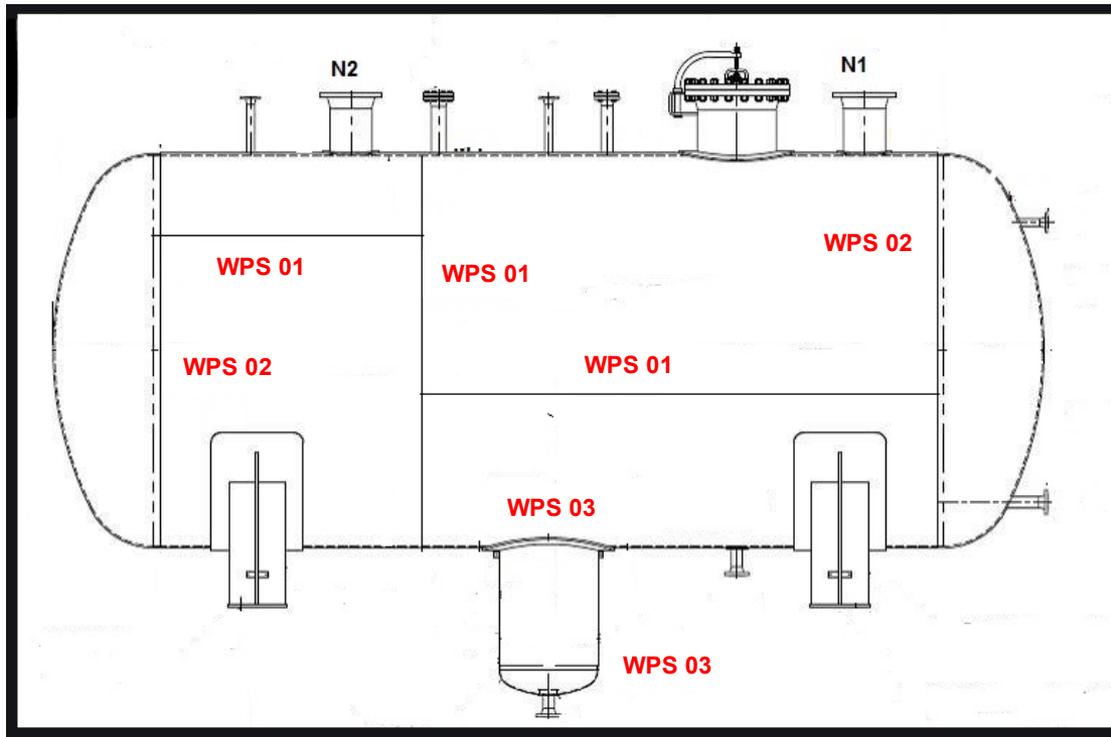
## 275 – Weld Maps (Cont'd)

- In order to comply with Code requirements, weld maps must be prepared
- Weld Maps are a best practice throughout industry
- A weld map communicates a “specified” weld in accordance with the appropriate WPS at a particular “location” (i.e., joint) on the weldment
  - There are several ways to achieve this; a simple example is included in this guide
- **GA requires a review of the weld map with the Supplier’s weld documentation (PQR, WPS, and WPQR) to ensure the appropriate and qualified WPS is applied/”specified” to the weld symbols on the drawing**

# 275 – Weld Maps (Cont'd)

- **Weld Maps:**

- Identify the WPS/BPS to be used to weld or braze each specific joint on the GA supplied drawing
- For GA, the WPS/BPS identification shall be shown in a contrasting color text (e.g., **red WPS identification text on a black line/text drawing**) next to the weld/braze symbol on the GA supplied drawing
  - A “bubble” method can also be used



# 275 – WPQR/WOPQR

- **Welder Performance Qualification Records (WPQR) and Welding Operator Performance Qualification Records (WOPQR) are required to be maintained per the applicable Code requirements.**
  - Records shall be available for audit
  - Most welding Codes require evidence of “continuity” or “maintenance” of qualification to be recorded within 6-month periods
  - There is software available that can assist in managing this function, but any tool can be acceptable
  - Common terminology is “Welder Continuity Log” and “Welder Maintenance Log”
  - There must be integrity in the log in terms of verifying the welder/operator performed qualified welds successfully within the time limits
    - Common ways of achieving this goal is by recording a job/order number that required a “qualified” (i.e. – WPS) weld process or procedure or by having a qualified weld witnessed and inspected by a qualified company representative
  - If the WPQR/WOPQR expires, requalification is necessary for reinstatement
  - Keep in mind that different Codes have different requirements

b) An example of objective evidence showing implementation of the SOP (e.g., welder continuity log). Welder continuity shall be maintained in accordance with relevant codes and specifications.

- NAVSEA S9074-AQ-GIB-010/248 Rev 1: Every **six** months
- AWS D1.X: Every **six** months
- AWS D9.1: Every **twelve** months
- ASME: Every **six** months

## 6.2.3 Period of Effectiveness

**6.2.3.1 Welders and Welding Operators.** The welder’s or welding operator’s qualification as specified in this code shall be considered as remaining in effect indefinitely unless:

- (1) the welder is not engaged in a given **process** of welding for which the welder or welding operator **is qualified** for a period exceeding **six months**, or
- (2) there is some specific reason to question a welder’s or welding operator’s ability (see **6.25.1**).

Reference: American Welding Society (AWS) Standards

# 275 – Welder Summary Table (Cont'd)

- **Welder Summary Tables (Form EMS-0365) replace the need to submit WPQRs for each welder**
  - EMS-0365 is available at <https://www.ga.com/procurement/quality-assurance-forms>
- **Individual WPQRs are only required to be submitted once for initial approval**

**Note:** Prerequisite conditions prior to use.


**Welder Summary Table**  
 Reference 09492L00008 EMS Standard Quality Clauses

*Complete the following sections with request information and email the form to Data Management at [ems\\_cm@ga.com](mailto:ems_cm@ga.com) or submit this form using other approved methods.*

**1 REQUESTOR INFORMATION**

Supplier/Contractor Name: Insert name

Date of Request: Mm/dd/yyyy

Purchase Order Number: e.g., 4700012345

Welder Qualification and Maintenance Program: Enter approved GA-EMS document number: SUP-000001

Example WPQR Windchill #: Enter approved GA-EMS document number: SUP-000002

**2 RESTRICTIONS**

This form may only be used when the following have been submitted and approved:

- The supplier's standard operating procedure (SOP) defining the supplier's process for qualifying welders/welding operators and tracking welder/welding operator maintenance in accordance with customer-specified welding codes
- Relevant objective quality evidence (OQE) demonstrating implementation and conformance with the SOP for welder/welding operator qualification maintenance (e.g., welder maintenance log or equivalent and a GA-EMS approved welder performance qualification record [WPQR])
  - Any revisions to the SOP require review and approval by GA-EMS prior to use.
- A single code-acceptable WPQR that is a representative sample of the other WPQRs used to qualify welders/welding operators listed in the summary table
  - This requirement may be satisfied by submitting a WPQR previously approved by GA-EMS.

**3 WELDER SUMMARY TABLE**

**3.1 List all welders and weld operators who will be used to fulfill the PO specified above.**

Welder Name	Identification #	Qualified on These Weld Processes (limit one per line)	Original Date Qualified	Most Recent Maintenance Date
(e.g. John Smith)	5591	GTAW	MM/DD/YYYY	MM/DD/YYYY
(e.g. John Smith)	5591	GMAW	MM/DD/YYYY	MM/DD/YYYY
(e.g. John Smith)	5591	SMAW	MM/DD/YYYY	MM/DD/YYYY

\*Add/delete rows as needed

EMS-0365

Revision: A

2017/11/18

## 275 – Document/Data Reuse

- You may request that previously approved welding documents under a prior PO be reused on a subsequent PO for the same item.

### 5) Document Reuse Requirements:

- a) If Seller would like to use previously approved welding and/or brazing procedures for new Buyer Orders specifying parts with similar raw materials/thicknesses and similar weld/braze specifications/codes, Seller must notify GA-EMS CDM by submitting EMS-0364 with their intent to reuse previously approved weld documentation and notify Buyer's Authorized Purchasing Representative specified in the Order concurrently.
- b) Seller is still required to submit new or revised documentation for Buyer's review. If any procedures or documentation is revised, then it needs to be submitted for review and approval prior to being used.
- c) Weld maps are required to exercise Document Reuse Option 2 and must be submitted with the request.

- Reuse is subject to approval by GA

# 275 – Document/Data Reuse

- There are two document reuse options specified on EMS-0364.
  - EMS-0364 is available at: <https://www.ga.com/procurement/quality-assurance-forms>

**GENERAL ATOMICS ELECTROMAGNETICS** Supplier Document Reuse Request  
Reference 09492L00008, EMS Standard Quality Clauses  
Fill in the following sections with request information and email the form to Data Management at [ems\\_cm@ga.com](mailto:ems_cm@ga.com).

**1 Requestor Information**  
Supplier/Contractor Name: Insert Name Here  
Date of Request: MM/DD/YYYY  
Quality Clause # for Request: Insert only one Quality Clause Number Here (e.g., 275)

**2 Restrictions**  
Each request for document reuse shall be specific to a quality clause (e.g., 275 or 280). Documents for multiple quality clause requirements shall be submitted separately.  
All document reuse requests shall be approved by GA-EMS prior to implementation.

**3 Document Reuse Options**  
**Option 1:** Supplier documents that were previously approved by GA-EMS for a specific part/hardware at a specific revision may be reused for the manufacturing of an identical part/hardware as long as the new part/hardware has the same part number and revision as the original part/hardware document.  
**Option 2:** Supplier documents that were previously approved by GA-EMS may be applicable for the manufacturing of a new part/hardware. The supplier document must meet or exceed the new part/hardware requirements of the purchase order (PO).

**4 Supplier Document Identification**  
**4.1 Option 1 Request (as applicable to the PO)**

Previous PO Number	Current PO Number	Previously Approved Windchill Task Number	Supplier Document Type/Description	Supplier Document Number	Supplier Document Revision	Part Number	Part Revision
4700012345	4700045678	SLIP-000123	(e.g. - WPS, PCR, NDE, Windchill Practices, NCR, Procedures (VT, SFT, PF, etc.))	(e.g. - WPS-123-D1.1, etc.)	A	345000123456	C

\*Add rows as needed

EMS-0364 Revision: A 2017/12/05  
1

**GENERAL ATOMICS ELECTROMAGNETICS** Supplier Document Reuse Request  
Reference 09492L00008, EMS Standard Quality Clauses

**4.2 Option 2 Request (as applicable to the PO)**

Previous PO Number	Current PO Number	Previously Approved Windchill Task Number	Supplier Document Number	Supplier Document Revision	Previous Part Number	Part Revision	New Part Number	Part Revision

\*Add rows as needed

EMS-0364 Revision: A 2017/12/05  
2

# 275 – Welding / Brazing Requirements for Repairs

- **Weld Repairs:**

- First distinguish between the need to “repair” a defective characteristic or “rework” unacceptable discontinuities from a weld deposit.
- If a repair is necessary an SDR is required and you should begin preparing a weld repair procedure.

## 6) Repairs for Weld/Braze Nonconformance

If no provisions for the repair of weld defects are made in the applicable Code, the following requirements apply:

Weld repair procedures shall be written as **detailed instructions** and as a minimum shall include the following:

- a) **Method of removal** of weld or base metal
- b) **Method used to ensure defect removal** (e.g. - Magnetic Particle Testing [MT] or Liquid Penetrant Testing [PT])
- c) **Method for the re-welding/brazing**, using qualified welders/brazers with an approved WPS (if different from the original)
- d) **Extent, location and depth of the excavation**, which shall be documented on an inspection report

**The re-welded/brazed area shall be re-examined and documented by the methods used for the examination of the original weld.**

# 275 – Welding / Brazing Requirements for Repairs (Cont'd)

## Rework

- Any defective discontinuity, such as porosity, undercut, lack of fusion, cracks, etc. that can be reworked back into a conforming condition with an existing WPS and qualified welders.
- The final condition of the weldment will conform to contract requirements despite the rework.

VS

## Repair

- Defects in the base metal, such as lamellar tears and mislocated holes, that cannot be reworked with existing approved procedures.
- The final condition of the weldment will likely deviate from the contract requirements as a result of the repair.
  - This is inclusive of altered material conditions and PWHT processes *not* previously approved on the WPS(s)

**CAUTION:** The definitions provided herein are unique to welding processes and should not be considered as synonymous with dimensional repair/rework definitions.

# 275 – Weld Planning

- While not required, having a standard approach (i.e., a Standard Operating Procedure (SOP)) for determining qualification will help consolidate/reduce costs and improve document quality and completeness

Weld Planning SOP											
Project Name											
P/N		D/N (if different)									
Charge #											
Weld Engineer											
Date Prepared											
Step #	Description	Element(s)	Sub-element(s)	Needed (Yes/No)	Planned Start Date	Due Date	Status	Cost (\$) (if applicable)	Risk(s)	Barriers	Comments
1	Identify Code(s) required	Identify qualification options	Multi-process Testing Requirements Prequalification								
2	Develop Weld Map (NOTE: Ref MWI)	Weldment characteristics (Ref DWG)	Joints Materials (Groups) Positions DWG Notes Thickness(s)								
3	Weld Process	Determine most appropriate process(s)									
4	Identify PQR(s)	SWPS Availability									
		Appropriate and Efficient WPS(s) Evaluate the use of existing WPS(s)									
4	Identify PQR(s)	Create PQR(s)	Create pWPS Budget (\$) Determine quantity of coupons Create schedule Identify Test Lab								
		Identify additional tools/fixtures/equipment	Specific instruments Chill bars Temp Sticks								
5	Approve Weld Docs	PQR									
		WPS									
		WPQR									
		WOPQR									
6	WPQR(s)/WOPQR(s)	Release in Windchill									
		Continuity/Maintenance Plan	"the Log" in ProWrite								
7	Welder Skill	Training									

Example

# 275 – Weld Planning (Cont'd)

- Develop a PQR that will give maximum coverage to the extent the applicable Code allows:
  - For example:
    - In several Codes, but D1.1 Table 6.1 in particular, qualification (i.e. – PQR weld coupon(s)) on a groove will automatically qualify for fillet, plug and slot weld joints
    - Qualification on 1" plate, per D1.1 Table 6.2, qualifies any future WPS that's properly supported by the PQR from 1/8" to Unlimited thickness
  - The benefit is the reduction of overall qualification (i.e. – PQR) costs

**Table 6.1**  
WPS Qualification—Production Welding Positions Qualified by Plate, Pipe, and Box Tube Tests (see 6.4)

Qualification Test	Weld Type	Test Positions	Production Plate Welding Qualified			Production Pipe Welding Qualified					Production Box Tube Welding Qualified				
			Groove CJP	Groove PJP	Fillet <sup>b</sup>	Butt Joint <sup>a</sup>		K-Connections			Butt Joint		K-Connections		Fillet <sup>b</sup>
						CJP	PJP	CJP	PJP	Filler <sup>b</sup>	CJP	PJP	CJP	PJP	
L A T E	CJP Groove <sup>c</sup>	1G	F	F	F	F	F				F	F	F	F	F
		2G	F, H	F, H	F, H	F, H	F, H				F, H	F, H	F, H	F, H	F, H
		3G	V	V	V	V	V				V	V	V	V	V
L A T E	Fillet <sup>d,e</sup>	4G	OH	OH	OH	OH	OH				OH	OH	OH	OH	OH
		1F			F										F
		2F			F, H										F, H
L A T E	Plug/Slot	3F			V										V
		4F			OH										OH

*Qualifies Plug/Slot Welding for Only the Positions Tested*

CJP – Complete Joint Penetration PJP – Partial Joint Penetration  
<sup>a</sup>Qualifies for circumferential welds in pipes equal to or greater than 24 in [600 mm] nominal outer diameter  
<sup>b</sup>Fillet welds in production T, Y, or K-connections shall conform to Figure 10.5. WPS qualification shall conform to 6.13  
<sup>c</sup>Qualifies for a welding axis with an essentially straight line, including welding along a line parallel to the axis of circular pipe.

**Table 6.2**  
WPS Qualification—CJP Groove Welds: Number and Type of Test Specimens and Range of Thickness Qualified (see 6.5)

1. Tests on Plate<sup>a</sup>

Nominal Plate Thickness (T) Tested, in [mm]	Reduced Section Tension (see Fig. 6.10)	Number of Specimens			Nominal Base Metal Thickness Qualified, in [mm]	
		Root Bend (see Fig. 6.8)	Face Bend (see Fig. 6.8)	Side Bend (see Fig. 6.9)	Min.	Max. <sup>b</sup>
1/8 ≤ T ≤ 3/8 [3 ≤ T ≤ 10]	2	2	2	(Footnote d)	1/8	2T
3/8 < T < 1 [10 < T < 25]	2	—	—	4	1/8	2T
1 and over [25 and over]	2	—	—	4	1/8	Unlimited

Reference: American Welding Society (AWS) Standards

# 275 – Cost Reduction Options

**CAUTION:** It is critical that the Supplier/user ensures applicability of the option chosen to the part being welded. If it doesn't apply to the part, GA-EMS will reject it

All of these options are **acceptable** to GA-EMS.

## WPS Qualification

- Qualify WPS by way of qualification testing in accordance with the applicable Code
- Most versatile/flexible path to WPS qualification

## Prequalified WPS

- Some Codes allow PWPS
  - Not all do
- A WPS can be written in conformance to the Prequalification Clause and begin certifying welders to it
- No Qualification Testing (PQR), and associated cost, required
- Still requires welding expertise to ensure pWPS(s) are properly implemented.

### 5.1 Scope

This clause contains requirements for prequalified Welding Procedure Specifications (WPSs). These WPSs are exempt from the requirements for testing required for qualification of WPSs per Clause 6.

It is divided into eight parts as follows:

Part A – WPS Development

Part B – Base Metal

Part C – Weld Joints

Part D – Welding Processes

Part E – Filler Metals and Shielding Gases

Part F – Preheat and Interpass Temperature Requirements

Part G – WPS Requirements

Part H – Post Weld Heat Treatment

**Prequalification of WPSs** (Welding Procedure Specifications) shall be defined as **except from** the WPS qualification testing required in Clause 6. All prequalified WPSs shall be written **in order for a WPS to be prequalified, conformance with all of the applicable requirements of Clause 6 shall be required.** WPSs that do not conform to the requirements of Clause 6 may be qualified by tests in conformance with Clause 6. For convenience, **Annex 2** lists provisions to be included in a prequalified WPS, and which should be addressed in the Fabricator's or Contractor's welding program.

Welders, welding operators and tack welders that use prequalified WPSs shall be qualified in conformance with Clause 6, Part C or Clause 10, Part D for tabulars.

D1.1, Clause 5

## Standard WPS

- AWS publishes and sells sWPS(s) ready for use.  
(<http://pubs.aws.org/t/procedures>)
- The AWS Welding Research Council (WRC) develops them and they are supported by many PQRs in the WRC's library.
- Not as versatile as WPS qualification
- ASME, NBIC and NAVSEA S9074-AQ-GIB-010/248 Rev 1 acceptable

Reference: American Welding Society (AWS) Standards

- **QC 273 – “Welding/Brazing Requirements for Commercial Products”**
  - QC 773 requirements are the same as QC 275 except for the following:
    - 30 Day SDRL submittal requirement
    - Welder Performance Qualification Maintenance Program shall be maintained to meet Code requirements, but does not need to be submitted to GA
    - Multi-process PQRs (e.g., AWS B2.1) are permitted at the discretion of the GA weld engineer
    - PQR supporting documentation shall be maintained, but not submitted
    - WPQRs are not required to be submitted

# Questions

**If you have any questions  
regarding this training please  
contact us at [SM-QA@GA.com](mailto:SM-QA@GA.com)**

Remember to contact your GA Purchasing Representative about any questions regarding open POs or your continued performance.