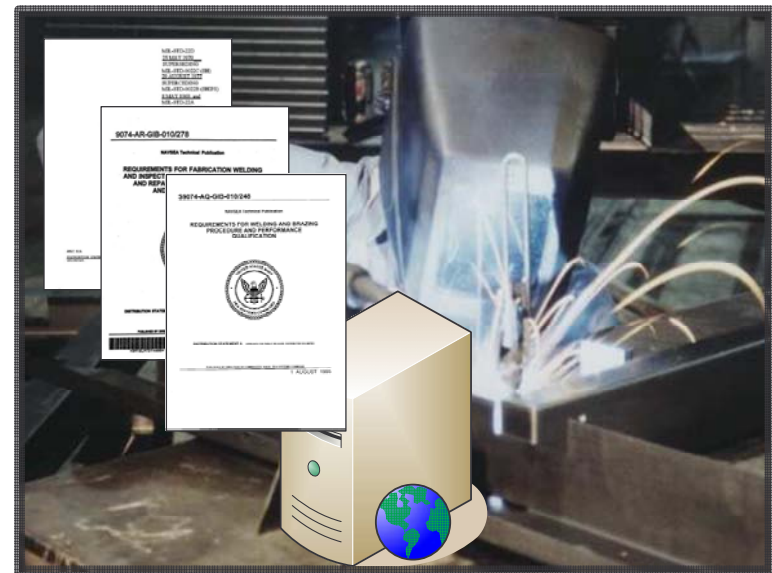




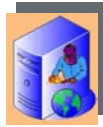
<https://www.navweld.com>

An Intelligent Shipyard Welding Procedure System

SBIR Project
Sponsored by
Office of Naval Research



Quality Control Solutions.



Presentation Outline

- SBIR Project
 - Status
- Follow-on Project



OBJECTIVE

Reduce the Cost of Developing & Reviewing Welding Procedures for U.S. Shipyards & their Vendors.



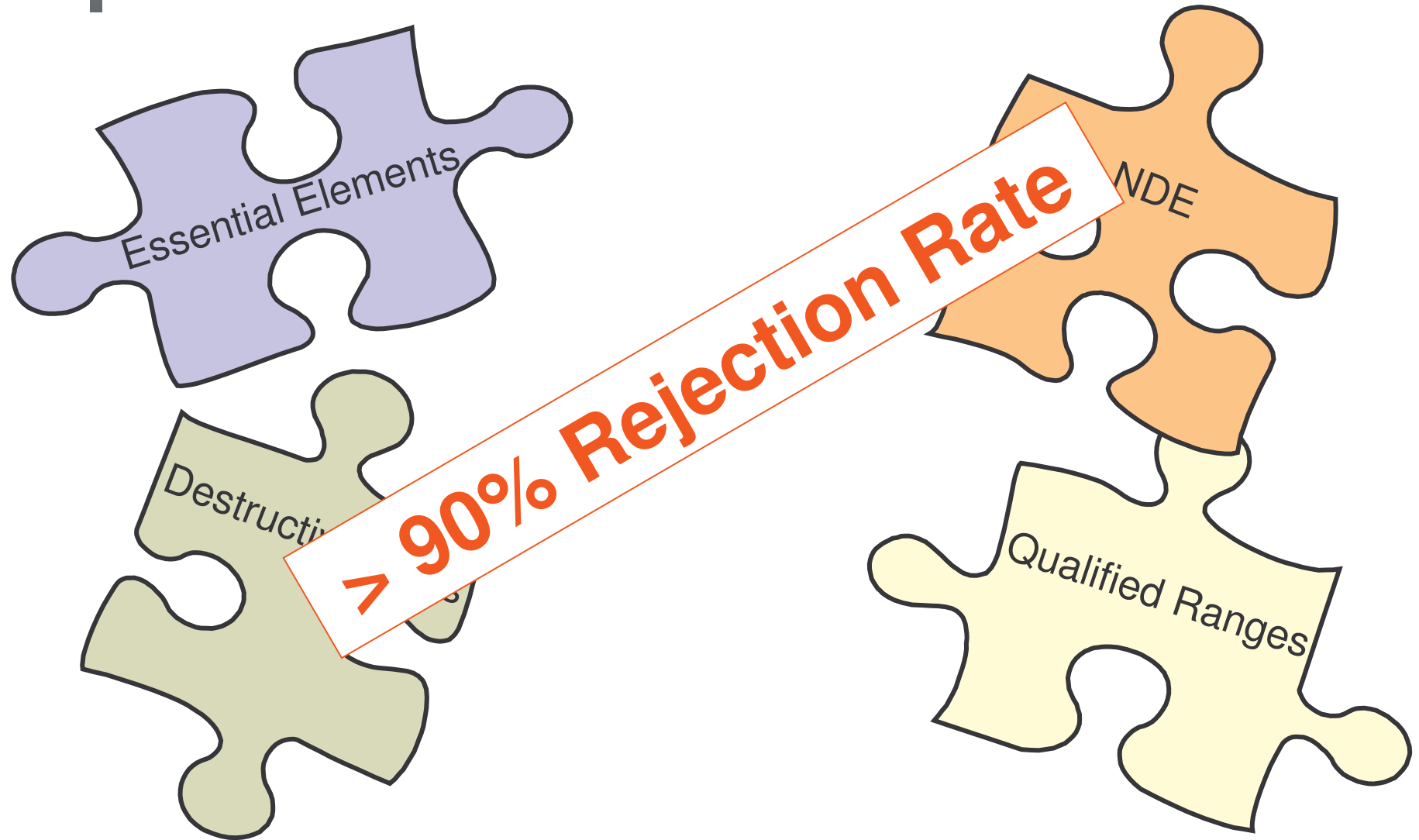
PROJECT TEAM

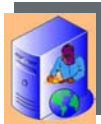
- WeldQC
- Northrop Grumman Newport News
- General Dynamics Electric Boat
- General Dynamics Bath Iron Works





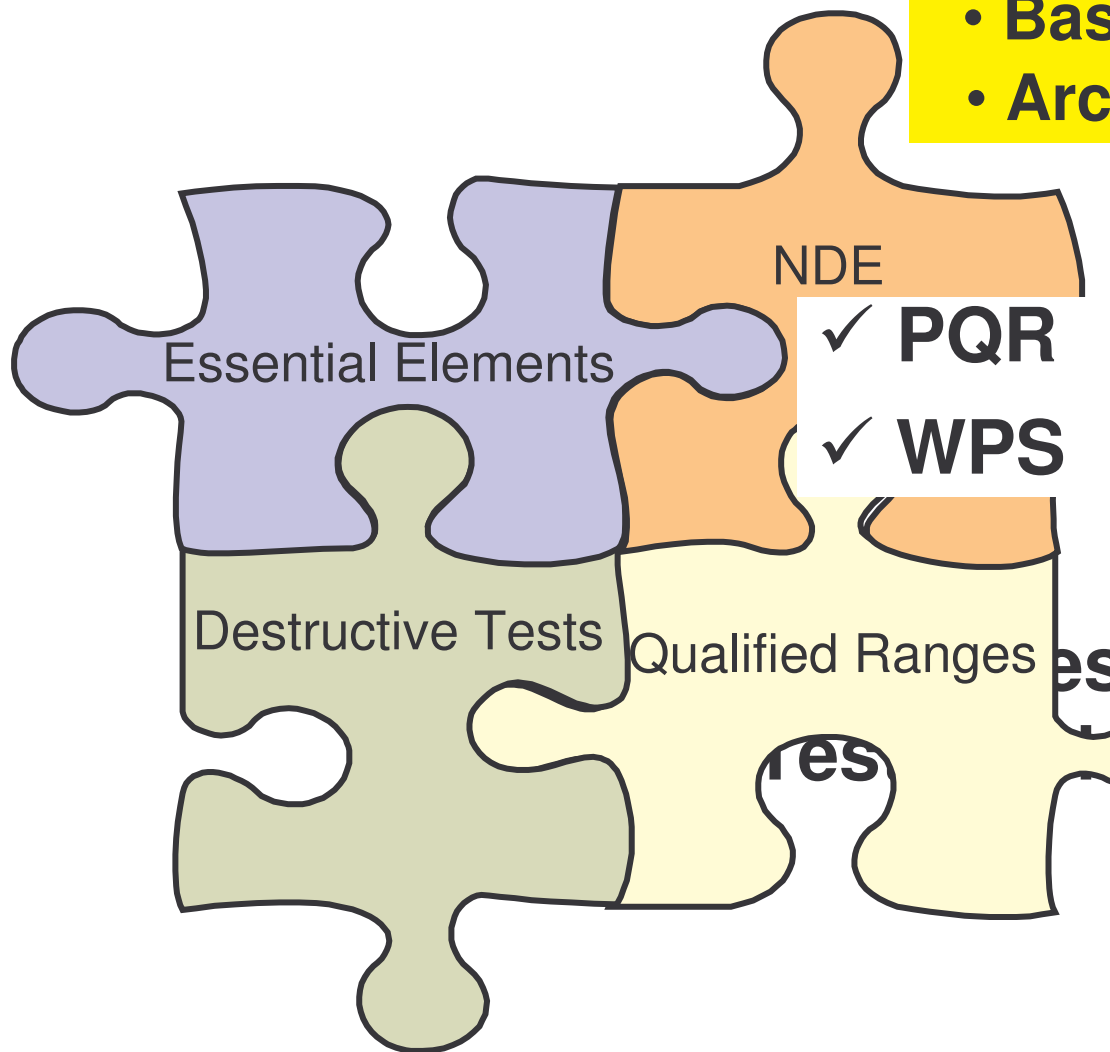
TechPub 248 is Complex





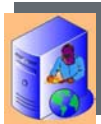
NavWeld

- Based on Tech Pub 248
- Arc Welding Processes

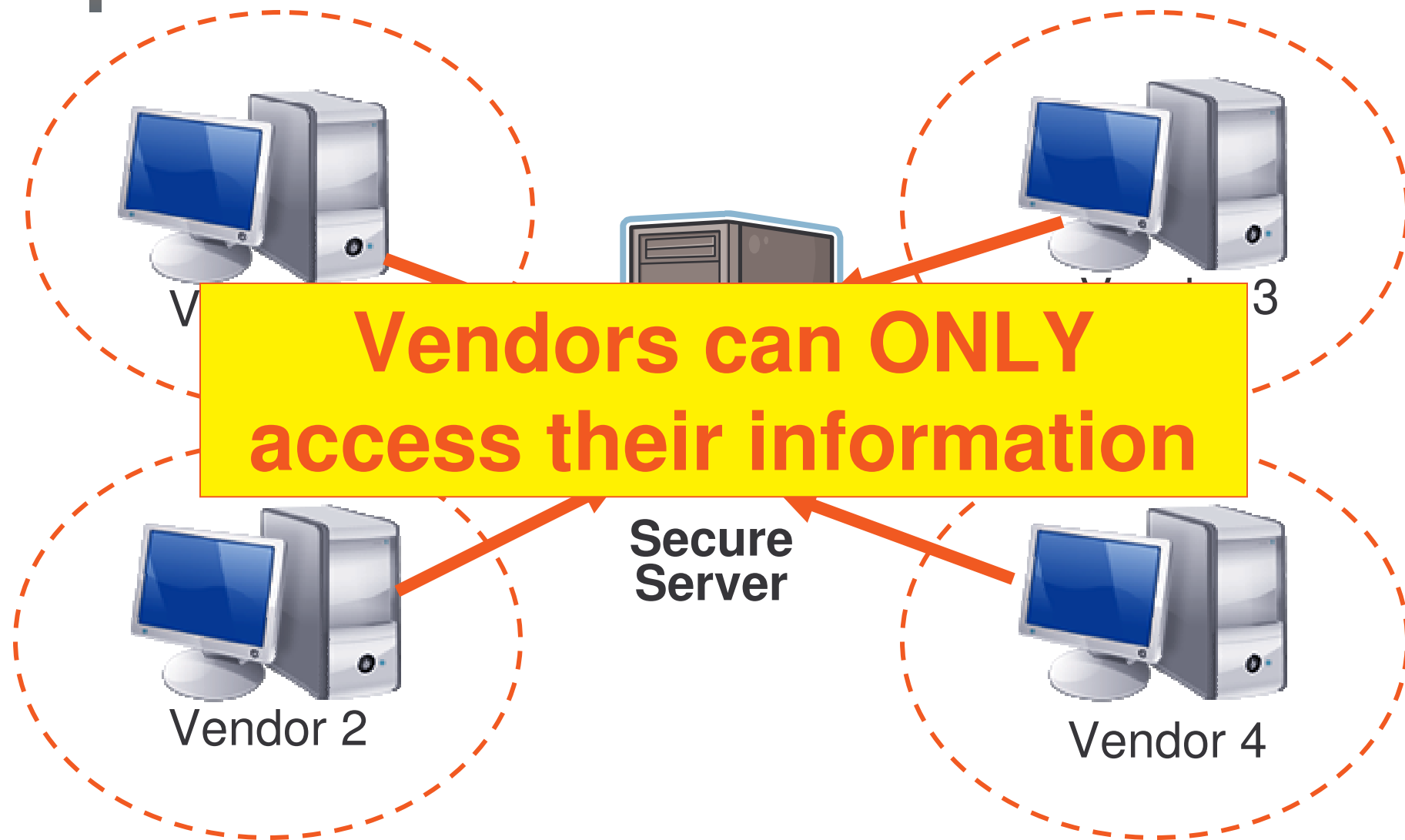


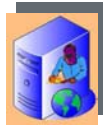
- ✓ Which Tests
- ✓ Test Entries

- ✓ Allowable Ranges of Essential Elements



NavWeld – Web Application





Internet/Intranet Advantages

- Platform Independent (Windows & Apple)
- No software to install
- Updates immediate
- Eliminates version control issues
- Centralized control of users



PQR Flowchart

Enter Data on PQR

- NavWeld Determines
- ✓ **Essential Elements**
 - ✓ **Non-Destructive Tests**
 - ✓ **Destructive Tests**

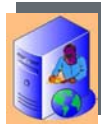
Complete PQR

- NavWeld Marks
- ✓ **Incomplete Items**

Generate “Qualified Range Report”

- NavWeld Determines
- ✓ **Qualified Ranges**





WPS Flowchart

Enter Data on WPS



Complete WPS

NavWeld Determines
✓ **Essential Elements**

NavWeld Marks
✓ **Incomplete Items**



Submittal & Review Flowchart

Generate PDFs

- PQR
- Qualified Range Report
- WPS

NavWeld Generates

✓ **Standard Format**

NavWeld Marks

✓ **Incomplete Items**

Sends PDFs to Shipyard

Reviewer Electronically adds Comments



Examples of Vendor Tools

- Indicates which:
 - Essential Elements are required
 - Non-Destructive Tests are required & entries for each test
 - Destructive Tests are required & entries for each test
- “Qualified Ranges” for the Essential Elements based on a PQR
- Provides Tooltips & Help to locate information in TP 248



Essential Elements

Incomplete

- Base Metals
- Weld Joint
- Process
- Non-Destructive Tests
- Destructive Tests
- Note Page - 1
- Certification
- Attachments

Reference Info.

Techpub 248
Mil-Std 22

Contact
Logout

<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Weld Type
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Welding Position
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Filler Metal
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Gas
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Preheat / Interpass
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Postweld Heat Treatment
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Equipment
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Technique
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Electrical

Polarity: DCEP - (Reverse)

Amperage: (amps) * TO Optional
(##.##) Optional (##.##) Optional

Arc Voltage: (volts) 18 TO Optional
(##.##) Optional (##.##) Optional

Wire Feed Speed: (in/min) TO Optional
(##.##) Optional (##.##) Optional

Travel Speed: (in/min) TO Optional
(##.##) Optional (##.##) Optional

Required

Optional

Unavailable



Destructive Tests

Add Optional Tests

Required Tests

No. of Specimens

Add Specimens

PQR qualified to previous version of MIL-STD-248. Make ALL NDE Tests Optional.

Add an optional Destructive Test
All Weld Metal Tensile

Use Face and Root Bend Tests Instead of Side Bend Test

Remove this Destructive Test Upon Saving

Transverse Tensile Tests -- (Minimum of 2 Full Thickness Tests Required)

Specimen No.	Test Type	Width/Dia. (in) (##.##)	Thickness (in) (##.##)	Area (sq. in) (##.##)	Total Load (lbs) (##.##)	Unit Stress (psi) (##.##)	Failure Type	Failure Location
<input type="checkbox"/>	Reduced						Ductile	Base M
<input type="checkbox"/>	Reduced						Ductile	Base M

Remove this Destructive Test Upon Saving

Side Bend Tests -- (Minimum of 3 Full Thickness Tests Required)

Specimen No.	Acceptance Criteria	Width (in) (##.##)	Thickness (in) (##.##)	Bend Radius (in) (##.##)	Result	Notes (Optional)
<input type="checkbox"/>					<SELECT>	
<input type="checkbox"/>					<SELECT>	
<input type="checkbox"/>					<SELECT>	



Digital Approval

Valid Digital Approval

Welder #1 Name:	welder	
Welder #2 Name:		(Optional)
Test Conducted By:	tester	
Witnessed By:		(Optional)
Laboratory Test Note(s):		(Optional)
Written By:		(Optional)
PQR Approved By:	manager	
Approved Date:	2/22/2007	(mm/dd/yy)

Save and Digitally Approve Troy Paskell **VALID DIGITAL APPROVAL**
Digitally Approved: 2/28/2008

I certify that the tests and the test results meet all requirements of the Welding Qualification Specifications listed and that the welding procedure meets all requirements of the Fabrication Specifications listed.

<< Previous Save Cancel

Changes causes Invalid Approval

Save and Digitally Approve TEST USER **INVALID DIGITAL APPROVAL**
Digitally Approved: 2/28/2008





Qualified Range Report

Level 1 & 2 Qualified Ranges for:

- Essential Elements
- Thickness
- Position
- Base/Filler Metal Cross Qualification



Qualified Range Report

General

	PQR	Level 1 Qualified Range	Level 2 Qualified Range	Tech Pub 248 References	Messages
Welding Process					
Welding Process (WP-1)	GMAW-Pulsed	PQR Value		4.7.4 a-c	
Process Type (WP-2)	Automatic	PQR Value		4.7.4 d & f	
Base Metal					
Base Metal S-No. (BM-1)	S-1	See Base/Filler Table below.			
Filler Metal					
Group No. (A-No.) (FM-1)	A-45B	See Base/Filler Table below.			
Group No. (A-No.) (FM-3)	A-45B	Addition or omission of supplementary filler is prohibited		4.7.9.3a	
Material Spec (FM-5)	AWS A5.14	See Base/Filler Metal Table below.			
Filler Metal Form (FM-8)	Bare Electrode	See Base/ Filler Metal Table below			
Size of Filler Metal (FM-11)	all: 0.045 (in)	PQR Value +/- 10%		4.7.9.3c	
Size of Filler Metal (FM-12)	all: 0.045 (in)		>0 to PQR Value + 0.015 inch	4.8a	Can decrease electrode size but cannot increase more than 0.015-inch.
Max. Individual Weld Pass					



Qualified Range Report

Thickness Table

Based on Table 6 & relevant sections of TechPub248

Base Metal Thickness Table for Groove and Fillet Welds

Thickness (T) on PQR used to determine qualified thickness	Qualified Base Metal Thickness ¹				Tech Pub 248 References	Additional Info
	Groove, Autogenous (Groove) ¹ & Seal (Groove) Welds		Fillet, Autogenous (Fillet), ¹ Socket (Fillet) Welds			
	Pipe (min/max)	Plate (min/max)	Pipe & Plate (min/max)			
Thinnest Base Metal	0.375	0.058 / 2T	0.125 / 2T	0.058 / Unlimited	Table 6 FN2f & Sections 4.4.1.9 & 4.4.2	

1. If multiple rows are shown, use the most stringent.

Base Metal and Weld Metal Deposit Thicknesses for Buildup, Buttering and Repair Welds qualified by Groove Welds.

Thickness (T) on PQR used to determine qualified thickness	Qualified Base Metal Thickness ¹		Qualified Weld Deposit Thickness ¹		Tech Pub 248 References	Additional Info
	Weld Buildup, Buttering & Repair Welds		Weld Buildup, Buttering & Repair Welds			
	Pipe (min/max)	Plate (min/max)	Pipe (min/max)	Plate (min/max)		
Thinnest Base Metal	0.375	0.058 / Unl	0.125 / Unl	0.058 / 2T	0.125 / 2T	Table 6 FN2f & Sections 4.4.1.9 & 4.4.2

1. If multiple rows are shown, use the most stringent.



Qualified Range Report

Position Table

Based on Table 4 & relevant sections of TechPub248

Welding Position Table

PQR		Qualified Welding Positions ^{1,2}			TechPub 248 References	Additional Information
Welding Position		Groove, Autogenous (Groove), Seal (Groove), & Weld Surfacing		Fillet, Autogenous (Fillet), & Socket (Fillet)		
		Pipe	Plate	Pipe & Plate		
Welding Position	1G	1GR	1G	1F, 2F		

1. Qualified Welding Positions only apply to the qualified Weld Types above.
2. If multiple rows are shown, use the most stringent.



Qualified Range Report

Base & Filler Table

Based on Table 3 of TechPub 248

Base and Filler Metal Table

	Base Material		Filler Metal	Filler Metal Type	Tech Pub 248 References	Additional Information
	S-No. / Class	S-No. / Class				
PQR	S-8/304L	S-1/Grade C	A-8B	MIL-309		
Qualified	S-8/<ALL>	S-1/<ALL> S-2/<ALL>	A-8B	MIL-309, MIL-310, ER309L	Section 4.7.1c	
Qualified	S-8/<ALL>	S-11A/<ALL>, S-11B/<ALL>, S-11C/<ALL>, S-11D/<ALL>	A-8B	MIL-309, MIL-310, ER309L	Section 4.7.1c	

Contents Search - Search - GO Powered By RoboHelp®

- Introduction
- How to Begin
- Change Password
- PQR
 - Search Page
 - General Info Page
 - Base Metals Page
 - Weld Joint Page
 - Process Page
 - Non-Destructive Tests Page
 - Destructive Tests Page
 - Certification Page
 - Notes Pages
 - Image Pages
 - Attachments
 - Printing a PQR Report
- Qualified Range Report
- WPS
- Definitions

Face and Root Bend Tests may be substituted for Side Bend Tests by checking the **Use Face and Root Bend Tests Instead of Side Bend Test** box, when permitted by S9074-AQ-GIB-010/248. Upon selecting Face and Root Bend Tests, the Side Bend Test becomes Optional and it can be deleted.

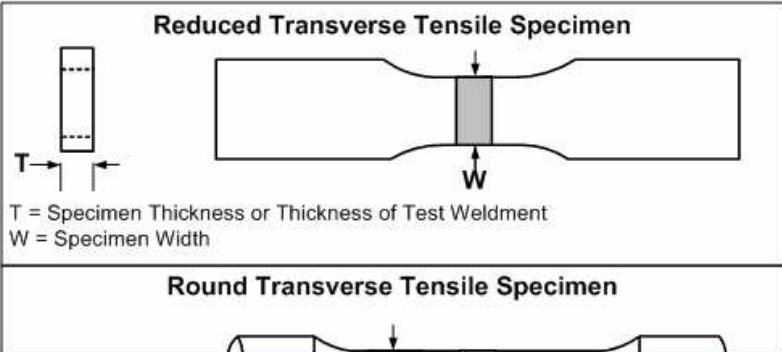
Dynamic Tear Tests may be substituted for Charpy Tests by checking the **Use Dynamic Tear for Toughness Testing**, when permitted by S9074-AQ-GIB-010/248. Upon selecting Dynamic Tear Tests, the Charpy Tests become Optional and they can be deleted.

Click on each section for more information.

- Transverse Tensile Tests**
Test Type: The following figure shows examples of the three types of Transverse Tensile specimens.

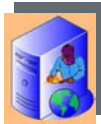
NOTE: If the Test Type is Round, the Thickness entry will be shaded, indicating that it is not applicable.

See AWS B4.0 for the required specimen dimensions and methods for calculating Area, Total Load, and Unit Stress (Ultimate Tensile Strength).



The figure shows two diagrams of transverse tensile specimens. The top diagram is labeled "Reduced Transverse Tensile Specimen" and shows a rectangular specimen with a central necked region. A vertical arrow labeled 'W' indicates the specimen width, and a horizontal arrow labeled 'T' indicates the specimen thickness. The bottom diagram is labeled "Round Transverse Tensile Specimen" and shows a similar specimen with a rounded necked region.

T = Specimen Thickness or Thickness of Test Weldment
W = Specimen Width



Tooltips

Electrical

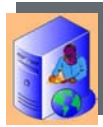
Polarity: **DCEP - (Reverse)**

Amperage: (amps) TO *Optional*
(##.##) (##.##)

Arc Voltage: (volts) TO *Optional*
(##.##) (##.##)

Section 4.7.5c, d
Section 4.7.92b
Section 4.8g, n

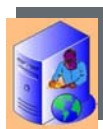
Relevant Sections of TP248



Other Tools

Ability to add:

- Notes Pages
- Images
- Attachments



Notes Pages

NavWeld - PQR Notes DEMO - Windows Internet Explorer

https://www.navweld.com/PQR/PQRRichNotePage.aspx?ID=01bb5534-fe30-46e9-932e-eaf416ffd634

File Edit View Favorites Tools Help

NavWeld - PQR Notes DEMO

NavWeld - PQR

Intelligent Shipyard Welding Procedures

PQR: 1234 rev. 1 Add Pages ▶ Print PQR Print Qualified Range Report Email PQR Save 29:52

Welcome
Introduction
How To Begin
PQR Help
WPS Help
FAQs
New Features

Begin
Main Menu
Search

PQR Navigation
✔ General Info
✔ Base Metals
✔ Weld Joint
▼ Process
Non-Destructive Tests
Destructive Tests
Note Page - 1
▼ Certification
Attachments

Page Order Number: (Optional)
Page Title: (Optional)

If horizontal scroll bar is shown in text editor, text may get cut off when printed.
Verify all text will be printed using the Print Preview button.

Style Format Font Size

Simply begin adding text.

Save Cancel Delete Add Template

Notes Pages



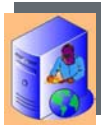
Notes Pages

Custom Tables & Templates

The screenshot shows the NavWeld software interface. An 'Insert Templates' dialog box is open, displaying a list of templates in the '/templates/' folder. The 'Diameter-Amps Volts.htm' template is selected and circled in red. Below the list, there is an 'Upload' section with a progress bar and 'Insert' and 'Cancel' buttons.

The main window shows a 'Qualified Range Report' with a table for 'Weld Layer' data. The table has columns for 'Weld Layer', '1', '2', '3', '4', and 'Remainder'. The rows include 'Period Mode', '1st Level Period', '2nd Level Period', '3rd Level Period', '4th Level Period', 'Low Pulse Mode', '1st Level Current (amps)', and '2nd Level Current (amps)'. The 'Add Template' button at the bottom right is circled in red.

Weld Layer	1	2	3	4	Remainder
Period Mode					
1 st Level Period					
2 nd Level Period					
3 rd Level Period					
4 th Level Period					
Low Pulse Mode					
1 st Level Current (amps)					
2 nd Level Current (amps)					
3 rd Level Current (amps)					
4 th Level Current (amps)					



Examples of Reviewer Tools

- **Less Errors by Vendors**
 - Reduces review time
- **Consistent Printed Formats**
 - Makes it easier to find information
- **Dynamic Printing**
 - Prints only the pertinent information
- **Items marked as Incomplete or Complete**
 - Highlights missing information
- **Electronic submission**
 - Electronically add & track review comments



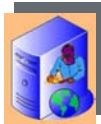
Incomplete Entries on Print Out

Incomplete

FILLER METALS		
Material	A-8B	
Specification	MIL-E-19933	
Material	MIL-309	
Electrode & Rod	Bare Electrode & Rod	
Toughness Required	NO	
Size	Pass(es)	Size (in)
	all	
Max. Individual Weld Pass Size/Thickness	.1 (in)	
Notes		
GAS		
	Type	Flow Rate (cfh)
Shielding	Argon	25
Backing	Argon	5
Gas Cup Size	No. 5	
Notes		
ELECTRICAL		
Polarity	DCEP - (Reverse)	
Amperage	125 (amps)	
Arc Voltage	14 (volts)	
Wire Feed Speed		
Travel Speed	4 (in/min)	
Notes		

INCOMPLETE SECTION(S)
(Process, NDE Tests, DST Tests, Certification, Digital Approval)

NavWeld Ver. 1.0
S9074-AQ-GIB-010/248



Reviewer's Comments

Adobe Acrobat Professional - [PQR with Comments.pdf]

File Edit View Document Comments Tools Advanced Window Help

118%

PROCEDURE QUALIFICATION RECORD

Company Name WeldQC Inc
PQR No. 5-D PQR Rev. (opt) _____ Date 08/02/2007
WPS No. (opt) _____ WPS Rev. (opt) _____
Welding Process(es) GTAW(Automatic)
Fabrication Spec(s) 278 Welding Spec(s) 248
Qualification Level 1

SCOPE

BASE METAL

S-No.	<u>S-8</u>	to	<u>S-1</u>
Material Specification	<u>ASTM A 240</u>	to	<u>ASTM A 178</u>
Type Or Grade	<u>304L</u>	to	<u>Grade C</u>
Form	<u>Pipe</u>	to	<u>Pipe</u>
Condition or Temper	<u>annealed</u>	to	<u>annealed</u>
Toughness Required?	<u>NO</u>	to	<u>NO</u>
Prod. Thickness >= 1/2 in.?	<u>NO</u>	to	<u>NO</u>
Pipe Diameter:	<u>4 (in)</u>	to	<u>4 (in)</u>

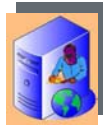
Second comment

Ability to add comments electronically

Page 1

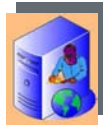
Owner Text Box 8/20/2007 11:21:18 AM Second comment

Owner Text Box 8/20/2007 11:19:58 AM Ability to add comments electronically



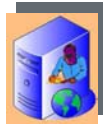
SBIR Status

- Completed
- Tested by Project Team
- Seeking additional testers
 - Shipyards
 - Vendors



Follow-on Project

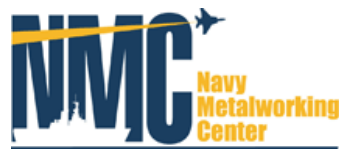
***Web-Based Welding Procedure System
for Shipyard Use***



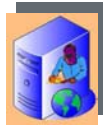
Project Team



Program Mgr. Jim Shevock



Quality Control Solutions.



Technical Objectives

Add Requirements for:

- Brazing, Resistance & Stud Welding
 - ABS-Navy Vessel Rules
 - NAVSEA Tech Pub S9074-AR-GIB-010/278
 - MIL-STD-1689A
 - Welder Performance Qualifications
-