

**Process Systems International, Inc.**  
 20 Walkup Drive Westborough, MA 01581  
**WELDING PROCEDURE SPECIFICATION (WPS)**

WPS No.: 151-1 Date: 05/06/96  
 Supporting PQRs: 151-1-H48

**BASE METAL (QW-403, QW-405)**  
 P No. 8 to P No.: 8  
 Thickness range. 0.1875" to 1.0000"  
 Position(s). All positions  
 Progression. Vertical Up  
 notes

**JOINT (QW-402)**  
 Joint design Groove/Fillet (see pg 2)  
 Backing..... With or without backing  
 Backing Matl Optional  
 Fillet Weld Size All (QW-451.4)  
 notes

**PREHEAT (QW-406)**  
 Minimum Temperature. 60 Degrees F.  
 Interpass Temp. Max. 350 Degrees F.  
 Preheat Maintenance. None

**POSTWELD HEAT TREATMENT (QW-407)**  
 Temperature range 1000 DEG.F. **A**  
 Time range 4.00  
 notes

Process / type .....	All pass(es) PAW / manual	None
Process thickness limit.	0.1875" to 1.0000"	None
<b>GAS (QW-408)</b>		
Shielding Gas / CFH.....	75% Argon, 25% He./ 20-30	None / -
Trailing Gas / CFH.....	None / -	None / -
Backing Gas / CFH.....	100% Argon / 9-24	None / -
Plasma Gas / CFH.....	100% Argon / 1-3	None / -
<b>FILLER METAL (QW-404)</b>		
AWS classification.....	ER308L	None
SFA Spec. No. & F No....	SFA#: 5.9 F#: 6	SFA#: None F#: -
A No. or Chem. Comp.....	8	None
Filler metal trade name.	SOLID FILLER METAL	None
SAW flux trade name/type	N/A / -	None / -
Elec./Wire size (in) ...	1/16   3/32   1/8	-   -   -
<b>ELECTRICAL (QW-409)</b>		
Welding amperage range..	30-100   75-160   100-200	-   -   -
Welding voltage range...	12-18   14-21   16-26	-   -   -
Travel speed (ipm).....	Var.   Var.   Var	-   -   -
Max. Heat Input (J/in)..	None	None
Tungsten Type/Size.....	EWTh-2 / 1/16"-3/16"	N/A / -
Current & Polarity.....	DCEN (straight)	N/A

**TECHNIQUE (QW-410)**  
 String / weave bead..... String & Weave Bead N/A  
 Orifice / gas cup..... 3/8" to 5/8" None  
 Contact tube to work.... N/A None  
 Oscillation..... Transverse None  
 Mult./Single electrode.. Single Electrode N/A  
 Other Technique Notes... Keyhole & Melt-in used None  
 Multiple or Single Pass (per side).... Multiple Passes

- (n1) No pass > 1/2 " t.
- (n2) No supplementary filler will be used with this procedure.
- (n3) WELD WIRE SHALL BE CLEANED SPECIAL AND HANDLED WITH POLY GLOVES.
- (n4) GRINDING WITH ABRASIVE WHEELS IS "NOT ALLOWED".
- (n5) WIRE BRUSHING IS "NOT ALLOWED".
- (n6) PWHT RAMP UP TO 300 DEG.F. THEN 100 DEG.F./HR. UP TO 1000 DEG.F.
- (n7) PWHT RAMP DOWN AT 100 DEG.F./HR. TO 300 DEG.F. AND COOL IN STILL AIR.

WELDING PROCEDURE SPECIFICATION (WPS)

WPS No.: 151-1

Date: 05/06/96 Revision No.: (

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 JOINT (QW-402)  
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Single-V groove

Backing : no backing  
 Root Opening: 3/16" max.  
 Groove Angle: 50 degree min.  
 Root Face : 1/8" max.

Single-Bevel groove

Backing : no backing  
 Root Opening: 3/16" max.  
 Groove Angle: 45 degree min.  
 Root Face : 1/8" max.

Single-V groove

Backing : gouged & back welded  
 Root Opening: 1/4" max.  
 Groove Angle: 50 degree min.  
 Root Face : 3/16" max.

Double-Bevel groove

Backing : gouged & back welded  
 Root Opening: 1/4" max.  
 Groove Angle: 45 degree min.  
 Root Face : 3/16" max.

Double-V groove

Backing : gouged & back welded  
 Root Opening: 1/4" max.  
 Groove Angle: 45 degree min.  
 Root Face : 3/16" max.

Single/Double Fillet

Backing :  
 Root Opening: 3/16" max.  
 Weld Size : Required fillet  
 plus root opening

Square groove

Backing : T-joint  
 Root Opening: 1/32" max.

Square groove

Backing : no backing  
 Root Opening: 3/32" max.

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 WELD JOINT DESCRIPTIONS SHOWN ARE NOT INCLUSIVE OF ALL OF THOSE FOUND ON A  
 JOB. WELD JOINT DESIGN REFERENCE IN AN ENGINEERING SPECIFICATION OR  
 DESIGN DRAWING SHALL TAKE PRECEDENCE OVER WELD JOINTS SHOWN IN THIS WPS.  
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Initial cleaning shall be in strict compliance with special job procedures.  
 Method of back gouging must be accomplished with a carbide burr cutter.

- (a) NON-FUSABLE RETAINERS MAY BE USED.
- (b) WELD WIRE SHALL BE CLEANED SPECIAL IN ACCORDANCE WITH SPECIFIC JOB PROCEDURES. SEALED IN BAGS AND HANDLED WITH POLY GLOVES AT ALL TIMES.
- (c) GRINDING AND WIRE BRUSHING ARE "NOT ALLOWED" ON THE LIGO JOB. DEFECT REMOVAL MUST BE ACCOMPLISHED WITH A CARBIDE BURR CUTTER.
- (d) WELDING STARTS & STOPS MUST RAMP GRADUALLY UP & DOWN TO AVOID CRACKING. THE WELDER SHALL PROVIDE A POST (AFTER FLOW) GAS FLOW OF 10 SECONDS.
- (e)

We certify that the statements in this record are correct and in accordance with the requirements of Sections IX and VIII of the ASME Code.

Prepared By: *A. Rollins* ( 05/06/96 ) Weld Specialist  
 Accepted By: *Alan L. Beal* ( 05/06/96 ) Q.A. Manager:

**Process Systems International, Inc.**  
**20 Walkup Drive Westborough, MA 01581**  
**Procedure Qualification Record (PQR)**

PQR No.: 151-1-H48

Date: 05/06/96

WPS No.: 151-1

**JOINT DESIGN (QW-402)**

**WELD JOINT CONFIGURATION**

Single-V groove  
 Gas backing was used  
 Groove Angle : 75 Degrees  
 Root Opening : 062-125 Inches  
 Root Face : 030-062 Inches

**BASE METAL (QW-403)**

Material form. Plate  
 Material Spec. SA-240, Type 304L  
 To SA-240, Type 304L  
 P No. 8 Gr. 1 to P No. 8 Gr. 1  
 Thickness (in) 0.5000

note:

**HEAT TREATMENT (QW-406, QW-407)**

Preheat Temperature: 60 Degrees F.  
 Preheat Maintenance: None  
 Interpass Temperature: 350 Degrees F.  
 PWHT temperature ... : 1000 Degrees F.  
 PWHT Holding time(hr): 4.00  
 note: +/- 50 DEG. F.

**POSITION (QW-405)**

Position of Joint : 1G - Flat  
 Progression: N/A

note:

Weld Process / type GAS (QW-408)	All pass(es) PAW / manual		None	
	Shielding Gas / CFH.....	75% Argon, 25% He./	20-30	None
Trailing Gas / CFH.....	None	/ -	None	/ -
Backing Gas / CFH.....	100% Argon	/ 10-20	None	/ -
Plasma Gas / CFH.....	100% Argon	/ 1-3	None	/ -
<b>FILLER METAL (QW-404)</b>				
AS Classification.....	ER308L		None	
SAF Spec. No. & P No....	SPA#:	5.9	F#:	6
A No. or Chem. Comp.....	8		SPA#:	None
Filler Metal Trade Name.	SOLID FILLER METAL		None	
SAW Flux Trade Name/Type	N/A		None	
Weld Deposit 't' (in)...	0.5000		None	
Elec./Wire Size (in)....	1/16	3/32	1/8	-
<b>ELECTRICAL (QW-409)</b>				
Amperage USED .....	30-100	75-160	100-200	-
Voltage USED .....	12-18	14-20	16-26	-
Travel Speed (ipm).....	Var.	Var	Var	-
Max. Heat Input (J/in)...	None		None	
Tungsten Type & Size....	EWTh-2 / 3/32"-3/16"		N/A	
Current Type/Polarity...	DCEN (straight)		N/A	
<b>TECHNIQUE (QW-410)</b>				
String or Weave Bead....	String & Weave Bead		N/A	
Orifice/Gas Cup Size....	1/2"-5/8"		None	
Contact Tube to Work....	N/A		None	
Oscillation.....	Transverse		None	
Mult./Single Electrodes.	Single Electrode		N/A	
Other Technique Notes...	Keyhole & Melt-in used		None	
Multiple or Single Pass (per side)....	Multiple Passes			

- (n1) Peening was not used with this weld test.
- (n2) No supplementary filler will be used with this procedure.
- (n3)
- (n4) PWHT Ramp up to 300 Deg.F. then 100 Deg.F./Hr. up to 1000 Deg.F.
- (n5) PWHT Ramp down at 100 Deg.F./Hr. to 300 Deg.F. and cool in still air.

TENSILE TEST (QW-150)

Specimen No.	Width (in.)	Thick. (in.)	Area (sq.in.)	Ultimate total load (lb)	Ultimate stress (psi)	Type of failure and location
1	0.745	0.513	0.382	34850	91200	Weld metal
2	0.745	0.505	0.376	34200	91000	Base metal

GUIDED BEND TEST (QW-160)

Figure No. and Type	Result	Figure No. and Type	Result
QW-462.2 Side bend	No defects	QW-462.2 Side bend	No defects
QW-462.2 Side bend	No defects	QW-462.2 Side bend	No defects

TOUGHNESS TEST (QW-170)

Spec. No.	Notch Location	Notch Type	Test Temp. ( F )	Impact Values (ft-lbs)	Lateral exp.		Drop weight break
					Shear %	Mils	
None							

HARDNESS TEST - No hardness test

Base metal	-1-	-2-	-3-	HAZ	-1-	-2-	-3-	WM	-1	-2-	-3-
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# (Heat Affected Zone=HAZ, Weld Metal=WM) #

Notes:

Stamp: H48 Welder's Name: Kennedy, Dan ID:  
 Tests conducted by: CONAM INSPECTION INC. Laboratory Test No: 14215  
 PQR was done & welding of coupon was witnessed by : Process Systems

We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.

Prepared By: A. Rollas ( 05/06/96 ) Weld Specialist  
 Certified By: Alan L. Bredford ( 05/06/96 ) Q.A. Manager: