LIGO-E960178-00-V

LIGO- V049-2-070 Rev B

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

WPS No.: 150 Date: 02/08/96
Supporting PQRs: 150 H48 Date: 04/23/96

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 None Time range None notes

	All pass(es)			None	
Process / type	PAW / manual				
Process thickness limit.	0.1875" to 1.0000"			None	
GAS (QW-408)					
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 / -	
FILLER METAL (QW-404)					
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	-	-	-
ELECTRICAL (QW-409)					
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 metal will be used with this procedure.
(n3)
(n4) WELD WIRE SHALL BE CLEANED SPECIAL AND HANDLED WITH POLY GLOVES.
(n5) GRINDING WITH ABRASIVE WHEELS IS "NOT ALLOWED.
(n6) WIRE BRUSHING IS "NOT ALLOWED".
(n7) DEFECT REMOVAL MUST BE ACCOMPLISHED WITH A CARBIDE BURR CUTTER.

WPS No.: 150 Date: 02/08/96 Revision No.: A Date: 04/23/96

JOINT (QW-402)

Single-V groove
Backing : no backing
Root Opening: .125-.1875 max.
Groove Angle: 50 degree min.
Root Face : .030-.060 max.

Single-Bevel groove
Backing : no backing
Root Opening: .125-.1875 max.
Groove Angle: 45 degree min.
Root Face : .030-060 max.

Single-V groove
Backing : gouged & back welded
Root Opening: .125-.1875 max.
Groove Angle: 50 degree min.
Root Face : .030-.060 max.

Double-Bevel groove
Backing : gouged & back welded
Root Opening: .125-.1875 max.
Groove Angle: 45 degree min.
Root Face : .030-.060 max.

Double-V groove
Backing : gouged & back welded
Root Opening: .125-.1875 max.
Groove Angle: 45 degree min.
Root Face : .030-.060 max.

Single/Double Fillet
Backing :
Root Opening: 1/32" 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.

WELD JOINT DESCRIPTIONS SHOWN ARE NOT INCLUSIVE OF ALL OF THOSE FOUND ON THE JOB. WELD JOINT DESIGN REFERENCE IN AN ENGINEERING SPECIFICATION OR DESIGN DRAWING SHALL TAKE PREFERENCE OVER WELD JOINTS SHOWN IN THIS WPS.

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 (04/23/96) Weld Specialist

Accepted By: Alan Burbank (04/23/96) QA Manager:

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

PQR No.: 150 H48 Date: 2/ 8/96 WPS No.: 150 Rev. 5

JOINT DESIGN (QW-402)
WELD JOINT CONFIGURATION
Single-V groove
Gas backing was used
Groove Angle : 75 Degrees
Root Opening : 0-125" Inches
Root Face : 030-062" Inches

note:

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

HEAT TREATMENT (QW-406, QW-407)
Preheat Temperature: 60 Degrees F.
Preheat Maintenance: None
Interpass Temperature: 350 Degrees F.
PWHT temperature ... : None Degrees F.
PWHT Holding time(hr): None
note:

POSITION (QW-405)
Position of Joint : 1G - Flat
Progression: N/A
note:

	All pass(es)		None
Weld Process / type	PAW / manual		
GAS (QW-408)			
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 / -
FILLER METAL (QW-404)			
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		
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		- | - | -
ELECTRICAL (QW-409)			
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
TECHNIQUE (QW-410)			
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) No supplementary filler metal will be used with this procedure.
(n2)
(n3)
(n4)
(n5)

Procedure Qualification Record (PQR)

PQR No.: 150 H48

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	0.748	0.497	0.372	33550	90200	Weld metal
2	0.750	0.505	0.379	34350	90600	Weld 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. Shear %	Lateral exp. Mils	Drop weight break
None							

HARDNESS TEST - No hardness test

Base metal	-1-	-2-	-3-	HAZ	-1-	-2-	-3-	WM	-1	-2-	-3-

(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: 14082
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 (2/ 8/96) Weld Specialist

Certified By: Alan R Bullock (2/ 8/96) QA Manager: