CBI

WELDING PROCEDURE SPECIFICATION

LIGO-E950037-05-B

IDENTIFICATION WPS	CONTRACT
ER308L/PORT	930212

PRODUCT	LIGO BEAM TUBE MODULES	PAGE	1	OF	3
CUSTOMER	CALTECH	REV. NO.	5		
		BY	DMF	DATE	06/26/95

WORK THIS DOCUMENT WITH GENERAL WELD PROCEDURE SPEC. GWPS GTAW

REFERENCE PROCEDURE QUALIFICATION RECORD			SPECIFIC CONTRACT	
NO.	POSITION QUALIFIED (QW-405)	THICKNESS QUALIFIED (QW-403)	POSITION (QW-405)	THICKNESS RANGE (QW-403)
10029	3G	1/16" to 1/4"	All	0.120" to 1/8"

SPECIFIC CONTRACT WPS REQUIREMENTS

CODE EDITION AND ADDENDA ASME Section VIII & IX, 1992 Edition, 92 Add.

JOINTS (QW-402) SEE GENERAL WELDING TECHNIQUE PAGE 3

PREHEAT/INTERPASS TEMPERATURE (QW-406) SEE ATTACHED PAGE 2

BACKING MATERIAL (QW-402)
None Required

POST WELD HEAT TREATMENT (QW-407)
PWHT REQUIRED No
IF PWHT IS REQUIRED, SEE APPROVED CONTRACT PWHT PROCEDURE FOR DETAILS AND EXTENT OF PWHT.

BASE MATERIAL (QW-403)

A240 Tp. 304L (ASME P-8, Gp. 1)

Any ASME P-8, Gp. 1 material may be welded together or to each other in any combination.

GAS (QW-408) COMPOSITION:

SHIELDING:	60% Ar - 40% He
FLOW RATE:	20-45 cfh
BACK UP	100% Argon
FLOW RATE:	See page 2

ELECTRICAL CHARACTERISTICS (QW-409)

CURRENT:	Direct Current
POLARITY:	Electrode Negative
OTHER:	Straight Polarity

AMPERAGE AND VOLTAGE RANGE. SEE PAGE 3
VOLUME OF WELD METAL REQUIRED No
SEE ATTACHED PAGE N/A
MODE OF TRANSFER N/A

FILLER MATERIAL (QW-404)

ASME SPECIFICATION NO:	SFA 5.9
ASME CLASSIFICATION:	ER308L *
ASME ANALYSIS NO:	A-8
ASME GROUP NO:	F-6
CONSUMABLE INSERT:	N/A
SUPP. POWDER FILLER:	N/A

TECHNIQUE (QW-410) / SPECIAL LIMITATIONS
SEE ATTACHED PAGE(S) 2, 3
STRINGER OR WEAVE TECHNIQUE SEE PAGE 3
TYPE OF WELDING
MANUAL [X] MACHINE [ ]
SEMI-AUTOMATIC [ ] AUTOMATIC [ ]

FLUX (QW-404)
N/A

CUSTOMER APPROVAL

* ER308L in accordance with WMS-ER308L.

REVIEWED	OB ENGR	DIST ENGR	WELDIN SERVICE HOUSTON	CORP QA	REG CONST QA	REG MFG QA				BY	DATE
									PREPARED	RWP	01/03/94
									CHECKED	BGG	02/28/95
							11/10/95 LIGO		AUTHORIZED		

M. Fallahian 11/10/95

WL100 REV JUL 87<PC>

LIMITATIONS:

1. *Pulsing current may be used.*
2. *Use multiple passes on side 1.*
3. *Use a single pass on side 2.*
4. *Use a single EWTh2 (2% thoriated tungsten) electode.*
5. *Only stainless steel brushes shall be used on stainless steel.*
6. *No single pass shall exceed 1/8" in thickness.*
7. *Only filler metal in accordance with WMS-ER308L shall be used.*
8. *A back purge of 100% Argon shall be used on opposite side of welding. The oxygen content shall be less than 2.0%.*
9. *See Procedure FPPUMPPORT for fitting/purging.*

INTERPASS TEMPERATURE:

The interpass temperature shall not exceed 350°F.

PREHEAT REQUIREMENTS (ASME P-8, Gp. 1):

No preheat is required except as an aid to remove moisture unless the ambient temperature falls below 0°F. When the ambient temperature falls below 0°F, a preheat of warm to the hand (approx. 100°F) is required within 3" of where the welding is started and maintained 3" ahead of the arc.

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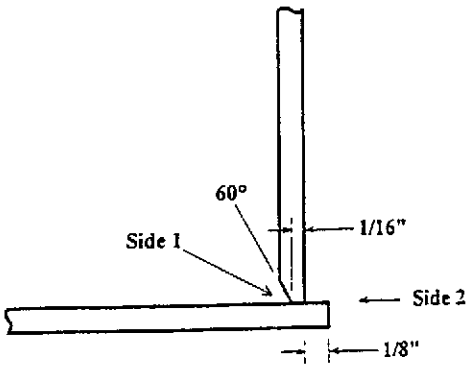
GENERAL WELDING TECHNIQUE

Operation Description	Beads Layer	Weld Proc.	Electrode Size	Electrode Type	Current (amps)	Voltage (Volts)	Peak (amps)	
Stringer	Inside Pass 1	GTA	N/A	Autog.	75-85	9-11	37-42	
Stringer	Outside Pass 1	GTA	N/A	Autog.	75-85	9-11	37-42	
Weave	Pass 2	GTA	0.035	ER308L*	65-90	9-11		

* ER308L in accordance with WMS-ER308L.

JOINT DETAIL - See contract drawings for applicable joint details and dimensions.



5G Position

Page
Contract

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PROCEDURE QUALIFICATION RECORD

To A. S. M. E. Section IX
ESSENTIAL VARIABLES

. No. 10029
Process GTAW
Manual [ ] Machine [X] Auto. [ ] Semiauto. [ ]
Material specification SA240 Type 304L together
ASME P No. 8, Gp. 1 To ASME P No. 8, Gp. 1
Thickness(if pipe, dia and wall thick) 0.11" to 1/8"
Filler metal group no. F F-6
Weld metal analysis no. A A-8
ASME specification no. SFA SFA 5.9
AWS specification no. A A 5.9

Flux or Atmosphere
Flux trade name N/A
Inert gas composition 60% Argon - 40% Helium
Flow rate 20 - 45 cfh
Preheat temperature range 70°F - 350°F (IPT)
Postweld heat treatment None Required

WELDING PROCEDURE

Single or multiple pass Multiple Single or multiple arc Single Position 3G
Mode of transfer for GMAW: Spray [ ] Globular [ ] Pulsating [ ] Short Circuit [ ]
Filler Metal for GTAW or PAW ER308L Filler metal diameter 0.035"
Electrode EWTh-2 Electrode diameter 1/8"
Type of backing None Required Welding current Direct Current, Electrode Negative
Consult WELDING VARIABLES for joint dimensions and welding current settings. (Straight Polarity)

TEST RESULTS

Reduced Section Tensile Results

Specimen No.	Dimensions, in.		Area	Ultimate Total Load	Ultimate Unit Stress		Character of Failure and Location
	Width	Thickness	sq. in.	Kips	ksi	MPa	
1443-1	0.750	0.092	0.069	5.7	82.6	569.5	Ductile in weld metal
11443-2	0.750	0.097	0.073	6.0	82.2	566.7	Ductile in weld metal

Guided Bend Test

Type	Result	Type	Result
2 Transverse Face Bends	OK	2 Transverse Root Bends	OK

Welder's name W. Kelly Brawner Social Security no. 413-82-4060 Welder's symbol WKB
Welder's name Social Security no. Welder's symbol
Who by virtue of these tests meets welder performance requirements.

Work Order (Orig. WPS) No. H11443 Rev. 2

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

Signed CBI

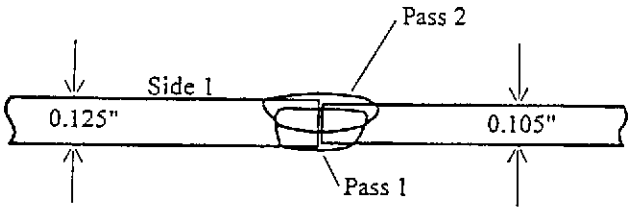
By _____ Date 1/24/94
Rick W. Prior

Remarks: Arcaloy (ER308L) by Alloy Rods

PROCEDURE QUALIFICATION RECORD

To A.S.M.E. Section IX

PART III WELDING VARIABLES



Maximum gap 0.010"
Plates fit on centerlines
All passes welded from Side 1
In Dwell is on the 1/8" side.

Side	1	1							
Pass number	1	2							
Filler wire	N/A	ER308L							
Wire diameter (inches)	N/A	0.035"							
Pulse mode	Pulsed	Sync							
Pulse width	50%	N/A							
Pulse frequency	3.0	3.0							
AVC response	--	--							
AVC mode	Samp	Cont							
Upslope time (sec)	2	2							
Downslope time (sec)	5	5							
Travel start delay (sec)	2	2							
Wire start delay (sec)	N/A	1							
Oscillation amp	N/A	0.15							
Track travel speed (ipm)	5.0	4.0							
Torch travel speed (ipm)	5.0	4.0							
Primary weld current (amps)	120	85							
Primary voltage (volts)	9.5	9.5							
Primary wire speed (ipm)	N/A	25							
Background current (amps)	85	60							
Background voltage (volts)	9.5	9.5							
Background wire (ipm)	N/A	10							
Out dwell time (x 0.1 sec)	N/A	2							
Excursion time (x 0.1 sec)	N/A	3							
In dwell time (x 0.1 sec)	N/A	3							
Primary time (%)	0.50	0.45							
Background time (%)	0.50	0.55							
Heat input (kJ/in)	11.7	7.4							
Energy density (MJ/in3)	N/A	1.5							

Qualification No. 10029
Date: 1/24/94

By _____
Rick W. Prior