

WELDING PROCEDURE SPECIFICATION

LIGO-8950038-03-B IDENTIFICATION WPS

CONTRACT

930212

OF

3

PRODUCT LIGO BEAM TUBE MODULES
CUSTOMER CALTECH

ER308L/GMA

PAGE 1

CUST	TOMER	CALTEC	4							REV. NO.	3			
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WOR	K THIS DO					ROCEDURE S			GMAW&F				·	
<u> </u>		REFEREN	_			FICATION RI					CIFIC CON			
NO. POSITION QUALIFIED THICKNE							•			SITION W-405)	1	HICKNES: (QW-403)	SS RANGE	
4858 2G All siz							re fillet All			<del></del>			to 3/8"	
										····			···	
					SPECIF	IC CONTRAC	TW	PS REQUIREM	ENTS			1		
COD	E EDITION	AND ADDE	NDA	ASME	Section	on VIII a	& I	X, 1992 Ed	lition,	92 Ado	ł.			
JOIN	TS (QW-402)			RAL WEI UE PAGE			PREHEAT/INTERPASS TEMPERATURE (QW-406) SEE ATTACHED PAGE 2							
BACE	KING MATE	ERIAL (QW-	402)				POST WELD HEAT TREATMENT (QW-407)							
N	Ione Requ	uired					PWHT REQUIRED No							
							IF P	WHT IS REQUI	RED, SEE	APPROVED	•			
BASE	MATERIA.	L (QW-403)					CONTRACT PWHT PROCEDURE FOR DETAILS AND EXTENT OF PWHT.							
							GAS (QW-408) COMPOSITION:							
A	1240 Tp.	304L	(ASI	ME P-8,	<i>G</i> p. 1	J	CYMPI PRIG							
١,	1017	n a a-	• .		7	h.	SHIELDING: 98% Ar - 2% 02 FLOW RATE: 20-45 cfh							
		P-8, Gp ogether					BACKUP 100% Nitrogen							
	ombinat:	-	01 60	,	001101	w,	FLOW RATE: See page 2							
							ELECTRICAL CHARACTERISTICS (QW-409)							
							CURRENT: Direct Current							
							POLARITY: Electrode Positive							
							1	ier:		rse Pol	-	_		
T. I. Y. 1	ED MATERI	KAT 40171 101			<del> </del>		4	PERAGE AND V			EPAGE	3 No		
FILL	ER MAIER	IAL (QW-404	1)				VOI	LUME OF WELI		CHED PAG	E	N/A	-	
ASMI	E SPECIFIC	ATION NO:	SFA	5.9			MOI	DE OF TRANSF		Globula			<del></del>	
1	E CLASSIFI			78L *	•	•								
ASME ANALYSIS NO: A-8							TEC	HNIQUE (QW-4						
ASME GROUP NO: F-6							SEE ATTACHED PAGE(S) 2, 3 STRINGER OR WEAVE TECHNIQUE SEE PAGE 3							
CONSUMABLE INSERT: N/A							STRINGER OR WEAVE TECHNIQUE SEE PAGE 3 TYPE OF WELDING							
SUPP. POWDER FILLER: N/A FLUX (OW-404)							MANUAL MACHINE							
N/A														
								SEMI-AU1				OMATIC	<u> </u>	
CUSTOMER APPROVAL							* ER308L in accordance with WMS-ER308L.							
R O	B DIST	WELDIN	CORE	REG	REG				<del></del>		T	<del> </del>		
	1	SERVICE	1	CONST	MFG			į			BY		DATE	
		HOUSTON	1	QA	QA		_				<u> </u>		22 (22 (2)	
E W				A man A	100			1 / 1	PREPARE CHECKEI		RWP BGG		03/01/94 02/28/95	
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M. Tellelian 11/19/95

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#### LIMITATIONS:

- 1. Maintain a contact tip to work distance of 3/8" to 1".
- 2. Use a gas cup nozzle sizes between 3/8" to 1" diameter. The gas cup nozzle shall cover the contact tip 1/8" minimum.
- 3. Use a single pass per side technique.
- 4. No single pass shall exceed 1/2" in thickness.
- 5. Only stainless steel brushes shall be used on stainless steel.
- 6. A purge using 100% nitrogen must be in place before any tacking or welding. The oxygen content shall bel less than 2.0%.
- 7. No welding over the spiral tube weld shall exist.
- 8. See procedure FPSTIFFENER for purging procedures.

### 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.



PRODUCT

CUSTOMER

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BY DMFDATE 06/26/95

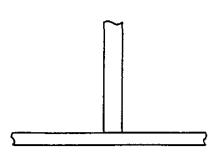
OF

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### GENERAL WELDING TECHNIQUE

Operation	Beads	Weld		Electrode	Current	Voltage	Peak	
Description	Layer	Proc.	Size	Туре	(amps)	(Volts)	(amps)	
Stringer Beads*	As Reqd	GMA	.035	ER308L**	130-260	21-28		
							į	
	weave to	echnique	∍.	& overhead w with WMS-ER3	1	deposited	i using a	

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



All position fillet welds

Page Contract

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# CBI

# PROCEDURE QUALIFICATION RECORD

TO A.S.M.E. SECTION IX ESSENTIAL VARIABLES

Process GMAW/GTAW  Material specification SA204 Type 304  ASME p. no. 8. 99. 1 To ASME p. no. 8. 69. 1 Fixe trace name None Required  FLUX OR ATMOSPHERE None Required  Flier metal group no. F. F-5  Welting PROCEDURE  Single or multiple pass Multiple  Single or multiple pass Multiple  Single or multiple pass Single  Mode of transfer for GMAW: Spray IX Globular   Palsasing   Short Circuit   Pasting of Take or Past None Single or multiple are Single Pasting of Take Or Past None Single or multiple are Single Pasting   Short Circuit   Pasting of Take Or Past None Single or multiple are Single Pasting   Short Circuit   Pasting of Take Or Past None Single or multiple are Single Pasting   Short Circuit   Pasting of Take Or Past None Single or multiple are Single   Pasting of Take Or Past None Single or multiple are Single   Pasting of Take Or Past None   Required   Filler metal diameter   Not Required   Single or multiple are Single   Pasting of Take Or Past None   Required   Single or multiple are   Single or multiple are   None   Required   Single or multiple are   None   Single	POR No4858				GTAW		СT	'A11				
Material specification  ASME p. no. 8_ 6D_ 1 To ASME p	CMALLIC	TAW		· · · · · · · · · · · · · · · · · · ·								
ASME p. no. 8, Gp. 1 To ASME p. no. 8, Gp. 1 Flux trade name Mone Required  Thickness (if pipe, dia and wall thick) 1/4"	· · · · · · · · · · · · · · · · · · ·		Ma									
Thickness (if pipe, dia and wall thick)	ASME p. no. 8, Gp. 1	To ASME	). 1	- FLUX OR ATMOSPHERE								
Filter metal group no. F. F-b  Weld metal analysis no. A. A-8  Preheat temperature range 70°F to 350°F IPT  ASME specification no. SFA-5.9  AWS specification no. A-5.9  WELDING PROCEDURE  Single or multiple pass Multiple  Single or multiple pass Multiple  WELDING PROCEDURE  Single or multiple pass Multiple  WELDING PROCEDURE  Single or multiple pass Multiple  Single or multiple pass Multiple  Single or multiple pass Multiple  WELDING PROCEDURE  Single or multiple pass Multiple  Single pass Multiple  Single or multiple pass Multiple  Single or m	Thickness (if nine, dia and	Luall shield 1	7. no. <u>0, 0,</u>		_ Fiux trade name NONE KEQUITED							
Weld metal analysis no. A. A-8 ASME specification no. SFA-5.9 ASME specification no. A-5.9  WELDING PROCEDURE Single or multiple pass Multiple Single or multiple arc Single Make Falsa Single Position  Mode of transfer for GMAW: Spray X Globular Pelasting Short Circuit Mode of transfer for GMAW or PAW Not Required Filler Metal for GTAW or PAW Not Required Filler metal diameter Mot Required Filler metal diameter	Filler metal group no. E	F-6	7 7	Ine	rt gas compos CM <i>t</i>	ition		0062				
ASME specification no. SPA-5.9  WELDING PROCEDURE Single or multiple pass Multiple Single or multiple arc Single Position 26  Mode of transfer for GMAW: Spray X Globular Pulsating Short Circuit Mot Required Filler metal diameter SMAW-1035", CTAW-3/32"B Filler metal diameter GMAW-1035", CTAW-3/32"B Filler metal diameter SMAW-1035", CTAW-3/32"B GTAW-1017et Current, Elect. Neg GMAW-1035", CTAW-3/32"B GTAW-1017et Current, Elect. Neg Consult WELDING VARIABLES for joint dimensions and welding current sestings.  TEST RESULTS GMAW-Direct Current, Elec. Pos (Reverse Polarity)  Specimen No. Dimensions In Reduced Section Tensile Results (Reverse Polarity)  Specimen No. Width Thickness Area in Z Total Load Stress And Direct Current, Elec. Pos (Reverse Polarity)  H510R-1 1.498 0.222 0.332 29.5 88.9 612.9 Ductile in WM H610R-2 1.502 0.220 0.330 29.1 88.2 608.1 Ductile in WM MM M610R-2 1.502 0.220 0.330 29.1 88.2 608.1 Ductile in WM MM M610R-2 1.502 0.220 0.330 29.1 88.2 608.1 Ductile in WM M610R-2 Transverse Face Bends OK 2 Transverse Root Bends OK  Welder's name Curtis Campbell Social Security no. 403-36-4037 Welder's Symbol CC M74 Order (Orig. WPS) No. H610R Rev. 0  We certify that the statements in his 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.  **GTAW - 100% Argon GMAW - 98% Argon/2% Oxygen  **Temporary copper chill bar used.  Updated to new form. 8/28/87, 151 4 < 1.	Weld metal analysis as A	A-8		Flo	w rate	70	9E +0 25	JUIT 10#	·			
WELDING PROCEDURE  Single or multiple pass	A SMF specification	SFA-5	q	Pre	Preheat temperature range /0°F to 350°F IPT							
Single or multiple pass   Multiple   Single or multiple are   Single   Position   26	AWS specification	A-5 9	<del></del>	Pos	itweld heat tre	atment	one	<del></del> -				
Filler Metal for GTAW or PAW Electrode GMAW-ER308, GTAW-EWTh-2  Electrode GMAW-ER308, GTAW-EWTh-2  Type of backing None**  Consult WELDING VARIABLES for joint dimensions and welding current settings.  TEST RESULTS  Reduced Section Tensile Results  Find Total Load Stress Consult Welding current Stress Consult Str	Single or multiple passMu	ltiple	W! Single	ELDING PRO	CEDURE Single		Position	2G	<del></del>			
Filler Metal for GTAW or PAW Electrode GMAW-ER308, GTAW-EWTh-2  Electrode GMAW-ER308, GTAW-EWTh-2  Type of backing None**  Consult WELDING VARIABLES for joint dimensions and welding current settings.  TEST RESULTS  Reduced Section Tensile Results  Find Total Load Stress Consult Welding current Stress Consult Str	Mode of transfer for GMAW	: Spray X	Globular	Pulsati	ng [] si	bort Circuit	7		-			
Electrode dismater   GMAW - 0.35", GTAW - 3/3"B	Filler Metal for GTAW or PA	w Ni	ot Requir	ed		Nz	at Doquit	red				
Consult WELDING VARIABLES for joint dimensions and welding current settings.  TEST RESULTS  Reduced Section Tensile Results  Specimen No.  Dimensions in Width Thickness Area in 2 Villimate Stress Polarity)  Melder's Results  GMAW-Direct Current, Elec. Pos (Reverse Polarity)  Width Thickness Area in 2 Villimate Stress Polarity  Width Thickness Area in 2 Villimate Stress Polarity  Meldor-1 1.498 0.222 0.332 29.5 88.9 612.9 Ductile in WM  H610R-2 1.502 0.220 0.330 29.1 88.2 608.1 Ductile in WM  Guided Bend Test  Type Result Type Result Type Result  2 Transverse Face Bends OK 2 Transverse Root Bends OK  Welder's name Curtis Campbell Social Security no. 403-36-4037 Welder's Symbol CC  Who by virtue of these tests meets welder performance requirements.  Work Order (Orig. WPS) No. H610R Rev.  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 J. S. Lee Date 10/15/80  **Temporary copper chill bar used.  Updated to new form, 8/28/87, ISI A S. J.  Updated to new form, 8/28/87, ISI A S. J.	Electrode GMAW-ER308	, GTAW-EW	Th-2	Floo	trado diamen	GMAN_ (	135" GTA	14-3/32"A	<del></del>			
Consult WELDING VARIABLES for joint dimensions and welding current settings.  TEST RESULTS  Reduced Section Tensile Results  Specimen No.  Dimensions in Width Thickness Area in 2 Total Load Kips Asi MPa and Location  H610R-1 1.498 0.222 0.332 29.5 88.9 612.9 Ductile in WM  H610R-2 1.502 0.220 0.330 29.1 88.2 608.1 Ductile in WM  Guided Bend Test  Type Result Type Result  2 Transverse Face Bends OK 2 Transverse Root Bends OK  Welder's name Curtis Campbell Social Security no. 403-36-4037 Welder's Symbol CC  Who by virtue of these tests meets welder performance requirements.  Work Order (Orig. WPS) No. H610R Rev. 0  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.  Ey J. S. Lee Date 10/15/80  **Temporary copper chill bar used.  Ubdated to new form. 8/28/87 JISI 4 5 // .	Type of backingNo	ne**		10/01	uode damete	GTAW-Di	rect Cur	rent. Ele	ec. Nea.			
TEST RESULTS Reduced Section Tensile Results    Specimen No.   Dimensions in   Width   Thickness   Area   in 2   Total Load   Kips   Ki	Consult WELDING VARIABLE	ES for ioint dim	ensions and w	voldina numana	oing current							
Specimen No.    Dimensions in   Width   Thickness   Area in 2   Total Load   Stress   Character of Failure and Location		- or joint am		TEST RESU	ILTS	GMAW-Di	rect Cur	rent, Ele	•			
Width Thickness Area in 2 Total Load Stress Ward Area and Location Rips Result Result Result Type Result Type Result Type Result Type Result R	Specimen No	Dimens			Ultimate Total Load	Ultimate I	Unit   CI	Character of Failure				
H610R-2 1.502 0.220 0.330 29.1 88.2 608.1 Ductile in WM  Guided Bend Test  Type Result Type Result Type Result 2 Transverse Root Bends OK  Welder's name Curtis Campbell Social Security no. 403-36-4037 Welder's Symbol CC  Work Order (Orig. WPS) No. H610R Rev. 0  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  Ey J. S. Lee Date 10/15/80  Remarks: *GTAW - 100% Argon GMAW - 98% Argon/2% Oxygen  **Temporary copper chill bar used.  Updated to new form, 8/28/87 JSI 4 4 4.		Width	Thickness	Area in 2		Stress						
Guided Bend Test  Type Result Type Result  2 Transverse Face Bends OK 2 Transverse Root Bends OK  Welder's name Curtis Campbell Social Security no. 403-36-4037 Welder's Symbol CC  Who by virtue of these tests meets welder performance requirements.  Work Order (Orig. WPS) No. H610R Rev. O  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  J. S. Lee Date 10/15/80  Remarks:  *GTAW - 100% Argon  GMAW - 98% Argon/2% Oxygen  **Temporary copper chill bar used.  Updated to new form, 8/28/87, 151 4 € 1.	H610R-1	1.498	0.222	0.332	29.5	88.9 6	12.9 Duc	tile in W	/M			
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Who by virtue of these tests meets welder performance requirements.  Work Order (Orig. WPS) No. H610R	2 Transverse	Face Bend	ls (	)K 2	Transvers	se Root B	ends	Ok				
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### J. S. Lee			,	Signed CBI								
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Updated to new form, $8/28/87$ , $151$ , $4 < 1$ .	GMAW -	98% Argor	1/2% Oxyg									
Updated to new form, $8/28/87$ , $151$ , $4 < 1$ .	**Temporary co	opper chil	I bar us	ed.								
					1.							
Frinted in USA				<u> </u>	<u>r</u>			<u> </u>	<del></del>			

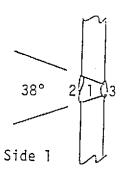


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## PROCEDURE QUALIFICATION RECORD

To A.S.M.E. Section IX

## PART III WELDING VARIABLES



3/32" Gap

### HORIZONTAL

! ! Layer	Electro	ode .	Amps	Volts	Trave!	Remarks (Gas Flow etc)	
	Type	Size			Speed in./min.		
1	ER308	.035	150	24	7	  GMAW-Stringer	
2	ER308	.035	150	24	19	Beads Side 1	
3	EWTH-2	1/8"	120	12		GTAW with out filler	
						metal Side 2.	

lification No. 4858

Alan E. Hudson By. Clau F. Gudson