



WELDING PROCEDURE SPECIFICATION

L100-8950035-05-B

IDENTIFICATION  
WPS  
ER308L/CIRC

CONTRACT  
930212

PRODUCT LIGO BEAM TUBE MODULES  
CUSTOMER CALTECH

PAGE NO. 1 OF 3  
REV. NO. 5  
BY WLR DATE 02/27/95

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	0.105" 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 <u>3</u>	PREHEAT/INTERPASS TEMPERATURE (QW-406)	SEE ATTACHED PAGE <u>2</u>
BACKING MATERIAL (QW-402)	None Required	POST WELD HEAT TREATMENT (QW-407)	PWHT REQUIRED <u>No</u> 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)	SHIELDING BACK UP COMPOSITION: 60% Ar - 40% He 100% Argon FLOW RATE: 20-45 cfh See page 2
FILLER METAL (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	ELECTRICAL CHARACTERISTICS (QW-409)	CURRENT: Direct Current POLARITY: Electrode Negative OTHER: Straight Polarity AMPERAGE AND VOLTAGE RANGE. SEE PAGE <u>3</u> VOLUME OF WELD METAL REQUIRED <u>No</u> SEE ATTACHED PAGE <u>N/A</u> MODE OF TRANSFER <u>N/A</u>
FLUX (QW-404)	N/A	TECHNIQUE (QW-410)/ SPECIAL LIMITATIONS	SEE ATTACHED PAGE(S) <u>2, 3</u> STRINGER OR WEAVE TECHNIQUE SEE PAGE <u>3</u> TYPE OF WELDING MANUAL <input type="checkbox"/> MACHINE <input checked="" type="checkbox"/> SEMI-AUTOMATIC <input type="checkbox"/> AUTOMATIC <input type="checkbox"/>
CUSTOMER APPROVAL	* ER308L in accordance with WMS-ER308L.		

OB ENGR	DIST ENGR	WELDING SERVICES HOUSTON	CORP QA	REG CONST QA	REG MFG QA	BY	DATE
						RWP BGG	01/10/94 02/27/95 / /

Prepared Checked AUTHORIZED  
M. Jellison J. Jones 11/10/95 Ligo



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LIMITATIONS:

1. This WPS is to be used with Dimetrics Gold Track welding system.
2. Use a two pass technique on side one only.
3. Use a single EWTh-2 (2% thoriaed tungsten) electrode.
4. No single pass shall exceed 1/8" in thickness.
5. Only stainless steel brushes shall be used on stainless steel.
6. Parameters on Page 3 shall be followed.
7. Only filler metal in accordance with WMS-ER308L shall be used.
8. Welding may progress uphill or downhill.
9. Welding may begin at any location along the weld joint.
10. See Procedure FPCIRCUMFERENTIAL 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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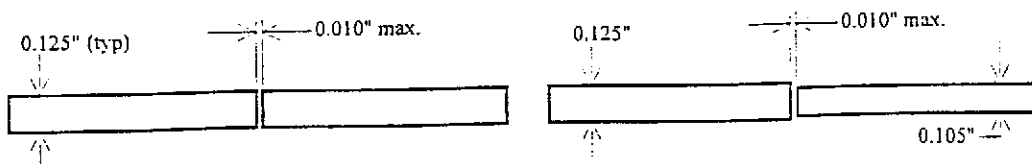
BY WLR DATE 02/27/95

WELDING PARAMETERS FOR DIMETRICS GOLD TRACK:

Parameter	First Pass	Second Pass
Position	5G	5G
Shielding Gas	60% Ar - 40% He	60% Ar - 40% He
Flow rate	20 - 45 cfh	20 - 45 cfh
Purge Gas	100% Argon	100% Argon
Flow rate	Note (1)	Note (1)
Filler Wire	Autogenous	ER308L (2)
Diameter	N/A	0.035"
Pulse Mode	Pulsed	Sync Pulsed
Pulse Width	50%	N/A
Pulse Frequency	3.0	3.0
AVC Response	20	0
AVC Mode	Samp	Cont
Upslope Time	2	2
Downslope Time	5	5
Travel Start Delay	2	2
Wire Start Delay	N/A	1
Oscillation Amplitude	0.00 - 0.06 (5)	0.15 - 0.26 (5)
Travel Speed	5.0 ipm	4.0 ipm
Primary		
Weld Current	120 amps	85 amps
Arc Voltage	9.5 volts	9.5 volts
Wire Feed Speed	N/A	25 ipm
Background		
Weld Current	85 amps	60 amps
Arc Voltage	9.5 volts	9.5 volts
Wire Feed Speed	N/A	13 ipm
Out Dwell Time	2	2
Excursion Time	3	3
In Dwell Time	Note (3)	Note (3)

NOTES:

- (1) See Procedure FPCIRCUMFERENTIAL for purge details.
- (2) ER308L in accordance with WMS-ER308L.
- (3) 2 for 1/8" thick plates.  
3 for 0.105" thick plate welded to 1/8" thick plate.
- (4) Welding parameters may vary +/- 10% from above values.
- (5) Oscillation amplitude may vary due to plate offset and position.



5G Position



# PROCEDURE QUALIFICATION RECORD

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

No. 10029  
 Process GTAW Manual  Machine  Auto.  Semiauto.   
 Material specification SA240 Type 304L together Flux or Atmosphere  
 ASME P No. 8, Gp. 1 To ASME P No. 8, Gp. 1 Flux trade name N/A  
 Thickness (if pipe, dia and wall thick) 0.11" to 1/8" Inert gas composition 60% Argon - 40% Helium  
 Filler metal group no. F F-6 Flow rate 20 - 45 cfh  
 Weld metal analysis no. A A-8 Preheat temperature range 70°F - 350°F (IPT)  
 ASME specification no. SFA SFA 5.9 Postweld heat treatment None Required  
 AWS specification no. A A 5.9

## 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 sq. in.	Ultimate Total Load Kips	Ultimate Unit Stress		Character of Failure and Location
	Width	Thickness			ksi	MPa	
11443-1	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

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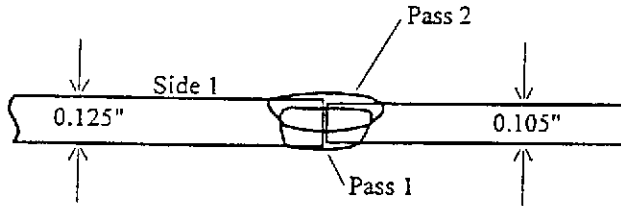
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PROCEDURE QUALIFICATION RECORD

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/in <sup>3</sup> )	N/A	1.5							

Qualification No. 10029  
Date: 1/24/94

By   
Rick W. Prior