



WELDING PROCEDURE SPECIFICATION

LIGO-8950042-00-B
IDENTIFICATION
WPS
E309/STRUCT

CONTRACT
930212

PRODUCT LIGO BEAM TUBE MODULES
CUSTOMER CALTECH

PAGE NO. 1 OF 3
REV. NO. 0
BY RWP DATE 02/10/94

WORK THIS DOCUMENT WITH GENERAL WELD PROCEDURE SPEC. GWPS-SMAW

REFERENCE PROCEDURE QUALIFICATION RECORD

NO.	POSITION QUALIFIED (QW-405)	THICKNESS QUALIFIED (QW-403)	SPECIFIC CONTRACT	
			POSITION (QW-405)	THICKNESS RANGE (QW-403)
6190	3G	3/16" to 2"	All	3/16" to 1"

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)
A240 Tp. 304L (ASME P-8, Gp. 1)
A36 (ASME P-1, Gp. 1)
A283 Gr. C (ASME P-1, Gp. 1)
Any ASME P-8, Gp. 1 material may be welded to any ASME P-1, Gp. 1 or Gp. 2 material in any combination.

GAS (QW-408) SHIELDING BACK UP
COMPOSITION: N/A N/A
FLOW RATE: N/A N/A

FILLER METAL (QW-404)
ASME SPECIFICATION NO: SFA 5.4
ASME CLASSIFICATION: E309
ASME ANALYSIS NO: A-8
ASME GROUP NO: F-5
CONSUMABLE INSERT: N/A
SUPP. POWDER FILLER: N/A

ELECTRICAL CHARACTERISTICS (QW-409)
CURRENT: Direct Current
POLARITY: Electrode Positive
OTHER: Reverse Polarity
AMPERAGE AND VOLTAGE RANGE. SEE PAGE 3
VOLUME OF WELD METAL REQUIRED No
SEE ATTACHED PAGE N/A
MODE OF TRANSFER N/A

TECHNIQUE (QW-410)/ SPECIAL LIMITATIONS
SEE ATTACHED PAGE(S) 2
STRINGER OR WEAVE TECHNIQUE SEE PAGE 2, 3
TYPE OF WELDING

MANUAL MACHINE
SEMI-AUTOMATIC AUTOMATIC

FLUX (QW-404) N/A

CUSTOMER APPROVAL

OB ENGR	DIST ENGR	WELDING SERVICES HOUSTON	CORP QA	REG CONST- QA	REG MFG- QA	BY	DATE
						RWP	02/10/94
						BGG	02/17/94
							/ /

M. Jellalain 11/10/95



IDENTIFICATION
WPS

CONTRACT

WELDING PROCEDURE SPECIFICATION

E309/STRUCT

930212

PRODUCT LIGO BEAM TUBE MODULES

PAGE NO. 2 OF 3

CUSTOMER CALTECH

REV. NO. 0

BY RWP DATE 02/10/94

LIMITATIONS:

1. This WPS is limited to the welding of structural components. It shall not be used for welding to the vessel shell or nozzle assemblies (ASME Sec. VIII Code Boundary Components).
2. Vertical welds shall be deposited uphill except:
 - a. The root pass may be welded downhill.
 - b. Wash passes may be downhill.
 - c. Material 3/8" thick and less may have all downhill passes.
 - d. Material up to 5/8" thick may have the second side welded with all downhill passes.
3. No single pass shall exceed 1/2" in thickness.
4. No flame burning is allowed on stainless steel materials.
5. Only stainless steel brushes may be used on stainless steel.

INTERPASS TEMPERATURE:

The interpass temperature shall not exceed 350°F.

PREHEAT REQUIREMENTS: ASME P-1, Gp. 1 to ASME P-8, Gp. 1

No preheat is required except as an aid to remove moisture unless the ambient temperature falls below 32°F. When the ambient temperature falls below 32°F, a preheat of warm to the hand is required within 3" of where the welding is started and maintained 3" ahead of the arc.

PREHEAT REQUIREMENTS: ASME P-1, Gp. 2 to ASME P-8, Gp. 1

No preheat is required except as an aid to remove moisture unless the ambient temperature falls below 50°F. When the ambient temperature falls below 50°F, a preheat of warm to the hand is required within 3" of where the welding is started and maintained 3" ahead of the arc.



IDENTIFICATION
WPS

CONTRACT

WELDING PROCEDURE SPECIFICATION

E309/STRUCT

930212

PRODUCT LIGO BEAM TUBE MODULES

PAGE NO. 3 OF 3

CUSTOMER CALTECH

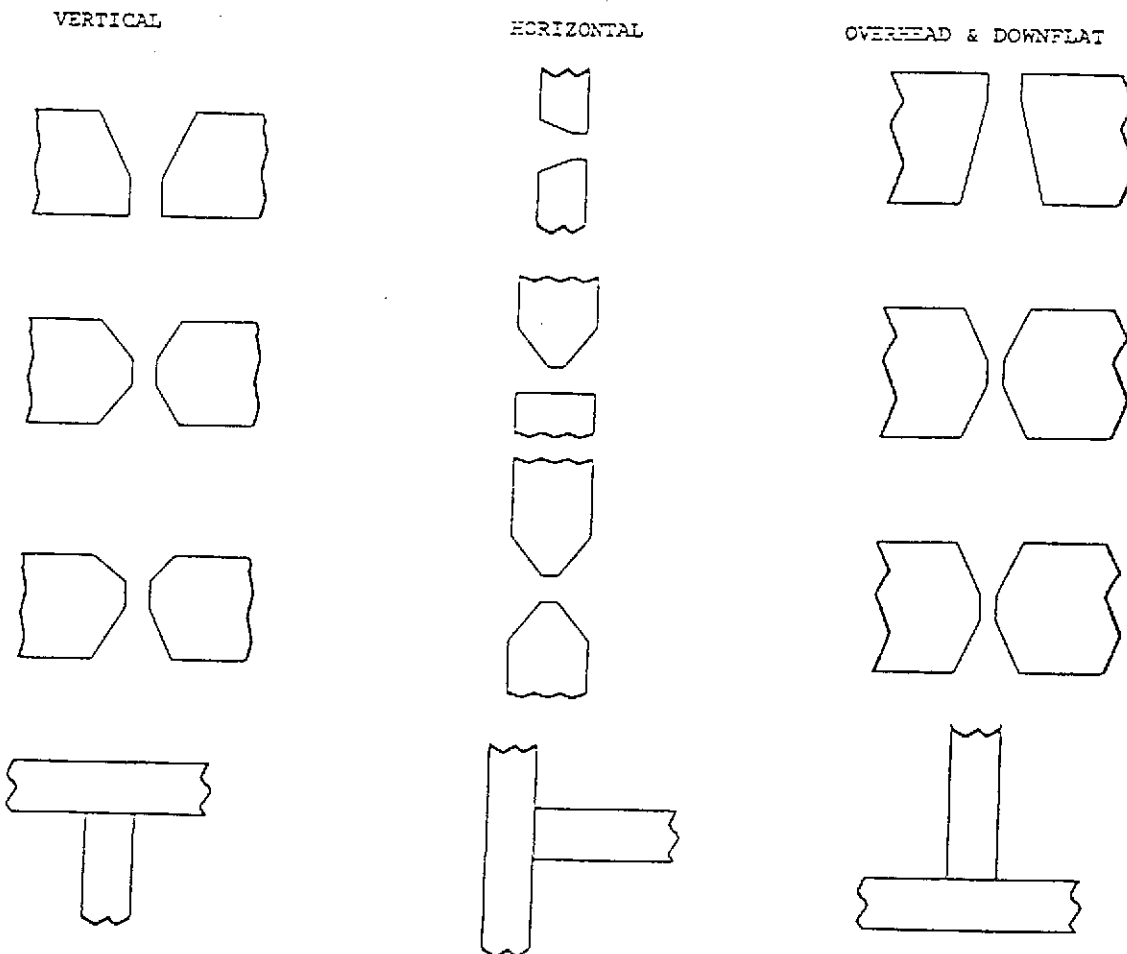
REV. NO. 0

BY RWP DATE 02/10/94

GENERAL WELDING TECHNIQUE

Operation Description	Beads Layer	Weld Proc.	Electrode		Current (amps)	Voltage (Volts)	Travel (IPM)	B.C.R. Sec/12"
			Size	Type				
Stringer Beads*	As Req'd	SMA	3/32	E309-15	60-100	23-26		54-30
			1/8		60-125	23-27		100-44
			5/32		100-180	23-27		86-45
			3/16		130-240	24-28		90-46
			1/4		150-320	24-30		130-59
			3/32		E309-16	60-100		19-22
			1/8	70-152		23-27		112-42
			5/32	110-196		24-31		105-49
			3/16	160-307		24-32		91-42
			1/4	180-390		24-34		127-52
			* Vertical Uphill welds may be deposited using a weave technique.					

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





PROCEDURE QUALIFICATION RECORD TO A.S.M.E. SECTION IX

PART II ESSENTIAL VARIABLES

PQR No. 6190 Date 2-3-83
 Process SMAW Manual Machine Automatic Semiautomatic
 Material specification A283 GR.C to A240 TP304 **FLUX OR ATMOSPHERE**
 ASME p. no. P1-GD.1 To ASME p. no. P8-GD.1 Flux trade name None Required
 Thickness (if pipe, dia and wall thick) 1.0" Inert gas composition None Required
 Filler metal group no. F. 5 Flow rate None Required
 Weld metal analysis no. A. 8 Is backing strip used? No
 ASME specification no. SFA 5.4 Preheat temperature range 70°F - 350°F (IPT)
 AWS specification no. A 5.4 Postweld heat treatment None Required

WELDING PROCEDURE

Single or multiple pass Multiple Single or multiple arc Single Position 3G

Electrode E309-15* Filler wire diameter 1/8", 5/32"
 Type of backing None Required Welding current Direct Current, Electrode Positi
 Consult PART III WELDING VARIABLES for joint dimensions and welding current settings. (Reverse Polarity)

TEST RESULTS

Reduced Section Tensile Results

Specimen No.	Dimensions in		Area in 2	Ultimate Total Load Lb	Ultimate Unit Stress PSI	Character of Failure and Location
	Width	Thickness				
H943W-1	1.003	0.871	0.874	64,900	74,300	Ductile in SA283 material
H943W-2	1.003	0.871	0.874	64,900	74,300	Ductile in SA283 material

Guided Bend Test

Type	Result	Type	Result
4 Transverse Side Bends	Okay	- - - - -	- - -

Welder's name C. 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. H943W Rev. 0 Date 1-17-83

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

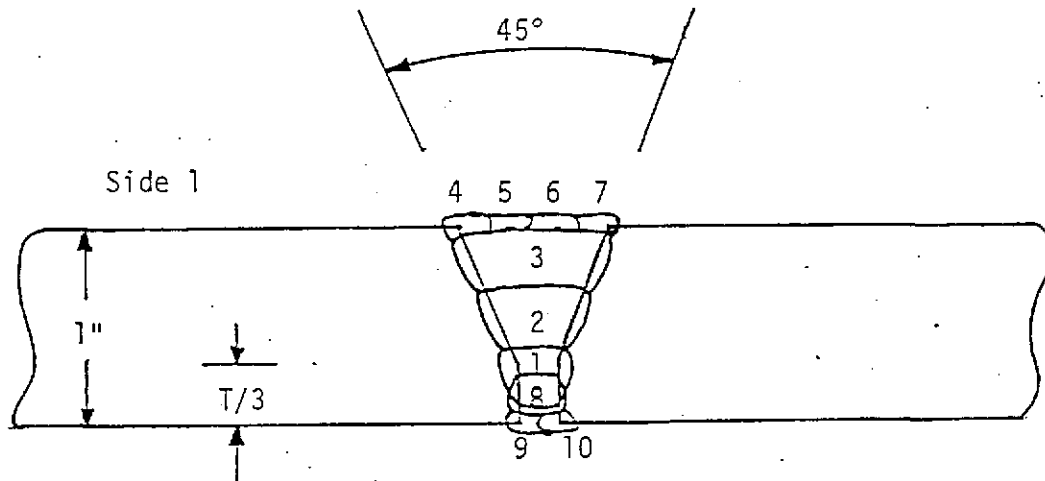
By J. W. Bransford J. W. Bransford Date 2-3-83

Remarks: *Arcaloy

PROCEDURE QUALIFICATION RECORD

To A.S.M.E. Section IX

PART III WELDING VARIABLES



Gap: 3/16

3G POSITION

Land: T/3

Layer	Electrode		Amps	Volts	PASS DIR.	Remarks (Gas Flow etc)
	Type	Size				
1	E309-15	1/8"Ø	125	28	DN	Root Pass
2-3	E309-15	5/32"Ø	110	25	UP	
4-7	E309-15	1/8"Ø	110	25	DN	Wash Pass
8	E309-15	1/8"Ø	90	25	UP	
9-10	E309-15	1/8"Ø	110	25	DN	Wash Pass

 Qualification No. 6190
 Date: 2-3-83

 BY J. W. Bransford
 J. W. Bransford