

SSTD-8070-0123-WELD Rev. D JULY 2019

National Aeronautics and Space Administration

John C. Stennis Space Center Stennis Space Center, MS 39529-6000

COMPLIANCE IS MANDATORY

JOHN C. STENNIS SPACE CENTER FLUX CORED ARC WELDING (FCAW) OF STRUCTURAL CARBON STEEL

Approved by:

<u>Approved in DDMS by Scott Olive</u> NASA SSC Center Operations Design & Construction Project Management Division	<u>7-11-2019</u> Date
Concurrence by:	
<u>Approved in DDMS by Gina Ladner</u> NASA SSC Center Operations Directorate Operations and Maintenance Division	<u>7-17-2019</u> Date
Approved in DDMS by Bartt Hebert NASA SSC Engineering & Test Directorate	<u>7-15-2019</u> Date
Approved in DDMS by Son Le NASA SSC Safety & Mission Assurance	<u>7-15-2019</u> Date
Issued by	

ISSUED CEF	7-17-2019
Central Engineering Files	Date

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Document History Log

Date	Originator/	Description
10/16/03	D. Dike	Initial Release
	Ext. 8-2803	
10/30/03	W. St. Cyr	Administrative Changes:
	Ext. 8-1134	Title, and throughout, change 'core' to 'cored' per AWS
		terminology; change page headers 'of page' from 14 to 16;
		on all Form E-1: change WPS Id. # (front) & PQR number
		(back); change all SA516/GR70 to AWS D1.1, Table 3.1,
		Group Iⅈ add Root Face Dimension 'zero'; and change
		the following: Pipe Diameter N/A to ≥ 24 ", Base Metal
		thickness Groove 1.00" to $\geq 1/8$ " (add Fillet $\geq 1/8$ "), Filler
		Metal AWS Class E71T-1 to AWS D1.1, Table 3.1, Grp I &
		II materials;
		6.1-b add ref to Appendix A for qualifications of welder;
		6.1-c add "acceptance criteria" and change STD 34-004 to
		AWS D1.1.
		Other changes:
		1.0 delete ASTM MA516, add AWS D1.1 Table 3.1, and
		change P1 Carbon Steel to Group 1 and Group II materials;
		3.0 delete ASTM A516, ASME Boiler Code, and SSC Standard 24,004, and add AWS A5,20;
		Standard 34-004, and add AWS A5.29; 6.2 delete ASTM A516, add AWS D1.1 Table 3.1 Grp Iⅈ
		6.3 add 'Procedure' to title, change para ref from 4.0 to
		4.1.1; 6.5 add AWS A5.29, and change D1.1 refs from
		Paragraphs to Table 3.1 Groups I and II;
		6.6 delete ref to para C5.3.1.3;
		6.7 add Flat 1-G position;
		6.14 change Appendix A to "approved SSC engineering"
		and add ref to AWS D1.1;
		6.15 add 'Post Weld' to title, and change text to "none."
		6.16 add ref to AWS D1.1 and change "approved" to
		"appropriate".
	10/16/03	Phone 10/16/03 D. Dike Ext. 8-2803

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В	11/2/14	W. St. Cyr Ext. 8-1134	Updated references throughout document. Updated format in accordance with SPR 1400.1 requirements. Moved requirement in Document Control (Section 4.0) to Responsibilities (Section 5.0), added responsible organization for this task, and renumbered the sections that followed. Added section for acronyms and abbreviations. Removed references to FOSC Safety data requirement document and AWS Welding Handbook. Revised Section 5.10 for clarity. Edited requirements in Sections 5.13.a and 5.13.b.
С	11/3/14	Doug Dike Ext. 8-2803	Five-year revision. Updated references and acronyms. Section 2.0: Added AWS A5.36 and noted AWS A5.20 and AWS A5.29 are superseded by AWS A5.36. Sections 7.1, 7.3 and 7.5: Replaced A 5.20 or A5.29 to A 5.36 in "Filler Material" section; changed Rev. A to Rev B, and resigned.
D	7/01/19	Doug Dike Ext 8-2803	Updated cover sheet approval/concurrence requirements per SSTD-8070-0005-CONFIG. Updated references and acronyms. Minor administrative changes. References to FOS changed to SACOM throughout document. Section 4.1-c: Added SSTD-8070-0013-WELD Class IV. Section 4.3: Changed paragraph 4.1 to section 4. Section 4.5: Expanded to include AWS A5.20 and A5.29 as well as A5.36. Changed Table 3.1 to 3.2. Section 4.6: Changed paragraph 5.3.1.3 to section 5. Section 4.9: Changed paragraph 5.12 to section 5. Section 4.10: Changed paragraph 5.12 to section 5. Section 4.12: Changed paragraph 5.12 to section 5. Section 4.12: Changed paragraph 5.12 to section 5. Section 4.12: Changed with the section 5. Section 4.12-b: Added "Maintain purge gas uniformity by eliminating disruptive drafts during FCAW operations." Section 4.13-a: Changed "should merge smoothly" to "shall be full, smooth, and well profiled". Section 4.14: Deleted original Section 4.14 as it was redundant content from Section 4.1. Within the new Section 4.14, added SSTD-8070-0013-WELD Class IV section 10.0. Updated WPS forms (SSC937A). Deleted 7.8, Weld No. PQR 2G2, as the details of this Radiographic Request/Report were included in the Section 7.7 report.

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1.0 SCOPE

This John C. Stennis Space Center (SSC) standard (SSTD) provides a qualified American Welding Society (AWS) D1.1 weld procedure for Flux Cored Arc Welding (FCAW) of AWS D1.1 Table 3.1 Group I and Group II carbon steel for structural use at SSC.

2.0 **REFERENCES**

Referenced documents shall be the latest version unless otherwise specified.

AWS D1.1, Structural Welding Code - Steel
AWS A5.20, Specification for Carbon Steel Electrodes for Flux Cored Arc Welding
AWS A5.29, Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding
AWS A5.36, Specification for Carbon and Low-Alloy Steel Flux Cored Electrodes for Flux
Cored Arc Welding and Metal Cored Electrodes for Gas Metal Arc Welding
SPR 1440.1, Records Management Program Requirements
SPR 8715.1, SSC Safety and Health Program Requirements
SSTD-8070-0005-CONFIG, Preparation, Review, Approval and Release of SSC Standards
SSTD-8070-0013-WELD, Classes Of Welding Inspection
SSTD-8070-0014-WELD, Oualifying Welders and Welding Procedures

3.0 **RESPONSIBILITIES**

- a. Responsibilities for the qualification of welders and the performance of the welding procedures are defined in Section 5.0.
- b. SSC Center Operations Directorate, Operations and Maintenance Division (OMD) shall maintain this SSTD in accordance with the control, review, approval, and release requirements of SSTD-8070-0005-CONFIG and the documents referenced therein.

4.0 **REQUIREMENTS AND PROCEDURES**

4.1 General

- a. All procedures shall be performed in compliance with applicable requirements in SSC Procedural Requirement (SPR) 8715.1. If ever there is a conflict between this SSTD and SPR 8715.1, the SPR shall take precedence.
- b. Welders shall be qualified in accordance with SSTD-8070-0014-WELD (e.g., Radiographic Reports in Appendix A are for qualification of welder).

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c. Inspection methods and acceptance criteria shall be in accordance with SSTD-8070-0013-WELD Class IV and AWS D1.1.

4.2 Specification Compliances

The carbon steel base metal to be welded shall meet the American Society for Testing and Materials (ASTM) specification(s) for one or more Group I or Group II materials listed in Table 3.1 of AWS D1.1.

4.3 **Procedure Qualification**

Qualification of procedures shall be in accordance with Section 4 of AWS D1.1.

4.4 Base Metal

The carbon steel base metal to be welded shall meet the ASTM specification(s) for one or more Group I or Group II materials listed in Table 3.1 of AWS D1.1.

4.5 Electrodes

Electrodes shall conform to the requirements of AWS A5.20, A5.29 and A5.36, and in accordance with Table 3.2 of AWS D1.1.

4.6 Shielding Gas

a. Shielding gas shall be $Argon/CO_2$ with a 75%/25% composition.

b. Shielding gas shall meet the requirements in accordance with section 5 of AWS D1.1.

4.7 **Positions**

Flat-1GHorizontal-2GVertical-3GOverhead-4G

4.8 Root Purge

None required.

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4.9 Base Metal Preparation

Base metal preparation shall be per the requirements in accordance with section 5 of AWS D1.1.

4.10 Backing

Backing, if used, shall meet the requirements of AWS D1.1, Section 5.

4.11 Electrical Characteristics

Refer to joining procedure for the selected process in attached sketches to this SSTD.

4.12 Welding Environment

- a. The welding environment shall meet the requirements in accordance with section 5 of AWS D1.1 and SSTD-8070-0013-WELD Class IV section 10.0.
- b. Maintain purge gas uniformity by eliminating disruptive drafts during FCAW operations.

4.13 Appearance of Weld

- a. The deposited weld metal shall be full, smooth, and well profiled into the parent metal, have a uniform throat section, and be free of overlaps or undercuts. Spot repair visual defects by grinding and re-welding, if necessary.
- b. Confine arc strikes to the weld area only. Arc strikes outside of the area of permanent welds should be avoided on any base metal. Cracks or blemishes caused by arc strikes shall be ground to a smooth contour and checked to ensure soundness.

Note: Exercise care to examine each pass to ensure the welds shall be free from flux, salt bath residue, weld spatter and other contaminates. This should be done with a grinder or wire wheel. Consult the Certified Weld inspector during the welding process.

4.14 Repair Welding

Weld defects beyond limits prescribed in AWS D1.1 and SSTD-8070-0013-WELD Class IV section 10.0. shall be removed by appropriate methods (such as air arc gouging, scarfing, or grinding), after which the defective area shall be re-welded using the same procedure used to weld the original weld.

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5.0 **RECORDS AND FORMS**

- a. Records required by the procedures of this SSTD shall be maintained in accordance with SPR 1440.1 and as specified in this SSTD.
- b. All records and forms are the latest version unless otherwise indicated.
- c. Forms may be obtained from the SSC Electronic Forms repository or from the National Aeronautics and Space Administration (NASA) SSC Forms Management Officer. Quality Records are identified in the SSC Master Records Index.
- d. The original, signed Welding Procedure Specification (WPS), Procedure Qualification Record(PQR) PQR and Welder Qualification Report (WQR) (copies of which are provided in the attachments of this SSTD) and the accompanying Certificate(s) of Analysis validation test documents shall be maintained in Central Engineering Files (CEF).

6.0 ACRONYMS AND ABBREVIATIONS

ASTM	American Society for Testing and Materials
AWS	American Welding Society
CEF	Central Engineering Files
CO ₂	Carbon Dioxide
FCAW	Flux Cored Arc Welding
NASA	National Aeronautics and Space Administration
OMD	Operations and Maintenance Division
PQR	Procedure Qualification Record
QA	Quality Assurance
SACOM	Synergy Achieving Consolidated Operations and Maintenance
SPR	John C. Stennis Space Center Procedural Requirement
SSC	John C. Stennis Space Center
SSTD	John C. Stennis Space Center Standard
WPS	Welding Procedure Specification

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7.0 ATTACHMENTS

WPS/PQR for Weld Positions 2G, 3G, 4G (*1)

Horizontal Position 2GWPS SSTD-8070-0123-WELD (2G)Horizontal Position 2GPQR SWR PT0A7Q1BTR-2Vertical Position 3GWPS SSTD-8070-0123-WELD (3G)Vertical Position 3GPQR SWR PT0A7Q1BTR-3Overhead Position 4GWPS SSTD-8070-0123-WELD (4G)Overhead Position 4GPQR SWR PT0A7Q1BTR-4

Radiographic Request/Report (*2)

Weld nos. PQR 2G, 3G, 4G Weld no. PQR 2G2

Certificates of Analysis (*1)

Report no. 676-2 Position 2G (November 25, 2002) Report no. 662-2B Position 3G (November 20, 2002) Report no. 662-2C Position 4G (November 20, 2002)

*1 – Originals in CEF.

*2 - Originals in SACOM QA files. (Records for qualifications of welders.)

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Horizontal Position 2G, WPS SSTD-8070-0123-WELD (2G) 7.1

NA	National Aeronaut Space Administrat John C. Stennis S Stennis Space Ce	tion	AWS - AMERICAN	WELDING SOCIETY (WPS)
10.00 LBA 7 TO 10 M	cedure Specification Record Nur J-0123-WELD (2G)	nber	Date June 1, 2019	Revision Number C
Qualified To AWS D1.1			Company Name Syncom Space Services (S	3)
Supporting P SWR PTO	PQR(s) A7Q1BR-2		Reference Docs. SSTD-8070-0123-WELD	
Scope FCAW Stri	uctural Carbon Steel		Joint Single	
BASE META	ALS			ESS RANGE QUALIFIED
Түре	See Note A. F	P-no Grp-no. I + II	As Min.	welded Max. With P WHT Max.
		P-no Grp-no. I + II	Complete Pen. ≥1/8"	N/AN/A
			Complete Pen.	<u> </u>
Backing	See Note A. F	P-no Grp-no. <u>I + II</u>	Impact Tested	
Retainers	-		Impact Tested	
Notes	See Note B.	10	Fillet Welds <u>ALL</u>	<u>N/AN/A</u>
				ER RANGE QUALIFIED s-welded With P WHT Max. Min. Max.
			Min. Nominal Pipe Size ≥ 24"	Max. Min. Max. N/A N/A
FILLER MET	ALC		Name of the state	ESS RANGE QUALIFIED
Process		ion F-no. A-no. Chemical Ana		
FCAW		See Note C		
FURW	E71T-1		≥1/8"	<u>N/AN/A</u>
	17/4			
Cons. Inser				
Flux	<u> </u>	<u> </u>		<u> </u>
WELDING P		FCAW	FCAW	
Velding Proc	2622			
Гуре История	hast fatomass to provide up 2011	Semi-Automatic	Semi-Automatic	
	heat/interpass temperature (%) erpass temperature (%)	75°F (Ambient) 400°F	75°F (Ambient) 400°F	
Tungsten Siz		N/A	+561 N/A	
Tungsten Typ	2.0	N/A	N/A	
Filler Metal S		.045" - 0.063"	.045" - 0.063"	
Laver Numbe	502 C12020	Root Pass through Pass 3	Pass 4 - 35	
Position of G		1G or 2G	1G or 2G	1
Veld Progres		N/A	N/A	
Current/Polar	230/2/20/	DCEP	DCEP	
Amperes			1	
Amperes Volts		24.5	27	
	l (in.tmin)	24.5 6 - 10 ipm	27 6 - 12 ipm	
Volts Travel Speec	l (in.tmin) sat Input (kj.tn)		31. 31150	
Volts Travel Speec Maximum He	at Input (kj.kn)		31. 31150	
Volts Travel Speec	at Input (kj.kn)		6 - 12 ipm Argon / CO2 - 75% / 2	250
Volts Travel Speec Maximum He DC Pulsing C Shielding:	vat Input (kj/n) Current Gas Type Flow Rate (cfh)	6 - 10 ipm Argon / CO2 - 75% / 25% 10 - 30 CFH	6 - 12 ipm Argon / CO2 - 75% / 2 10 - 30 CFH	250
volts Fravel Speec Maximum He DC Pulsing C Shielding:	at Input (kj/m) Current Gas Type Flow Rate (c/h) Gas Type	6 - 10 ipm Argon / CO2 - 75% / 25%	6 - 12 ipm Argon / CO2 - 75% / 2	250
/olts Fravel Speec Maximum He DC Pulsing C Shielding: Frailing:	at Input (kj/m) Current Gas Type FlowRate (cm) Gas Type FlowRate (cm)	6 - 10 ipm Argon / CO2 - 75% / 25% 10 - 30 CFH N/A	6 - 12 ipm Argon / CO2 - 75% / 2 10 - 30 CFH N/A	250
/olts Fravel Speec Maximum He DC Pulsing C Shielding: Frailing:	at Input (kj/m) Current Gas Type Flow Rate (cm) Gas Type Flow Rate (cm) Gas Type	6 - 10 ipm Argon / CO2 - 75% / 25% 10 - 30 CFH	6 - 12 ipm Argon / CO2 - 75% / 2 10 - 30 CFH	250
Volts Fravel Speec Maximum He DC Pulsing C Shielding: Frailing: Backing:	at Input (kj/m) Current Gas Type Flow Rate (cm) Gas Type Flow Rate (cm) Gas Type Flow Rate (cm)	6 - 10 ipm Argon / CO2 - 75% / 25% 10 - 30 CFH N/A N/A	6 - 12 ipm Argon / CO2 - 75% / 2 10 - 30 CFH N/A N/A	250
Volts Travel Speec Maximum He DC Pulsing C Shielding: Trailing: Backing: String or Wea	at Input (kj/m) Current Gas Type Flow Rate (cm) Gas Type Flow Rate (cm) Gas Type Flow Rate (cm) Ave	6 - 10 ipm Argon / CO2 - 75% / 25% 10 - 30 CFH N/A N/A String or Weave	6 - 12 ipm Argon / CO2 - 75% / 2 10 - 30 CFH N/A N/A String or Weave	250
Volts Travel Speec Maximum He DC Pulsing C Shielding: Trailing: Backing: Backing: String or Wea Drifce/Gas C	at Input (kj/m) Current Gas Type Flow Rate (cm) Gas Type Flow Rate (cm) Gas Type Flow Rate (cm) Ave Cup Size	6 - 10 ipm Argon / CO2 - 75% / 25% 10 - 30 CFH N/A N/A String or Weave 1/2"	6 - 12 ipm Argon / CO2 - 75% / 2 10 - 30 CFH N/A N/A String or Weave 1/2"	250
Volts Travel Speec Maximum He DC Pulsing C Shielding: Trailing: Backing: Backing: String or Wea Drifce/Gas C Multi/Single F	at Input (kj/m) Current Gas Type FlowRate (cfn) Gas Type FlowRate (cfn) Gas Type FlowRate (cfn) ave Cup Size Pass per Side	6 - 10 ipm Argon / CO2 - 75% / 25% 10 - 30 CFH N/A N/A String or Weave	6 - 12 ipm Argon / CO2 - 75% / 2 10 - 30 CFH N/A N/A String or Weave	250
Volts Travel Speec Maximum He DC Pulsing C Shielding: Trailing: Backing: Backing: String or Wea Drifce/Gas C	at Input (kj/m) Current Gas Type Flow Rate (cm) Gas Type Flow Rate (cm) Gas Type Flow Rate (cm) Gas Type Flow Rate (cm) ave Cup Size Pass per Side t Chemistry	6 - 10 ipm Argon / CO2 - 75% / 25% 10 - 30 CFH N/A N/A String or Weave 1/2"	6 - 12 ipm Argon / CO2 - 75% / 2 10 - 30 CFH N/A N/A String or Weave 1/2" Multi-pass	256

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 Velocity

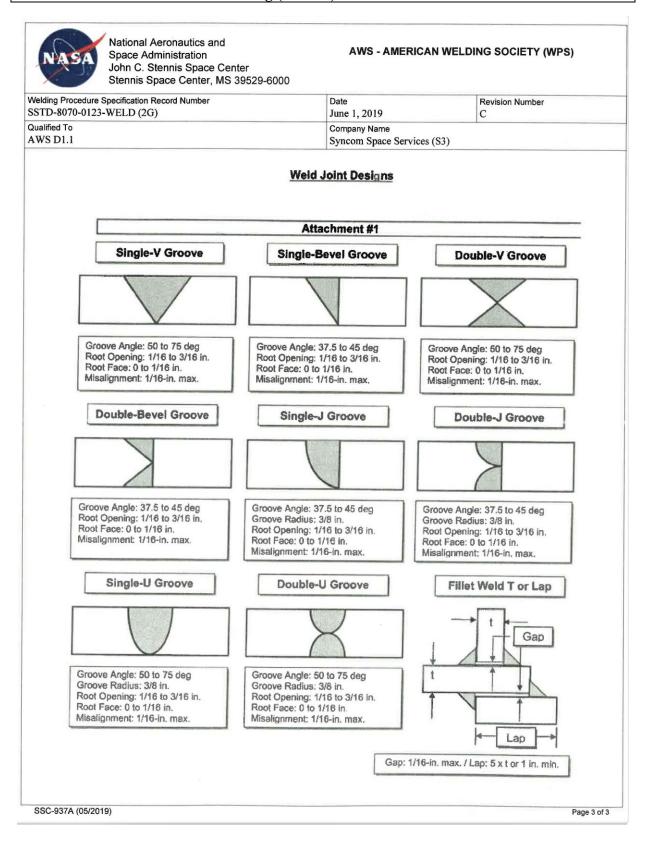
Space John C Stenni	al Aeronautics and Administration C. Stennis Space Center s Space Center, MS 39529-600		N WELDING SOCIETY (WPS)
Welding Procedure Specificati SSTD-8070-0123-WELD		Date June 1, 2019	Revision Number C
Qualified To AWS D1.1		Company Name Syncom Space Services	
BASE METALS			
Peening	Not allowed.		
Surface Preparation	Joint Prep - Flame cut and light	grinding on surfaces to be welded.	
Initial/Interpass Cleaning	Chipping hammer, wire brush, g	grinding.	
Back Gouging Method	None		
POSTWELD HEAT TREATM	IENT		
Temperature	None		
Time and Temperature	None		
Other	None		
A. See AWS D1.1 Tabl B. Root Opening: 5/32 Root Face Dimension			
Groove Angle: 37 1/			
	- l shall be SFA A5.20, A5.29, or A	5.36.	
Signature 1	\cap	Signature 2	
Engineer Name	Signature	Quality Name	Signature $\begin{pmatrix} 36\\ 36\\ 94 \end{pmatrix}$
Doug Dike Date June 1, 2019		George Smith Date June 1, 2019	Dunge & Dunith
Signature 3		Signature 4	
Customer Reviewer Name Benjamin McGrath	Signature	Customer Name	Signature
Date June 1, 2019	Bynet	Date Date	
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Degrangihle Officer N			inten On	anationa O	n amati		Maint	Ũ	
Responsible Office: N			-		-				sion
SUBJECT: Flux Core	ed Arc	weid	ing (FC	(AW) of St	ructu	iral Ca	rbon S	steel	
.2 Horizontal Posit	tion 20	G, PQI	R SWR	PT0A7Q1	BTR-	-2			
	PRE	QUALIFIE	ED	URE SPECIFICAT QUALIFIE	DBYT	ESTING .			
Company Name <u>Mise</u> Welding Process(es) Supporting PQR No. (FCA			Identificatio Revision _/ Authorized Type – Mar Mach	A by	Date 10	/29/2003	LD (2G) By W. St. Cy Date: 10/30/03 i-Automatic Automatic Automatic	
JOINT DESIGN USED Type:)			POSITION					
Single 🖾		le Weld E	C	Position of (Vertical Pro					
Backing: Yes 🛛 Backing Material: <u>AWS</u> Root Opening <u>5/32*</u> R	No S D1.1 Tab	le 3.1, G	roupsi&	ELECTRICA		RACTERIS	TICS		
Groove Angle: <u>37-1</u> Back Gouging: Yes	/2° Radi	us (J-U) _	N/A	Transfer Mo	de (GM/		Shor Globular	t-Circuiting Spray	_
BASE METALS				Current: AC Other	0 0	CEP 🛛	DCEN D		
					Siz	(GTAW) ze: <u>N/A</u> pe: <u>N/A</u>			
AWS Specification AWS Classification Se						ead: <u>Strin</u> Pass (per si		/eave Multipass	_
				Electrode Spa			itudinal	N/A	_
SHIELDING Flux	Gas	Argon/	0.0			Later		N/A	
			75%/25%	Contact Tube	to Wor	Angle k Distance	1/2" -	N/A 1"	
Electrode-Flux (Class)				Peening	No	ne			_
	Gas	Cup Size	91/2"	Interpass Cle	aning: C	hipping Ha	mmer, Wi	re Brush, Grinding	_
PREHEAT				POSTWELD	HEAT T	REATMEN	т		
Preheat Temp., Min	75°F (An			Temp. N/A					_
Interpass Temp., Min	75°F	Max	400°F	Time <u>N/A</u>	_				-
	Filler	Metals	1	ING PROCEDUR Current					-
Pass or Weld Layer(s) Process	Class	Diam.	Type & Polarity	Amps or Wire Feed Speed	Volts	Travel Speed		Joint Details	
ROOT THRU PASS 3	E71T-1	1/16"	DCEP	157 in/min	24.5	8 ipm		- 75'	
4-35 FCAW	E71T-1	1/16"	DCEP	155 in/min	27	10 ipm			
Form E-1 (Front)								5/32"	

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Responsible Office: NASA SSC Center Operations, Operations and Maintenance Division SUBJECT: Flux Cored Arc Welding (FCAW) of Structural Carbon Steel

Stennis

Procedure Qualification Record (PQR) # _____SWR PTOA7Q1BTR-2____ **Test Results**

			TF	NSILE TES	r	2G Posit	ion
		1	1			1	Character of
Specimen No.	Width	Thickness	Are	a U	litimate tensile load, ib.	Ultimate unit stress, psi	failure and
T-1	0.754"	0.933"	0.703"	56,0	600	80,512	BASE
T-2	0.757"	0.929"	0.703"	56,8	300	80,797	BASE
			GUIDED	BEND TES	ST		
Specimen No.	Type of bend	Result		Remarks			
SB-1	Side Bend	Satisf	factory				
SB-2	Side Bend	Satist	factory				
SB-3	Side Bend	Satisf	factory	1			
SB-4	Side Bend	Satist	factory				
Undercut Piping porosity Convexity Fest date	None			RT report n UT report n Minimum si Macroetch 1. <u>N/A</u> 2. <u>N/A</u> All-weld-me	ze multiple pass	IR Result Result	single pass 3. <u>N/A</u>
				Yield point/s	strength, psi	N/A	
				Elongation i	in 2 in., %l	N/A	
				Labora	tory test no.	676-2	
Velder's name	Mark Corr			Clock no.	N/A	Stamp no.	MSS 34
ests conducte	d by	Tech Weld				Laboratory	
				Test Numbe			
				Per Te			
Va the under	ianed certify that	the statements				est welds were pre	norod welded
			of section		NS D.1.1, <u>(2002</u> (year Mississip) Structural Weldin	
				ву 20	hyper		
				Title Ou	all Annung le	Faultana	
				Title Qu	ality Assurance	Engineer	

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7.3 Vertical Position 3G, WPS SSTD-8070-0123-WELD (3G)

NAS	National Aeronaut Space Administra John C. Stennis S Stennis Space Ce	tion	AWS - AMERICAN WELD	ING SOCIETY (WPS)
	edure Specification Record Nu 0123-WELD (3G)	mber	Date June 1, 2019	Revision Number C
Qualified To AWS D1.1			Company Name Syncom Space Services (S3)	
Supporting PG SWR PTOA			Reference Docs. SSTD-8070-0123-WELD	
Scope	tural Carbon Steel		Joint Single	
BASE METAL	S			NGE QUALIFIED
		P-no. Grp-no. I + II	As-welded	
			Complete Pen. ≥1/8"	N/A N/A
Welded To	See Note A.	P-no Grp-no. I + II	Complete Pen.	
Backing	See Note A.	P-no Grp-no. I + II	Impact Tested	
Retainers			Impact Tested	<u> </u>
	See Note B.		Fillet Welds ALL	N/A N/A
NULES	Dee Note D.	2		IGE QUALIFIED
			As-welded	Max. Min. Max.
			Nominal Pipe Size ≥ 24"	N/A N/A
FILLER META	LS		THICKNESS RA	INGE QUALIFIED
Process	SFA Classifica	tion F-no. A-no. Chemical Ana	llysis or Trade Name As-welded Min.	d With PWHT Max. Min. Max.
FCAW	<u>E71T-1</u>	See Note C		N/A N/A
		— <u> </u>) () (
Cons. Insert. Flux				
025000	2	<u> </u>	- 19 - 19 - 19 - 19 - 19 - 19 - 19 - 19	
WELDING PR Welding Proce		FCAW	FCAW	FCAW
	33	Semi-Automatic	Semi-Automatic	Semi-Automatic
Type Misimum mela	eat/interpasstemperature (°F)	75°F (Ambient)	75°F (Ambient)	75°F (Ambient)
	pass temperature (°F)	400°F	400°F	400°F
Tungsten Size		4001 N/A	N/A	N/A
		N/A	N/A	N/A
Fungsten Type Filler Metal Siz		.045" - 0.063"	.045" - 0.063"	045" - 0.063"
aver Number		Root, 2, and 3	4 - 10	11 - 18
Position of Gro	2	Vertical 3G	Vertical 3G	Vertical 3G
Veld Progress		Up	Up	Up
Current/Polarit	10E-10	DCEP	DCEP	DCEP
Amperes	y	DOEL	DOEL	DOLI
volts		28	28	28
ravel Speed (in their)	6 - 10 ipm	6 - 10 ipm	6 - 10 ipm
vlaximum Hea		o - roupm	c - roipin	G- To Ipin
C Pulsing Cu	- /2 - 22 - 22 - 22 - 22 - 22 - 22 - 22	0 0		
	asType	Argon / CO2 - 75% / 25%	Argon / CO2 - 75% / 25%	Argon / CO2 - 75% / 25%
FlowRate(cfn) 10-30CFH		10 - 30 CFH	10 - 30 CFH	
	asType	N/A	N/A	N/A
	Flow Rate (cfh)	1900	Utra	131612
	asType	N/A	N/A	N/A
	Flow Rate (cfh)			UKO:
String or Weav		String or Weave	String or Weave	String or Weave
Drifce/Gas Cu		1/2"	1/2"	1/2"
vlutti/SinglePa	210/2015/26	Multi-Pass	Multi-Pass	Multi-Pass
Veld Deposit (wulti-Pass	mutti-Pass	wutu+Pass
0.010-0.010-0-0.01	unentitstry	0	24	22
Notes	and a state of the	Contact Tube to Work Distance 1/2	2" - 1"	

SSC-937A (05/2019)

Stennis	SSTD-8070-0123-WELD D
Standard	Number Rev.
Standard	Effective Date: July 1, 2019
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Responsible Office: NASA SSC Center Operations, Operat	tions and Maintenance Division
SUBJECT: Flux Cored Arc Welding (FCAW) of Struct	ural Carbon Steel
National Aeronautics and Space Administration AWS - AME	ERICAN WELDING SOCIETY (WPS)

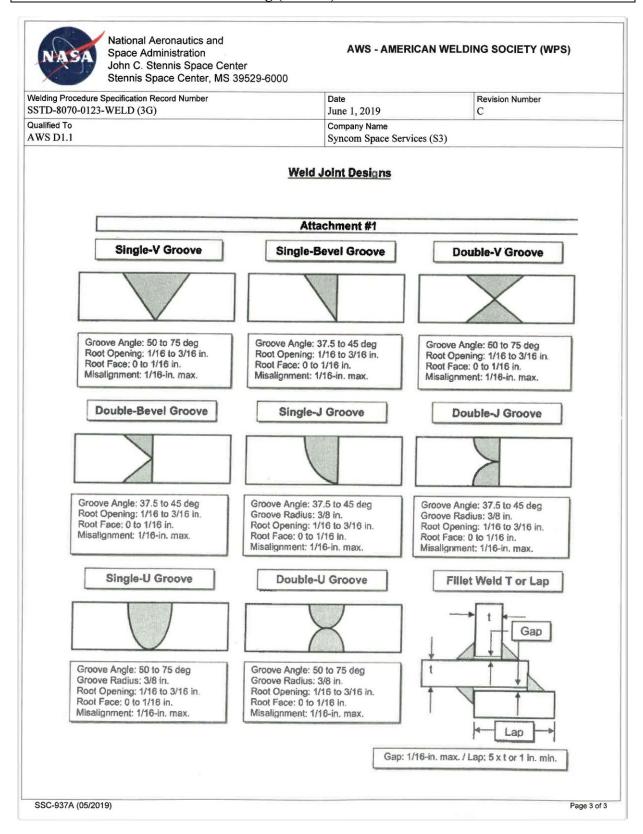
	Stennis Space Cer Space Center, MS			
	Welding Procedure Specification Record Number SSTD-8070-0123-WELD (3G)			Revision Number C
Qualified To AWS D1.1			June 1, 2019 Company Name Syncom Space Servic	es (S3)
BASE METALS				
Peening	Not allowed.			
Surface Preparation	Joint Prep - Flame cu	it and light grinding o	on surfaces to be welded	l
Initial/Interpass Cleaning	Chipping, Hammer,	Wire Brush, Grinding	5.	
Back Gouging Method	None			
POSTWELD HEAT TREATME	NT			
Temperature	None			
Time and Temperature	None			
Other	None			
NOTES				
A. AWS D1.1 Table 3.1,	Groups I + II.			
B. Root Opening: 5/32"				
Root Face Dimension:	Zero			
Groove Angle: 37 1/2	0			
C. Weld wire to be used s	shall be SFA A5.20, A	A5.29, or A5.36.		
Signature 1	\cap	0	Cignoture 2	
Signature 1 Engineer Name	Signature		Signature 2 Quality Name	Signature 33
Doug Dike	1	2///	George Smith	
Date June 1, 2019		IXP	Date	Dunge E. Smith
	100	~ ``	June 1, 2019	
Signature 3		Δ	Signature 4	
Customer Reviewer Name Benjamin McGrath	Signature	A.M.L	Customer Name	Signature
Date	Ben	A.M.O	Date	
June 1, 2019 SSC-937A (05/2019)	- Cong			Page 2 of 3

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tennis							SSTD-8	070-01	123-WELD	D
tandard							<i>Number</i> Effective	Data	July 1, 2019	Rev.
							Review I		July 1, 2019	
						-		Jute.		e 18 of 2
esponsible Ot	ffice: N/	ASA S	SC Ce	nter Op	erations. Or	peratio	ons and	Main	0	
UBJECT: F				1						
		<i>u</i> 1 11 <i>c</i>	··· ciu		110000	uctu				
4 Vertical	Positior	W			OA7Q1BT RE SPECIFICAT QUALIFIEI CATION RECOR	ION (W	STING -			
					Identification Revision A)123-WE 29/2003		ur
	Name Miss		ace Servi	ces	Authorized b			1	Date:10/30/03	
-	rocess(es)				Type – Man		0	(\$em	ni-Automatic 🖾	
Supporting) PQR No. (s)_SWR	PTOA7C	1B1R-3	Machi	ine 🛙		V	Automatic D	
JOINT DE	SIGN USED				POSITION					
Туре:					Position of G	Groove:	Vertical 3G	Fille	et:3G	
Single 🗵	Vec El I		e Weld 🗆	1	Vertical Prog	ression	: Up 🛙	Dow	vn 🗆	
Backing: Backing M Root Open	Yes I I aterial: <u>AWS</u> ing <u>5/32°</u> Ro	No D 1.1 Tab oot Face D	le 3.1, Gr)imensior	oupsi&II Zero	ELECTRICA	L CHAR	ACTERIST	ICS		
Groove An	gle: 37-1/	2° Radii		N/A	Transfer Mod	de (GMA	(W)	Sho	rt-Circuiting	
Back Goug	jing: Yes [No 🖾	Metho	d				Globular		
BASE MET	ALS				Other		CEP 🛛	DCEN	Pulsed	
Material Sp	ec. AWS	D1.1			Tungsten Ele	ectrode (GTAW)			
Type or Gra				oups I & II		Siz				
Thickness: Diameter (F	Groove Pipe) ≥24"	≥1/8"	Fillet	≥1/8"		Ту	pe: N/A			
FILLER ME		45.00			TECHNIQUE					
	fication		or A5.29		Stringer or W Multi-pass or 3					
	d Group II ma			0.7101	Number of Ele	-		ue)	Mulupass	
					Electrode Spa	icing	Longi	tudinal	N/A	_
SHIELDING	3	Gas	Argon/	CO			Later		N/A	
				75%/25%	Contact Tube		Angle	The second	N/A	
						to work	Distance		- 1"	
Electrode-F	lux (Class) I		Rate 30	CFH	Peening	to work		1/2" -	- 1"	_
Electrode-F	lux (Class) I	V/A Flow	Rate 30 Cup Size		Peening	Nor	ne		- 1" /ire Brush, Grinding	
Electrode-F	ilux (Class) <u>I</u>	V/A Flow			Peening Interpass Clea	Nor aning: <u>C</u>	ne hipping Ha	mmer, W		2
PREHEAT Preheat Ter	mp., Min	V/A Flow	Cup Size	1/2"	Peening Interpass Clear POSTWELD I TempN/A	Nor aning: <u>C</u>	ne hipping Ha	mmer, W		<u></u>
PREHEAT	mp., Min	<u>V/A</u> Flow Gas	Cup Size	400°F	Peening Interpass Clea POSTWELD I TempN/A TimeN/A	Nor aning: <u>C</u> HEAT TI	ne hipping Ha	mmer, W		
PREHEAT Preheat Ter	mp., Min	<u>V/A</u> Flow Gas 75°F (Am 75°F	Cup Size	400°F	Peening Interpass Clear POSTWELD I TempN/A TimeN/A NG PROCEDUR	Nor aning: <u>C</u> HEAT TI	ne hipping Ha	mmer, W		
PREHEAT Preheat Ter Interpass Te Pass or	mp., Min	<u>V/A</u> Flow Gas 75°F (Am 75°F	Cup Size	400°F WELDI	Peening Interpass Clear POSTWELD I TempN/A TimeN/A NG PROCEDUR Current	Nor aning: <u>C</u> HEAT TI	ne hipping Ha	mmer, W		
PREHEAT Preheat Ter Interpass Te Pass or Weld	mp., Min emp., Min	V/A Flow Gas 75°F (Am 75°F Filler I	Cup Size	400°F WELDI	Peening Interpass Clear POSTWELD I Temp. N/A Time N/A NG PROCEDUR Current Amps or <u>Wire</u>	Nor aning: <u>C</u> HEAT TI	ne hipping Ha REATMEN Travel	mmer, W	Vire Brush, Grinding	
PREHEAT Preheat Ter Interpass Te Pass or Weld Layer(s)	np., Min emp., Min Process	V/A Flow Gas 75°F (Am 75°F Filler I Class	Cup Size	400°F WELDI Type & Polarity	Peening Interpass Clear POSTWELD F TempN/A TimeN/A NG PROCEDUR Current Amps or <u>Wire</u> Feed Speed	Nor aning: C HEAT TI E Volts	re hipping Ha REATMEN Travel Speed	mmer, W		
PREHEAT Preheat Ter Interpass Te Pass or Weld Layer(s) ROOT	mp., Min emp., Min Process FCAW	V/A Flow Gas 75°F (Am 75°F Filler I Class E71T-1	Cup Size	400°F WELDI Type & Polarity DCEP	Peening Interpass Clear POSTWELD I Temp. N/A Time N/A NG PROCEDUR Current Amps or <u>Wire</u>	Nor aning: <u>C</u> HEAT TI	ne hipping Ha REATMEN Travel	mmer, W	Vire Brush, Grinding	
PREHEAT Preheat Ter Interpass Te Pass or Weld Layer(s)	np., Min emp., Min Process	V/A Flow Gas 75°F (Am 75°F Filler I Class	Cup Size	400°F WELDI Type & Polarity	Peening Interpass Clear POSTWELD F TempN/A TimeN/A NG PROCEDUR Current Amps or <u>Wire</u> Feed Speed	Nor aning: C HEAT TI E Volts	re hipping Ha REATMEN Travel Speed	mmer, W	Vire Brush, Grinding	
PREHEAT Preheat Ter Interpass Te Pass or Weld Layer(s) ROOT	mp., Min emp., Min Process FCAW	V/A Flow Gas 75°F (Am 75°F Filler I Class E71T-1	Cup Size	400°F WELDI Type & Polarity DCEP	Peening Interpass Clear POSTWELD I TempN/A TimeN/A NG PROCEDUR Current Amps or <u>Wire</u> Feed Speed 196 in/min	Nor aning: C HEAT TI E Volts 28	Travel Speed 8 ipm	mmer, W	Vire Brush, Grinding	
PREHEAT Preheat Ter Interpass Te Pass or Weld Layer(s) ROOT 2 & 3	np., Min emp., Min Process FCAW FCAW	V/A Flow Gas 75°F (Am 75°F Filler I Class E71T-1 E71T-1	Cup Size	400°F WELDI Type & Polarity DCEP DCEP	Peening Interpass Clear POSTWELD F TempN/A TimeN/A NG PROCEDUR Current Amps or <u>Wire</u> Feed Speed 196 in/min	Nor aning: C HEAT TI E Volts 28 28	Travel Speed 8 ipm 8 ipm	mmer, W	Vire Brush, Grinding	
PREHEAT Preheat Ter Interpass Te Pass or Weld Layer(s) ROOT 2 & 3 4-10	mp., Min emp., Min Process FCAW FCAW FCAW	V/A Flow Gas 75°F (Am 75°F Filler I Class E71T-1 E71T-1 E71T-1	Cup Size	400°F WELDI Type & Polarity DCEP DCEP DCEP	Peening Interpass Clear POSTWELD I TempN/A TimeN/A NG PROCEDUR Current Amps or <u>Wire</u> Feed Speed 196 in/min 196 in/min	Nor aning: C HEAT TI E Volts 28 28 28 28	Travel Speed 8 ipm 8 ipm 10 ipm	mmer, W	Vire Brush, Grinding	
PREHEAT Preheat Ter Interpass Te Pass or Weld Layer(s) ROOT 2 & 3 4-10	mp., Min emp., Min Process FCAW FCAW FCAW	V/A Flow Gas 75°F (Am 75°F Filler I Class E71T-1 E71T-1 E71T-1	Cup Size	400°F WELDI Type & Polarity DCEP DCEP DCEP	Peening Interpass Clear POSTWELD I TempN/A TimeN/A NG PROCEDUR Current Amps or <u>Wire</u> Feed Speed 196 in/min 196 in/min	Nor aning: C HEAT TI E Volts 28 28 28 28	Travel Speed 8 ipm 8 ipm 10 ipm	mmer, W	Vire Brush, Grinding	
PREHEAT Preheat Ter Interpass Te Pass or Weld Layer(s) ROOT 2 & 3 4-10	mp., Min emp., Min Process FCAW FCAW FCAW	V/A Flow Gas 75°F (Am 75°F Filler I Class E71T-1 E71T-1 E71T-1	Cup Size	400°F WELDI Type & Polarity DCEP DCEP DCEP	Peening Interpass Clear POSTWELD I TempN/A TimeN/A NG PROCEDUR Current Amps or <u>Wire</u> Feed Speed 196 in/min 196 in/min	Nor aning: C HEAT TI E Volts 28 28 28 28	Travel Speed 8 ipm 8 ipm 10 ipm	mmer, W	Vire Brush, Grinding	

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			Test Re			
	1	1	TENSIL	ETEST	3G Posit	1
Specimen No.	Width	Thickness	Area	Ultimate tensile load, lb.	Ultimate unit stress, psi	Character of failure and location
T-1	0.752"	0.979*	0.736"	59,600	80,978	BASE
T-2	0.753"	0.988"	0.744"	59,600	80,108	BASE
			GUIDED BE	ND TEST		
Specimen	Type of bend	Pa	Sult	ND TEST	Demedia	
No. SB-1	Side Bend		actory		Remarks	
SB-2	Side Bend		actory			
SB-3	Side Bend		actory			
SB-4	Side Bend	-	actory			
		outor	Lotory			
VISUAL INSPI	Acceptable		Pa	diographic ultreasurie au		
				diographic-ultrasonic exa		
Undercut				report no.: PTOA7Q1BT		
	None		UT	report no.: N/A	Result _	N/A
Convexity					D TEST RESULT	
Test date	11-14-02		Min	imum size multiple pass	Maximum size	single pass
Witnessed by	Monty Wiggin	S	Mac	croetch	Macroetch	
			1.	N/A 3. N/A	1 N/A	3. N/A
						0. 10/1
			Z	N/A	2. <u>N/A</u>	
Other Tests			All-v	veld-metal tension test		
			_			
				sile strength, psi 80.97		
				d point/strength, psi <u>N</u>		
				igation in 2 in., %N		
				Laboratory test no.	662-2B	
	Mark Corr		Cloc	k no. <u>N/A</u>	Stamp no. M	ASS 34
ests conducte	d by	Tech Weld	Teet	Number 000.0D	Laboratory	
				Number <u>662-2B</u>		
Va the undersi	anod codification	the statements i	Per	Tech Weld		
nd tested in ac	cordance with the	e requirements o	of section 4 of A	re correct and that the te ANSI/AWS D.1.1, <u>(2002)</u> (year)	est welds were pre Structural Weldin	pared, welded, g Code – Steel.
			Sign		i Space Services	
			By _	Manufactu	rer or Contractor	
			Title	Quality Assurance	haineer	
			Thus	Guanty Assurance p	aigineer	

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7.5 Overhead Position 4G, WPS SSTD-8070-0123-WELD (4G)

NAS	National Aerona Space Administ John C. Stennis Stennis Space	ration	AWS - AMERIC	AN WELDING	SOCIETY (WPS)
	edure Specification Record	Number	Date		ision Number
Acres 202066-00-0049	-0123-WELD (4G)		June 1, 2019	C	
Qualified To AWS D1.1			Company Name Syncom Space Service	s(S3)	
Supporting P SWR PTO A	QR(s) A7Q1BTR-4		Reference Docs. SSTD-8070-0123-WEI	.D	
Scope FCAW Stru	xtural Carbon Steel		Joint Single		
BASE META				KNE SS RANGE	
Туре	See Note A.	P-no. Grp-no. I + II		As-welded Max.	With P WHT Min. Max.
			Complete Pen. ≥ 1		N/A N/A
/Velded I o	See Note A.	P-no Grp-no. I + II	Complete Pen.		
Backing	See Note A.	P-no Grp-no. I + II	Impact Tested		
Retainers			Impact Tested		
Notes	See Note B.	6	Fillet Welds ALI	A	N/A N/A
VUIES	Decirole D.			ETER RANGE Q	UALIFIED
			M Nominal Pipe Size ≥2-	As-welded n. Max. 4"	With PWHT Min. Max. N/A N/A
FILLER META	ALS			KNESS RANGE	
rocess	North Television and the second	cation F-no. A-no. Chemical Ana		As-welded	With P WHT
FCAW	E71T-1				Min. Max. N/A N/A
IUAN			<u></u>	·	
Cons. Insert					
Flux	N/A				
Total And the first set					
	ROCEDURE				
Velding Proc	ROCEDURE	FCAW	FCAW		FCAW
Velding Proc Type	ROCEDURE ess	Semi-Automatic	Semi-Automa		Semi-Automatic
Velding Proc Type Minimum preh	ROCEDURE ess neat/interpasstemperature (*	Semi-Automatic F) 75°F (Ambient)	Semi-Automa 75°F (Ambie		Semi-Automatic 75°F (Ambient)
Velding Proc Type Minimum preh Maximum inte	ROCEDURE ess neat/interpass temperature (* erpass temperature (*F)	Semi-Automatic F) 75°F (Ambient) 400°F	Semi-Automa 75°F (Ambie 400°F		Semi-Automatic 75°F (Ambient) 400°F
Velding Proce Type Ainimum preh Aaximum inte Tungsten Size	ROCEDURE ess neat/interpass temperature (* erpass temperature (*) e	Semi-Automatic F) 75°F (Ambient) 400°F N/A	Semi-Automa 75°F (Ambie 400°F N/A		Semi-Automatic 75°F (Ambient) 400°F N/A
Velding Proc ype Ainimum preh Aaximum inte ungsten Size ungsten Typ	ROCEDURE ess neat/interpass temperature (* erpass temperature (*F) e	Semi-Automatic F) 75°F (Ambient) 400°F N/A N/A N/A	Semi-Automa 75°F (Ambie 400°F N/A N/A	nt)	Semi-Automatic 75°F (Ambient) 400°F N/A N/A N/A
Velding Proc ype Ainimum preh Aaximum inte ungsten Size ungsten Typ iller Metal Si	ROCEDURE ess neat/interpass temperature (* erpass temperature (*F) e ze (n.)	Semi-Automatic F) 75°F (Ambient) 400°F N/A N/A N/A .045° - 0.063°	Semi-Automa 75°F (Ambie 400°F N/A N/A .045″ - 0.063	nt)	Semi-Automatic 75"F (Ankient) 400"F N/A N/A N/A .045" - 0.063"
Velding Proc Type Minimum preh Maximum inte Tungsten Size Tungsten Typ Tiller Metal Si ayer Numbel	ROCEDURE ess neat/interpass temperature (* erpass temperature (*F) e ze (n.) r	Semi-Automatic F) 75°F (Ambient) 400°F N/A N/A N/A .045" - 0.063" Root, 1, 2, and 3	Semi-Automa 75°F (Ambie 400°F N/A N/A .045″ - 0.063 Root, 1, 2 an	nt)	Semi-Automatic 75"F (Ankient) 400"F N/A N/A .045" - 0.063" Root, 1, 2 and 3
Velding Proc Type Minimum preh Maximum inte Tungsten Size Tungsten Typ Filler Metal Si ayer Number Position of Gr	ROCEDURE ess neat/interpass temperature (* erpass temperature (*F) e ie ize (n) r oove	Semi-Automatic F) 75"F (Ambient) 400"F N/A N/A N/A .045" - 0.063" Root, 1, 2, and 3 Overhead 4G Overhead 4G	Semi-Automa 75°F (Ambie 400°F N/A N/A .045″ - 0.063	nt)	Semi-Automatic 75"F (Ankient) 400"F N/A N/A .045" - 0.063" Root, 1, 2 and 3 Overhead 4G
Welding Proc Type Minimum preh Maximum inte Tungsten Size Tungsten Typ Filler Metal Si "ayer Number Position of Gr Weld Progres	ROCEDURE eess neat/interpass temperature (*) e ie ize (n.) r oove	Semi-Automatic F) 75°F (Ambient) 400°F N/A N/A N/A .045" - 0.063" Root, 1, 2, and 3	Semi-Automa 75°F (Ambie 400°F N/A N/A .045″ - 0.063 Root, 1, 2 an Overhead 4	nt)	Semi-Automatic 75"F (Ankient) 400"F N/A N/A .045" - 0.063" Root, 1, 2 and 3
Velding Proc Type Minimum preh Maximum inte Tungsten Size Tungsten Typ Filler Metal Si Layer Number Position of Gr Veld Progres Current/Polari	ROCEDURE eess neat/interpass temperature (*) e ie ize (n.) r oove	Semi-Automatic F) 75°F (Ambient) 400°F N/A N/A 0.45° - 0.063°' Root, 1, 2, and 3 Overhead 4G N/A N/A	Semi-Automa 75°F (Ambie 400°F N/A N/A .045° - 0.060 Root, 1, 2 an Overhead 4 N/A	nt)	Semi-Automatic 75°F (Ankient) 400°F N/A N/A .045° - 0.063° Root, 1, 2 and 3 Overhead 4G N/A
Velding Proce Type Minimum preh Maximum inte Tungsten Size Tungsten Typ Filler Metal Si Jayer Number Position of Gr Veld Progres Current/Polari Amperes	ROCEDURE eess neat/interpass temperature (*) e ie ize (n.) r oove	Semi-Automatic F) 75°F (Ambient) 400°F N/A N/A 0.45° - 0.063°' Root, 1, 2, and 3 Overhead 4G N/A N/A	Semi-Automa 75°F (Ambie 400°F N/A N/A .045° - 0.060 Root, 1, 2 an Overhead 4 N/A	nt)	Semi-Automatic 75°F (Ankient) 400°F N/A N/A .045° - 0.063° Root, 1, 2 and 3 Overhead 4G N/A
	ROCEDURE ess meat/interpass temperature (*) e r ze (n.) r coove sion ity	Semi-Automatic F) 75°F (Ambient) 400°F N/A N/A 0.45° - 0.063° Root, 1, 2, and 3 Overhead 4G N/A DCEP	Semi-Automa 75°F (Ambie 400°F N/A N/A .045° - 0.060 Root, 1, 2 an Overhead 4 N/A DCEP	nt)	Semi-Automatic 75°F (Ankient) 400°F N/A N/A .045" - 0.063" Root, 1, 2 and 3 Overhead 4G N/A DCEP
Velding Proce Fype Minimum pref Maximum inte Fungsten Size Fungsten Typ Filler Metal Si Jayer Numbea Jayer Numbea Oveld Progres Current/Polari Amperes Volts Fravel Speed	ROCEDURE ess meat/interpass temperature (*) e e ze (n.) r oove sion ity (n./min)	Semi-Automatic F) 75"F (Ambient) 400"F N/A N/A 0.45" - 0.063" Root, 1, 2, and 3 Overhead 4G N/A DCEP 2 26	Semi-Automa 75°F (Ambie 400°F N/A N/A 045° - 0.06 Root, 1, 2 an Overhead 4 N/A DCEP 26	nt)	Semi-Automatic 75°F (Ankient) 400°F N/A N/A .045° - 0.063° Root, 1, 2 and 3 Overhead 4G N/A DCEP 26
Velding Proce rype Minimum preh Maximum inte rungsten Size rungsten Typ Filler Metal Si ayer Number ayer Number astion of Gr Veld Progres Current/Polari Amperes Volts	ROCEDURE ess meat/interpass temperature (*) e e ze (n.) r oove sion ity (n./min) at Input (ij/m)	Semi-Automatic F) 75"F (Ambient) 400"F N/A N/A 0.45" - 0.063" Root, 1, 2, and 3 Overhead 4G N/A DCEP 2 26	Semi-Automa 75°F (Ambie 400°F N/A N/A 045° - 0.06 Root, 1, 2 an Overhead 4 N/A DCEP 26	nt)	Semi-Automatic 75°F (Ankient) 400°F N/A N/A .045° - 0.063° Root, 1, 2 and 3 Overhead 4G N/A DCEP 26
Velding Proce Type Minimum preh Maximum inte fungsten Size Tungsten Typ Filler Metal Si Layer Number Position of Gr Veld Progres Costion of Gr Veld Progres Volts Travel Speed Maximum Hea DC Pulsing Co	ROCEDURE ess meat/interpass temperature (*) e e ze (n.) r oove sion ity (n./min) at Input (ij/m)	Semi-Automatic F) 75"F (Ambient) 400"F N/A N/A 0.45" - 0.063" Root, 1, 2, and 3 Overhead 4G N/A DCEP 2 26	Semi-Automa 75°F (Ambie 400°F N/A N/A 045° - 0.06 Root, 1, 2 an Overhead 4 N/A DCEP 26	nt)	Semi-Automatic 75°F (Ankient) 400°F N/A N/A .045° - 0.063° Root, 1, 2 and 3 Overhead 4G N/A DCEP 26
Velding Proce Type Minimum preh Maximum inte Tungsten Size Tungsten Typ Filler Metal Si Layer Number Position of Gr Veld Progres Vold Progres Vold Progres Volts Travel Speed Maximum Hea DC Pulsing Cr Shielding:	ROCEDURE ess enpast temperature (*) e e ze (n.) r coove sion ity (n.4nin) at Input (kj/n) urrent	Semi-Automatic F) 75°F (Ambient) 400°F N/A N/A N/A .045" - 0.063" Root, 1, 2, and 3 Overhead 4G N/A DCEP 26 6 - 10 ipm 10 ipm	Semi-Automa 75°F (Ambie 400°F N/A N/A 045° - 0.06 Root, 1, 2 an Overhead 4 N/A DCEP 26 6 - 10 ipm	nt)	Semi-Automatic 75"F (Ankient) 400"F N/A N/A .045" - 0.063" Root, 1, 2 and 3 Overhead 4G N/A DCEP 26 6 - 10 ipm
Velding Proce Type Minimum preh Maximum inte Tungsten Size Tungsten Typ Filler Metal Si Layer Number Position of Gr Weld Progress Current/Polari Anperes Zolts Travel Speed Maximum Hea DC Pulsing Co Shielding:	ROCEDURE ess enpast temperature (*) e pass temperature (*) e ze (n.) r coove sion ity (n.4nin) at Input (kj/n) urrent Gas Type	Semi-Automatic F) 75°F (Ambient) 400°F N/A N/A N/A .045° - 0.063° Overhead 4G N/A Overhead 4G N/A DCEP 26 6 - 10 ipm Argon / CO2 - 75% / 25% CO2 - 75% / 25%	Semi-Automa 75°F (Ambie 400°F N/A N/A 045° - 0.06: Root, 1, 2 an Overhead 4 N/A DCEP 26 6 - 10 ipm	nt)	Semi-Automatic 75"F (Ankient) 400"F N/A N/A 045" - 0.063" Root, 1, 2 and 3 Overhead 4G N/A DCEP 26 6 - 10 ipm Argon /CO2 - 75% / 25%
Velding Proce Type Minimum preh Maximum inte Tungsten Size Tungsten Typ Filler Metal Si Layer Number Position of Gr Weld Progress Current/Polari Amperes Volts Travel Speed Maximum Hea DC Pulsing C Shielding:	ROCEDURE ess enpast temperature (*) e epass temperature (*) e ze (n.) r coove sion ty (n.4nin) at Input (ij/n) urrent Gas Type Flow Rate (offn)	Semi-Automatic F) 75°F (Ambient) 400°F N/A N/A 0.45° - 0.063° Root, 1, 2, and 3 Overhead 4G N/A DCEP 26 6 - 10 ipm 400°F 26 0.10 ipm 0.10 ipm	Semi-Automa 75°F (Ambie 400°F N/A N/A 045″ - 0.06: Root, 1, 2 an Overhead 4 N/A DCEP 26 6 - 10 ipm 26 6 - 10 ipm Argon / CO2 - 759 10 - 30 CFł	nt)	Semi-Automatic 75"F (Ankient) 400"F N/A N/A 045" - 0.063" Root, 1, 2 and 3 Overhead 4G N/A DCEP 26 6 - 10 ipm Argon /CO2 - 75% / 25% 10 - 30 CFH
Velding Proce Type Minimum preh Maximum inte Tungsten Size Tungsten Typ Filler Metal Si Layer Number Position of Gr Veld Progress Current/Polari Amperes Autorent/Polari Amperes Autores Autores Content Travel Speed Maximum Hea OC Pulsing Co Shielding:	ROCEDURE ess enpass temperature (*) e epass temperature (*) e ze (n.) r coove sion tr (ntnin) at Input (ij.in) at Input (ij.in) urrent Gas Type Flow Rate (offn) Gas Type	Semi-Automatic F) 75°F (Ambient) 400°F N/A N/A 0.45° - 0.063° Root, 1, 2, and 3 Overhead 4G N/A DCEP 26 6 - 10 ipm 400°F 26 0.10 ipm 0.10 ipm	Semi-Automa 75°F (Ambie 400°F N/A N/A 045″ - 0.06: Root, 1, 2 an Overhead 4 N/A DCEP 26 6 - 10 ipm 26 6 - 10 ipm Argon / CO2 - 759 10 - 30 CFł	nt)	Semi-Automatic 75"F (Ankient) 400"F N/A N/A 045" - 0.063" Root, 1, 2 and 3 Overhead 4G N/A DCEP 26 6 - 10 ipm Argon /CO2 - 75% / 25% 10 - 30 CFH
Velding Proce Type dinimum preh daximum inte fungsten Size fungsten Typ filler Metal Si fungsten Type siller Metal Size of Progres Current/Polari Amperes Auts fravel Speed daximum Hea OC Pulsing Co Shielding: frailing: dacking:	ROCEDURE ess ess enpass temperature (*) e epass temperature (*) e ze (n.) r coove sion r coove sion ity (n./min) at Input (¢i/m) urrent Gas Type Flow Rate (cfh) Gas Type Flow Rate (cfh)	Semi-Automatic F) 75"F (Ambient) 400"F N/A N/A 0.45" - 0.063" Root, 1, 2, and 3 Overhead 4G N/A DCEP 26 6 - 10 ipm 47gon / CO2 - 75% / 25% 10 - 30 CFH N/A N/A	Semi-Automa 75°F (Ambie 400°F N/A N/A 045° - 0.06: Root, 1, 2 an Overhead 4 N/A DCEP 26 6 - 10 ipm Argon / CO2 - 759 10 - 30 CFI N/A	nt)	Semi-Automatic 75"F (Ambient) 400"F N/A N/A .045" - 0.063" Root, 1, 2 and 3 Overhead 4G N/A DCEP 26 6 - 10 ipm Argon / CO2 - 75% / 25% 10 - 30 CFH N/A
Velding Proce Type dirimum preh daximum inte fungsten Size fungsten Typ Filler Metal Si ayer Number Position of Gr Veld Progres Current/Polari Amperes /olts fravel Speed daximum Hea DC Pulsing Cr Shielding: frailing: Backing:	ROCEDURE ess heat/interpass temperature (*) e pe ze (n.) r coove sion ity (in./min) at Input (id/n) urrent Gas Type Flow Rate (ofh) Gas Type Flow Rate (ofh) Gas Type Flow Rate (ofh)	Semi-Automatic F) 75"F (Ambient) 400"F N/A N/A 0.45" - 0.063" Root, 1, 2, and 3 Overhead 4G N/A DCEP 26 6 - 10 ipm 47gon / CO2 - 75% / 25% 10 - 30 CFH N/A N/A	Semi-Automa 75°F (Ambie 400°F N/A N/A 045° - 0.06: Root, 1, 2 an Overhead 4 N/A DCEP 26 6 - 10 ipm Argon / CO2 - 759 10 - 30 CFI N/A	nt)	Semi-Automatic 75"F (Ambient) 400"F N/A N/A .045" - 0.063" Root, 1, 2 and 3 Overhead 4G N/A DCEP 26 6 - 10 ipm Argon /CO2 - 75% / 25% 10 - 30 CFH N/A
Velding Proce Type Minimum preh Maximum inter Fungsten Type Filler Metal Si Position of Gr Aupperes Volt3 Fravel Speed Maximum Hea DC Pulsing Cr Shielding: Frailing: Backing:	ROCEDURE ess heat/interpass temperature (*) e e ze (n) r oove sion ity (in./min) at Input (¢/m) urrent Gas Type Flow Rate (ofh) Gas Type Flow Rate (ofh) Gas Type Flow Rate (ofh) we	Semi-Automatic F) 75"F (Ambient) 400"F N/A N/A 0.45" - 0.063" Root, 1, 2, and 3 Overhead 4G N/A DCEP 26 6 - 10 ipm Argon / CO2 - 75% / 25% 10 - 30 CFH N/A N/A	Semi-Automa 75°F (Ambie 400°F N/A N/A 045° - 0.06: Root, 1, 2 an Overhead 4 N/A DCEP 26 6 - 10 ipm Argon / CO2 - 755 10 - 30 CF} N/A	nt)	Semi-Automatic 75"F (Ambient) 400"F N/A N/A .045" - 0.063" Root, 1, 2 and 3 Overhead 4G N/A DCEP 26 6 - 10 ipm Argon /CO2 - 75% / 25% 10 - 30 CFH N/A
Velding Proc Type Minimum pref Maximum inte Tungsten Size Tungsten Typ Filler Metal Si ayer Numbee Soliton of Gr Veld Progres Current/Polari Amperes Volts Travel Speed Maximum Hee OC Pulsing C Shielding: Trailing: Backing: String or Vea Drifce/Gas C	ROCEDURE ess meat/interpass temperature (*) e e ze (n) r cove sion ity (in.min) at Input (\u00ed im) urrent Gas Type Flow Rate (oft) Gas Type Flow Rate (oft) Gas Type Flow Rate (oft) Gas Type	Semi-Automatic F) 75"F (Ambient) 400"F N/A N/A N/A .045" - 0.063" Root, 1, 2, and 3 Overhead 4G N/A DCEP 26 6 - 10 ipm 400 F Argon / CO2 - 75% / 25% 10 - 30 CFH N/A N/A String or Weave 10 - 30 CFH	Semi-Automa 75°F (Ambie 400°F N/A N/A 045° - 0.063 Root, 1, 2 an Overhead 4 N/A DCEP 26 6 - 10 ipm Argon / CO2 - 75° 10 - 30 CFI N/A N/A String or Wea	nt)	Semi-Automatic 75°F (Ambient) 400°F N/A N/A 045°'-0.063°' Root, 1, 2 and 3 Overhead 4G N/A DCEP 26 6 - 10 ipm Argon /CO2 - 75% / 25% 10 - 30 CFH N/A N/A String or Weave
Velding Proce Fype Minimum preh Maximum inter Fungsten Size Fungsten Typ Filler Metal Si avger Number Position of Gr Veld Progres Current/Polari Amperes Volts Fravel Speed Maximum Hea DC Pulsing C Shielding: Frailing: Backing: String or Wea	ROCEDURE ess heat/interpass temperature (*) e pass temperature (*) e ze (n.) r cove sion ity (in./min) at Input (\u00eduk) try (in./min) at Input (\u00eduk) cove sion ity flowRate (offi) Gas Type FlowRate (offi) Gas Type FlowRate (offi) we up Size ass per Side	Semi-Automatic F) 75°F (Ambient) 400°F N/A N/A N/A .045° - 0.063° Overhead 4G N/A Overhead 4G N/A DCEP 26 6 - 10 ipm Argon / CO2 - 75% / 25% 10 - 30 CFH N/A N/A String or Weave 1/2"	Semi-Automa 75°F (Ambie 400°F N/A N/A 045° - 0.06: Root, 1, 2 an Overhead 4 N/A DCEP 26 6 - 10 ipm 26 6 - 10 ipm Argon / CO2 - 759 10 - 30 CF} N/A N/A String or Weat 1/2″	nt)	Semi-Automatic 75°F (Ambient) 400°F N/A N/A 045° - 0.063° Root, 1, 2 and 3 Overhead 4G N/A DCEP 26 6 - 10 ipm 26 6 - 10 ipm Argon / CO2 - 75% / 25% 10 - 30 CFH N/A N/A String or Weave 1/2°

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esponsible Office	: NASA SSC Center	Operations Oper	tions and Main	v	
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UDJECI: Flux	Cored Arc Welding (rcaw) of Struc	aurai Carboli A	Steel	
NASA Space John C	al Aeronautics and Administration 2. Stennis Space Center s Space Center, MS 39529-600		MERICAN WELDING	SOCIETY (WPS)	
Welding Procedure Specificati SSTD-8070-0123-WELD		Date June 1, 2019	Rev C	ision Number	
Qualified To		Company Name			
AWS D1.1		Syncom Space	Services (S3)		
BASE METALS					
Peening	Not allowed.				
Surface Preparation	Joint Prep - Flame cut and light	grinding on surfaces to be v	velded.		
Initial/Interpass Cleaning	Chipping, Hammer, Wire Brush	, and Grinding			
Back Gouging Method	None				
POSTWELD HEAT TREAT	None				
Temperature Time and Temperature	None				-
•					-
Other	None				
A. AWS D1.1 Table 3.1 B. Root Opening: 5/32	,				
Root Face Dimension					
Groove Angle: 37 1	/2°				
C. Weld wire to be used	shall be SFA A5.20, A5.29, or A	5.36.			
Signature 1 Engineer Name	Signature	Signature 2 Quality Name		33	
Doug Dike		George Smith	Signa		
Date	- 7/ N	Date	M		the
June 1, 2019	4 4 M	June 1, 2019	Ol-	myrc. Am	
Signature 3		Signature 4			
Customer Reviewer Name	Signature	Customer Name	Signa	ature	
Benjamin McGrath		LANASA 580			
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June 1, 2019	1 mg / mg				

Page 2 of 3

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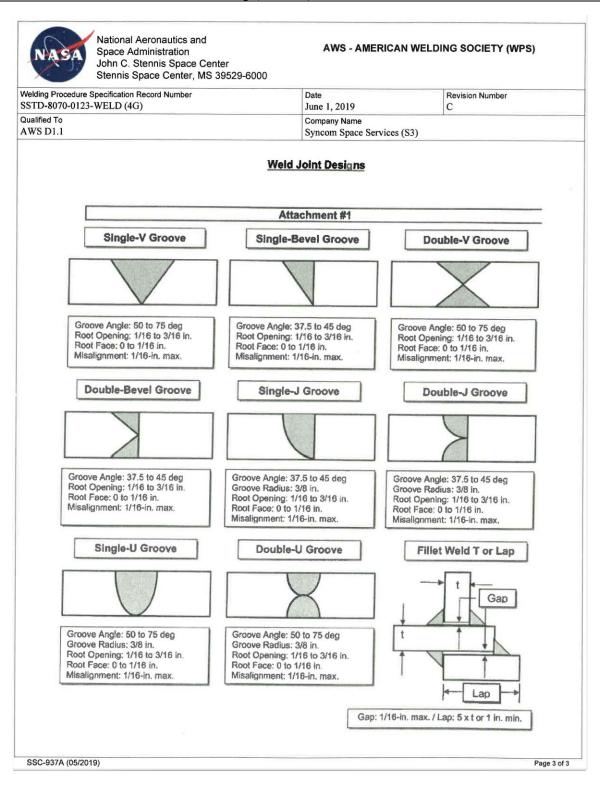
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 Effective Date:
 July 1, 2019

 Review Date:
 July 1, 2024

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Responsible Office: NASA SSC Center Operations, Operations and Maintenance Division SUBJECT: Flux Cored Arc Welding (FCAW) of Structural Carbon Steel



Standard Description	Stenni	s							SSTD-8070	0-0123-WELD	D	
Review Date: July 1, 2024 Page 23 of Page 23 of Responsible Office: NASA SSC Center Operations, Operations and Maintenace Division SUBJECT: Flux Cored Arc Welding (FCAW) of Structural Carbon Steel 6 Overhead Position 4G, PQR SWR PT0A7Q1BTR-4 Welding Procedure Specific ATION (MPD) Yes 8 PREDUALIFE or PROCEDURE OUALIFICATION RECORDS (POR) Yes 9 Company Name Mississipal Space Services Welding Processies) FOAW Supporting PQR No. (a) SWR PT0A7Q1BTR-4 JOINT DESIGN USED Type: Single 8 Double Weld D Backing Material: SWS D/1 Table 3.1 chrougs 1.8 II. Red Operating 5227 cold free Dimension 2.20 Groove Angle: 37.127 Redus (J-U) NA Back Couping: Yes 8 No D Backing Material: SWS D/1 Table 3.1 chrougs 1.8 II. Red Operating 5227 cold free Dimension 2.20 Groove Angle: 37.127 Redus (J-U) NA Back Mode (GMAW) Short-Circulting D Groove Angle: 37.127 Redus (J-U) NA Back Mode (GMAW) Short-Circulting D Groove Angle: 37.127 Redus (J-U) NA Back Mode (GMAW) Short-Circulting D Groove Angle: 37.127 Redus (J-U) NA Back MS Specification Sec Staff Fillet 2.187 Type or Grade AMS D1.1 Table 3.1 chrougs 1.8 II. Thickness: Groove 2.187 Fillet 2.187 Billet METALS AWS Specification Sec Staff Fillet 2.187 Group Land Group II materials. Billetorde File (Class MS D1.1 Table 3.1 chrougs 1.8 II. Compared Nationals (Price) 2.247 Fillet Metals Transfer Mode (GMAW) Size Materials Material Spec. NA AWS Specification Sec Staff Fillet 2.17 Fillet METALS AWS Specification Sec Staff Fillet 2.17 Fillet METALS AWS Specification Sec Staff Fillet 2.18 Fillet Metals Torp, MA Transfer Mode (Specing Metal Materials Shife Direct Materials 1.17 Corent AC D DCEP B Directorde File (Class MS D1.1 Table 3.1 chrougs 1	Standa	ard						F		ter July 1 2010	Rev.	
Page 23 of Responsible Office: NASA SSC Center Operations, Operations and Maintenance Division SUBJECT: Flux Cored Arc Welding (FCAW) of Structural Carbon Steel .6 Overhead Position 4G, PQR SWR PT0A7Q1BTR-4 WELDING PROCEDURE Services Outline Do by TESTING (************************************								┝				
Responsible Office: NASA SSC Center Operations, Operations and Maintenance Division SUBJECT: Flux Cored Arc Welding (FCAW) of Structural Carbon Steel .6 Overhead Position 4G, PQR SWR PT0A7Q1BTR-4 Welding Procession: Operations, Corespondence of the procession								ŀ	Iterien Dau		e 23 of	
SUBJECT: Flux Cored Are Welding (FCAW) of Structural Carbon Steel 6 Overhead Position 4G, PQR SWR PT0A7Q1BTR-4 Metalong PROCEDURE QUALIFIED Overhead Position 4G, PQR SWR PT0A7Q1BTR-4 Metalong PROCEDURE QUALIFIED Overhead AG PROCEDURE QUALIFIED Overhead AG PROCEDURE QUALIFIED Overhead AG PROCEDURE QUALIFIED Single 80 Single 80 Single 80 Single 80 Single 80 Backing: Yes B No □ Backing: Soci face Dimension	Respo	nsible Of	fice: N	ASA S	SC Ce	nter Op	erations, Or	oerati	ons and M	U		
.6 Overhead Position 4G, PQR SWR PT0A7Q1BTR-4. MELDING PROCEDURE SPECIFICATION (MPE) Yes B predocularified on the second system of the sec	-					1						
WELDING PROCEDURE SPECIFICATION (WPS) Yes B QUALIFIED CONTON RECORDS (PGN) Vestion of Process (PGN) Company Name _Missission Scace Services Welding Process(es)FCAM Vestion							,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,					
Company Name_Missission Space Services Discrete Services Discrete Services Weiding Process(es) FCAW Supporting PQR No. (s) SWR PTOA7Q IBTR-4 JOINT DESIGN USED Type - Manual I Type: Machine I Single 8 Double Weid I Backing Kes 8 ^{TV} No II ELECTRICAL CHARACTERISTICS Root Opening 522: Roof Face Dimension_Zero Globular 80 Spray II Corrent: AC III DESIGN USED Transfer Mode (GMAW) Backing Materia: AWS D1.1 Trable 3.1 Groups 18.11 ELECTRICAL CHARACTERISTICS Root Opening 522: Roof Face Dimension_Zero Group or Grade _AWS D1.1 Type or Grade _AWS D1.1 Tupics 1.1 Type or Grade _AWS D1.1 Tupics 1.1 Type or Grade _AWS D1.1 Trable 3.1 Groups 18.11 Trapsfer Mode (GMAW) Stringer or Wasee Bead: Stringer and Weave Multi-pass or Single Pass (per side) AWS Specification _See AWS D1.1 Trable 3.1 Groups 18.11 Type: MA Composition 739/225% Contact Tube to Work Distance 1/2 - 1* Filler Metals Gas Cup Size 1/2* PREHEAT Ges Cup Size 1/2* PreheAT Travel Mode Proteset Temp, Min _75*F (Ambient) Time _NA </th <th>.6</th> <th>Overhea</th> <th>d Positi</th> <th>W</th> <th></th> <th></th> <th>QUALIFIE</th> <th>FION (V D BY T</th> <th>VPS) Yes⊠ ESTING <u>√</u></th> <th></th> <th></th>	.6	Overhea	d Positi	W			QUALIFIE	FION (V D BY T	VPS) Yes⊠ ESTING <u>√</u>			
Supporting PQR No. (s) SWR PT0A701BTR4 Machine D Automatic D JOINT DESIGN USED Type: Single 8 Double Weld D Backing: Yes 87 No D Backing: Up Down D Backing: Yes 87 No D Backing: Up Down D Backing: Yes 87 No D Backing: Up Down D Backing: Yes 87 No D Backing: Up Down D Backing: Yes 87 No D Backing: Up Down D Back MC Opening 5022 Radius (J-U) NA ELECTRICAL CHARACTERISTICS Back MC Souging: Yes Di N pM Method Current: AC D DCEP 8 DOEN D Pulsed D Material Spec AWS D1.1 Table 3.1 Groups I & H Tugsten Electrode (GTAW) Size: N/A Tugsten Electrode (GTAW) Type : Single Pass (per side) Multipass None of Electrodes 1 Electrodes 1 Multipass Virge 124 Fillet Metals 30 CEH Corneat Tube to Work Distance 172 - 1* Peening None NA Electrode-Flux (Class) N/A (Fraz 30 CEH Gas Cup Size 172* Context Tube to Work Distance 172 - 1* Peening None NA						ices	Revision _ A	by R		003 By W. St. C Date: 10/30/0		
Type: Position of Groove: Overhead 4G Fillet: 4G Single 88 Double Weld □ Vertical Progression: Up □ Down □ Backing Meterial: AVIS D1/1 Table 3.1. Groups 1& II ELECTRICAL CHARACTERISTICS Root Opening 5/02; Root Dopping 5/02; Shot Diping 5/02; Shot Diping 5/02; Back METALS AVIS D1.1 Table 3.1. Groups 1 & II Transfer Mode (GMAW) Shot-Circuiting □ BASE METALS AVIS D1.1 Table 3.1. Groups 1 & II Transfer Mode (GMAW) Shot-Circuiting □ Material Spec. AVIS D1.1 Table 3.1. Groups 1 & II Transfer Mode (GMAW) Shot-Circuiting □ Material Spec. AVIS D1.1 Table 3.1. Groups 1 & II Transfer Mode (GMAW) Shot-Circuiting □ Material Spec. AVIS D1.1 Table 3.1. Groups 1 & II Transfer Mode (GMAW) Shot-Circuiting □ Material Spec. AVIS D1.1 Table 3.1. Groups 1 & II Transfer Mode (GMAW) Shot-Circuiting □ Muster CPipe) 224* Transfer Mode (GMAW) Shot-Circuiting □ Gibbot Multipass FILLER METALS AVIS Classification AS 20 or A5.29 Multipass or Single Pass (per side) Multipass ShifeLDING		-		1		21BTR-4			0 (
Single B Double Weld □ Backing: Yes B Backing: <t< td=""><td></td><td></td><td>SIGN USED</td><td>)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>			SIGN USED)								
Backing: Yes B [™] No □ Backing Material: AWS D1.1 Table 3.1. Groups 1.8 II Root Opening 5725. Root Face Dimension Zero Groove Angle: <u>37-1/2</u> Radius (J-U) <u>N/A</u> Back Gouging: Yes □ No,/B Method BASE METALS / Material Spec. <u>AWS D1.1</u> Type or Grade <u>AWS D1.1 Table 3.1. Groups 1.8 II</u> Thickness: Groove <u>21/8</u> Fillet <u>21/8</u> Turgsten Electrode (GTAW) Size: <u>N/A</u> Tingsten Electrode (GTAW) Size: <u>N/A</u> Composition 75%/25% Electrode Flux (Class) <u>N/A Fillet 20 CFH</u> Gas Cup Size <u>1/2</u> PreHEAT Preheat Temp., Min <u>75°F</u> (Ambient: Time <u>N/A</u> Time <u>N/A</u> Time <u>N/A</u> Time <u>N/A</u> Time <u>N/A</u> Time <u>N/A</u> Time <u>N/A</u> Time <u>N/A</u> Sign <u>Time</u> <u>Travel</u> Joint Details Filler Metals <u>Current</u> <u>Fass or <u>Filler Metals</u> <u>Current</u> <u>Fass or Filler Metals <u>Current</u> <u>Fass or Filler Metals <u>Current</u> <u>Fass or Filler Metals <u>Current</u> <u>Fass or Filler Metals <u>Current</u> <u>Filler Metals <u>Current</u> <u>Fass or Filler Metals <u>Current</u> <u>Fass or Filler Metals <u>Current</u> <u>Filler Metals <u>Curr</u></u></u></u></u></u></u></u></u></u></u></u></u></u></u></u></u></u></u></u>				Devis	lo Wold F	-				tes and the second s		
Root Opening <u>5/32</u> " Roofing Face DimensionZero Groove Angle:Radius (J-U)NA Transfer Mode (GMAW)Short-Circuiting □ Giobular BSpray □ Current: AC □ DCEP BDCEN □ Pulsed □ Other Tungsten Electrode (GTAW) Size:NA Tungsten Electrode (GTAW) Size: NAA Tungsten Electrode (GTAW) Size: NAA Tungsten Electrode (GTAW) Size: NAA Tungsten Electrode (GTAW) Size: NAA Size: NAA Tungsten Electrode (GTAW) Size: Size: Size: AWS Specification AWS Classification Group I and Group II materials SHIELDING FluxGas Argon/CO Composition 75%/25%, Electrode-Flux (Class) NA Gas Cup Size/2" PREHEAT PREHEAT Preheat Temp, Min75*F_ (Ambient) Interpass Cleaning: Chipping Hammer. Wire Brush, Grinding PREHEAT Preving ROOT FCAW E71T-1 1/16* DCEP 192 in/min 26 8 ipm 421 FCAW E71T-1 1/16* DCEP 192 in/min 26 8 ipm 421 FCAW E71T-1 1/16* DCEP 192 in/min 26 8 ipm 421 FCAW E71T-1 1/16* DCEP 192 in/min 26 8 ipm 421 FCAW E71T-1 1/16* DCEP 192 in/min 26 8 ipm 422 k FCAW E71T-1 1/16* DCEP 192 in/min 26 8 ipm 421 FCAW E71T-1 1/16* DCEP 192 in/min 26 8 ipm 422 k FCAW E71T-1 1/16* DCEP 192 in/min 26 8 ipm 421 FCAW E71T-1 1/16* DCEP 192 in/min 26 8 ipm 422 k FCAW E71T-1 1/16* DCEP 192 in/min 26 8 ipm 423 k FCAW E71T-1 1/16* DCEP 192 in/min 26 8 ipm 424 k FCAW E71T-1 1/16* DCEP 192 in/min 26 8 ipm 425 k ipm Joint Details 426 k ipm Joint Details 427 k FCAW E71T-1 1/16* DCEP		Backing:		No 🗆				ression	. Орш			
Groove Angle:		Backing Ma	aterial: AWS	D1.1 Tab	le 3.1. G	roups &	ELECTRICA	L CHA	RACTERISTICS			
BASE METALS Material Spec. AWS D1.1 Type or Grade AWS D1.1 Table 3.1 Groups I & II Thickness: Groove $\geq 1/8^{\circ}$ Fillet $\geq 1/8^{\circ}$ Fillet $\geq 1/8^{\circ}$ <br< td=""><td></td><td>Groove Ang</td><td>gle:37-1.</td><td>/2⁶ Radi</td><td>us (J-U)</td><td>N/A</td><td>_</td><td>,</td><td>Glob</td><td>ular 🖾 Spray 🗆</td><td></td></br<>		Groove Ang	gle:37-1.	/2 ⁶ Radi	us (J-U)	N/A	_	,	Glob	ular 🖾 Spray 🗆		
Material Spec. ^AWS D1.1 Type or Grade AWS D1.1 Table 3.1 Groups I & II Thickness: Group 1 and Group I is a 1.8 if FILLER METALS AVS Specification AWS Specification A5.20 or A5.29 AWS Classification See AWS D1.1 Table 3.1 for Multipass or Single Pass (per side) Group II materials Multipass or Single Pass (per side) Flux Gas Argon/CO2 Composition 75%/25% Longitudinal Flux Gas Cup Size 1/2* Reterial Temp., Min 75*F (Ambient) Preheat Temp., Min 75*F (Ambient) Interpass Temp., Min 75*F (Ambient) Presenses Temp., Min Type & Amps or Wire Weld Layer(s) Process Weld Eiler Metals ROOT FOAW VECTIV 1/16* Q226 FOAW FOAW F711-1 Q226 FOAW Pass or Class Weld Layer(s) Process Class Diam. Polarity Feed Speed Joint Details ROOT FOAW </td <td></td> <td>BASE MET</td> <td>ALS 1</td> <td></td> <td></td> <td></td> <td>-</td> <td></td> <td>DCEP 🛛 DC</td> <td>EN D Pulsed D</td> <td></td>		BASE MET	ALS 1				-		DCEP 🛛 DC	EN D Pulsed D		
Thickness: Groove $\geq 1/8^{\circ}$ Fillet $\geq 1/8^{\circ}$ Type: N/A Diameter (Pipe) $\geq 24^{\circ}$ TECHNIQUE AWS Specification $A5.20 \text{ or } A5.29$ AWS Classification $See AWS D1.1$ Table 3.1 for Group I and Group II materials. TECHNIQUE Stringer or Weave Bead: Stringer and Weave Multipass or Single Pass (per side) Multipass Number of Electrodes 1 Composition 75%/25% Contact Tube to Work Distance 1/2" - 1" Peening None Interpass Temp., Min75°F (Ambient) Interpass Temp., Min75°F (Ambient) Interpass Temp., Min75°F (Ambient) Interpass or Wire Weald VA WELDING PROCEDURE WELDING PROCEDURE Vest Main26 8 jpm 75'			ec. AWS				Tungsten Ele	ectrode	(GTAW)			
Diameter (Pipe) ≥24" FILLER METALS AWS Specification							-	Si	ze: N/A			
AWS Specification A5.20 or A5.29 Stringer or Weave Bead: Stringer and Weave AWS Classification See AWS D1.1 Table 3.1 for Multi-pass or Single Pass (per side) Multipass Group 1 and Group II materials. Number of Electrodes 1 SHIELDING Composition 75%/25% Longitudinal N/A Electrode-Flux (Class) N/A_Flow Rate 30 CFH Contact Tube to Work Distance 1/2" - 1" Gas Cup Size 1/2" Peening None Interpass Cleaning: Chipping Hammer. Wire Brush. Grinding Interpass Cleaning: Chipping Hammer. Wire Brush. Grinding PREHEAT POSTWELD HEAT TREATMENT Temp. N/A Preheat Temp., Min 75°F Amage or Wire Travel Veld Ager(s) Process Class Diam. Filler Metals Current Travel Joint Details ROOT FCAW E711-1 1/16" DCEP 192 in/min 26 8 ipm 4-21 FCAW E711-1 1/16" DCEP 192 in/min 26 8 ipm 2-226 FCAW E711-1 1/16" DCEP 192 in/min 26 8 ip				≥1/8 ^{°°}		21/8"	-	Ту	/pe: N/A		_	
AWS Specification A5.20 or A5.29 Stringer or Weave Bead: Stringer and Weave AWS Classification See AWS D1.1 Table 3.1 for Multi-pass or Single Pass (per side) Multipass Group 1 and Group II materials. Number of Electrodes 1 SHIELDING Composition 75%/25% Longitudinal N/A Electrode-Flux (Class) N/A_Flow Rate 30 CFH Contact Tube to Work Distance 1/2" - 1" Gas Cup Size 1/2" Peening None Interpass Cleaning: Chipping Hammer. Wire Brush. Grinding Interpass Cleaning: Chipping Hammer. Wire Brush. Grinding PREHEAT POSTWELD HEAT TREATMENT Temp. N/A Preheat Temp., Min 75°F Amage or Wire Travel Veld Ager(s) Process Class Diam. Filler Metals Current Travel Joint Details ROOT FCAW E711-1 1/16" DCEP 192 in/min 26 8 ipm 4-21 FCAW E711-1 1/16" DCEP 192 in/min 26 8 ipm 2-226 FCAW E711-1 1/16" DCEP 192 in/min 26 8 ip		FILLER ME	TALS				TECHNIQUE					
Group I and Group II materials. Number of Electrodes 1 SHIELDING Flux Gas Argon/CO2 Composition 75%/25% Composition 75%/25% Contact Tube to Work Distance 1/2" - 1" Electrode-Flux (Class) N/A_Flow Rate 30 CFH Gas Cup Size 1/2" Contact Tube to Work Distance 1/2" - 1" PREHEAT POSTWELD HEAT TREATMENT Temp., Min 75"F (Ambient) Travel POSTWELD HEAT TREATMENT Preheat Temp., Min 75"F Max 400"F Time N/A WELDING PROCEDURE Filler Metals Current Travel Joint Details ROOT FCAW E71T-1 1/16" DCEP 192 in/min 26 8 ipm 4-21 FCAW E71T-1 1/16" DCEP 192 in/min 26 8 ipm 22-26 FCAW E71T-1 1/16" DCEP 192 in/min 26 8 ipm 4-21 FCAW E71T-1 1/16" DCEP 192 in/min 26 8 ipm 22-26 FCAW E71T-1 1/16" DCEP 192 in/min 25 8 ipm 10		AWS Specif	fication				Stringer or W	/eave B				
Electrode SpacingLongitudinalN/ASHIELDINGLateralN/AFluxGas Argon/CO2 Composition 75%/25%Contact Tube to Work DistanceN/AElectrode-Flux (Class)N/A_Flow Rate 30 CFH Gas Cup SizeNoneInterpass Cleaning:Chipping Hammer. Wire Brush. GrindingPREHEATPOSTWELD HEAT TREATMENT Temp., N/APreheat Temp., Min75°F (Ambient)Interpass Temp., MinTorsetWellUrrentWeldLayer(s)ProcessClassDiam.Type & Amps or Wire Feed SpeedVoitsSpeedJoint DetailsROOTFCAWE71T-11/16"Quart192 in/min2& 3FCAWE71T-11/16"DCEP192 in/min268 ipmQuartTravel SpeedJoint DetailsContact Tube to Work DistanceV/ATravel SpeedPass orWingPass orVoitsSpeedJoint DetailsROOTFCAWE71T-11/16"DCEP192 in/min268 ipm22-26FCAW <th col<="" td=""><td></td><td></td><td></td><td></td><td>.1 Table</td><td>3.1 for</td><td></td><td>-</td><td>. ,</td><td>Multipass</td><td></td></th>	<td></td> <td></td> <td></td> <td></td> <td>.1 Table</td> <td>3.1 for</td> <td></td> <td>-</td> <td>. ,</td> <td>Multipass</td> <td></td>					.1 Table	3.1 for		-	. ,	Multipass	
SHIELDINGLateralN/AFluxGasArgon/COAngleN/AComposition 75%/25%Contact Tube to Work Distance $1/2^{-} - 1^{\circ}$ Electrode-Flux (Class)N/AFlow Rate 30 CFHPeeningNoneGas Cup Size $1/2^{\circ}$ Interpass Cleaning: Chipping Hammer. Wire Brush, GrindingPREHEATPOSTWELD HEAT TREATMENTPreheat Temp., Min $75^{\circ}F$ (Ambient)Temp.Interpass Temp., Min $75^{\circ}F$ Max400°FWELDING PROCEDUREWELDING PROCEDURERoorVeldCurrentPass orClassDiam.VeldPolarityFeed SpeedLayer(s)ProcessClassDiam.POLP192 in/min2 & 3FCAWE71T-11/16°DCEP192 in/min2 2-26FCAWE71T-11/16°DCEP192 in/min22-26FCAWE71T-11/16°DCEP192 in/min258 ipm1/2°1/2°1/2°1/2°1/2°1/10°1/10°DCEP1/2°1/2°1/2°1/111/16°DCEP1/2°1/111/16°DCEP1/2°1/111/16°DCEP1/2°1/111/16°DCEP1/2°1/111/16°DCEP1/2°1/111/16°DCEP		Group r anu	oroup in hi	atoriai3.						nal <u>N/A</u>		
Composition 75%/25% Contact Tube to Work Distance 1/2" - 1" Electrode-Flux (Class) N/A_Flow Rate 30 CFH None Gas Cup Size_1/2" Interpass Cleaning: Chipping Hammer, Wire Brush, Grinding PREHEAT POSTWELD HEAT TREATMENT Preheat Temp., Min75°FMax400°F TempN/A Interpass Temp., Min75°FMax400°F TimeN/A WELDING PROCEDURE WELDING PROCEDURE Pass or Weld Layer(s) Process Class POSTWELD 192 in/min 26 8 ipm 75° 2 & 3 FCAW E71T-1 1/16° DCEP 192 in/min 26 4-21 FCAW E71T-1 1/16° DCEP 22-26 FCAW E71T-1 1/16° DCEP 192 in/min 26 8 ipm 1000000000000000000000000000000000000)	0					Lateral	N/A		
Electrode-Flux (Class) N/A_Flow Rate 30 CFH Peening None Gas Cup Size_1/2" Interpass Cleaning: Chipping Hammer, Wire Brush, Grinding PREHEAT POSTWELD HEAT TREATMENT Preheat Temp., Min_75°F (Ambient) TempN/A Interpass Temp., Min_75°F (Ambient) Time_N/A Interpass Temp., Min_75°F (Ambient) TempN/A Interpass Temp., Min_75°F (Ambient) Time_N/A VelLDING PROCEDURE WELDING PROCEDURE Veld Filler Metals Current Veld Process Class Diam. Polarity Feed Speed Volts Speed Joint Details Class Diam. Polarity 2 & 3 FCAW E71T-1 1/16° DCEP 192 in/min 26 8 ipm 4-21 FCAW E71T-1 1/16° DCEP 192 in/min 26 8 ipm 22-26 FCAW E71T-1 1/16° DCEP 192 in/min 26 8 ipm 4-21 FCAW E71T-1 1/16° DCEP 192 in/min 26 8 ipm 22-26 FCAW		riux			and the second		Contact Tube	to Wor				
PREHEAT POSTWELD HEAT TREATMENT Preheat Temp., Min 75°F (Ambient) Temp. Interpass Temp., Min 75°F (Ambient) Temp. WELDING PROCEDURE Weld Interpass Temp. Nin Travel Pass or Filler Metals Current Travel Joint Details Weld Process Class Diam. Polarity Feed Speed Volts Speed Joint Details ROOT FCAW E71T-1 1/16" DCEP 192 in/min 26 8 ipm 75° 2 & 3 FCAW E71T-1 1/16" DCEP 192 in/min 26 8 ipm 4-21 FCAW E71T-1 1/16" DCEP 192 in/min 26 8 ipm 22-26 FCAW E71T-1 1/16" DCEP 192 in/min 26 8 ipm 10 Interpass DCEP 192 in/min 26 8 ipm 10° 22-26 FCAW E71T-1 1/16" DCEP 192 in/min 25 8 ipm 10° 10 Interpass Interpass		Electrode-Fl	lux (Class)	N/A_Flow	Rate 30	CFH	Peening	No	ne			
Preheat Temp., Min75°F (Ambient)Interpass Temp., Min75°F (Max400°FTempN/AWELDING PROCEDUREWELDING PROCEDUREWELDING PROCEDUREPass or Weld Layer(s)Filler MetalsCurrent PolarityPass or Weld Layer(s)Filler MetalsCurrent PolarityTravel SpeedJoint DetailsROOTFCAWE71T-11/16°DCEP192 in/min268 ipm2 & 3FCAWE71T-11/16°DCEP192 in/min268 ipm4-21FCAWE71T-11/16°DCEP192 in/min268 ipm2-26FCAWE71T-11/16°DCEP192 in/min268 ipm2-26FCAWE71T-11/16°DCEP192 in/min258 ipm				Gas	Cup Size	e <u>1/2</u> "	Interpass Cle	aning: (Chipping Hamm	er, Wire Brush, Grindin	9	
Preheat Temp., Min75°F(Ambient) T5°FTemp.N/AInterpass Temp., Min75°FMax400°FTimeN/AWELDING PROCEDUREWELDING PROCEDUREWELDING ProcessClassDiam.Type & Amps or Wire PolarityTravel Feed SpeedJoint DetailsROOTFCAWE71T-11/16°DCEP192 in/min268 ipm4-21FCAWE71T-11/16°DCEP192 in/min268 ipm4-21FCAWE71T-11/16°DCEP192 in/min268 ipm22-26FCAWE71T-11/16°DCEP192 in/min268 ipm22-26FCAWE71T-11/16°DCEP192 in/min268 ipm $= 5/32"$ $= 5/32"$ $= 5/32"$ $= 5/32"$		PREHEAT					POSTWELD	HEAT 1	REATMENT			
WELDING PROCEDUREPass or Weld Layer(s)Filler MetalsCurrentProcessClassDiam.Type & PolarityAmps or Wire Feed SpeedTravel SpeedROOTFCAWE71T-11/16"DCEP192 in/min268 ipm2 & 3FCAWE71T-11/16"DCEP192 in/min268 ipm4-21FCAWE71T-11/16"DCEP192 in/min268 ipm22-26FCAWE71T-11/16"DCEP192 in/min268 ipm22-26FCAWE71T-11/16"DCEP192 in/min258 ipm						10000	Temp. N/A					
Pass or Weld Layer(s)Filler MetalsCurrentTravel PolarityTravel Feed SpeedJoint DetailsROOTFCAWE71T-11/16"DCEP192 in/min268 ipm2 & 3FCAWE71T-11/16"DCEP192 in/min268 ipm4-21FCAWE71T-11/16"DCEP192 in/min268 ipm22-26FCAWE71T-11/16"DCEP192 in/min268 ipm22-26FCAWE71T-11/16"DCEP192 in/min258 ipm		interpass Te	emp., Min_	/5°F	Max			20				
Weld Layer(s)ProcessClassDiam.Type & PolarityAmps or Wire Feed SpeedTravel SpeedJoint DetailsROOTFCAWE71T-11/16"DCEP192 in/min268 ipm2 & 3FCAWE71T-11/16"DCEP192 in/min268 ipm4-21FCAWE71T-11/16"DCEP192 in/min268 ipm22-26FCAWE71T-11/16"DCEP192 in/min258 ipm21-8E71T-11/16"DCEP192 in/min258 ipm22-26FCAWE71T-11/16"DCEP192 in/min258 ipm	[Filler	Metals							
ROOT FCAW E71T-1 $1/16"$ DCEP 192 in/min 26 8 ipm 75" 2 & 3 FCAW E71T-1 $1/16"$ DCEP 192 in/min 26 8 ipm 75" 4-21 FCAW E71T-1 $1/16"$ DCEP 192 in/min 26 8 ipm 10" 10" 22-26 FCAW E71T-1 $1/16"$ DCEP 192 in/min 25 8 ipm 10" 10		Weld	Process	Class	Diam.			Volts		Joint Details		
2 & 3 FCAW E71T-1 $1/16"$ DCEP 192 in/min 26 8 ipm 4-21 FCAW E71T-1 $1/16"$ DCEP 192 in/min 26 8 ipm 22-26 FCAW E71T-1 $1/16"$ DCEP 192 in/min 26 8 ipm 22-26 FCAW E71T-1 $1/16"$ DCEP 192 in/min 25 8 ipm 4-21 FCAW E71T-1 $1/16"$ DCEP 192 in/min 26 8 ipm 22-26 FCAW E71T-1 $1/16"$ DCEP 192 in/min 25 8 ipm			FCAW	E71T-1		DCEP	and an and a second			75.		
4-21 FCAW E71T-1 $1/16"$ DCEP 192 in/min 26 8 ipm 4.21 22^{-23} $22^$										10		
22-26 FCAW E71T-1 1/16" DCEP 192 in/min 25 8 ipm $72 - 73 - 73 - 73 - 73 - 73 - 73 - 73 - $									1.	22 - 23 24 23		
										12 SIZ 13		
		22-20	FGAW	E/11-1	1/16	DCEP	192 in/min	25	в ipm	FT-	5	
Form E 1 (Eropi)										5/32	ul	
rome-r (riony	L	Form E-1 (From	nt)		L	1						

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	FIUCE	dure Qualificati		t Results	UNICTORIG		
			TEM	SILE TEST		4G Positi	on
Specimen No.	Width	Thickness	Area	a U	timate tensile load, lb.	Ultimate unit stress, psi	Character o failure and location
T-1	0.752"	0.976"	0.734"	59,3	00	80,790	BASE
T-2	0.757"	0.964"	0.730"	59,6	00	81,644	BASE
			GUIDED	BEND TES	т		
Specimen No.	Type of bend	Re	esult			Remarks	
SB-1	Side Bend	Satist	factory				
SB-2	Side Bend	Satist	factory				
SB-3	Side Bend	Satist	factory				
SB-4	Side Bend	Satist	factory				
VISUAL INSPI	ECTION						
Appearance _	Acceptable			Radiograph	ic-ultrasonic exa	amination	
Undercut	None					Result	
Piping porosity	/ None			UT report no	b.: <u>N/A</u>	Result	N/A
Convexity	None				FILLET WEL	D TEST RESULT	S
Test date	11-14-02			Minimum siz	e multiple pass	Maximum size	single pass
Witnessed by	Monty Wiggin	S		Macroetch		Macroetch	
				4 51/0	2 1/4	1. N/A	2 11/0
							3. <u>IN/A</u>
				2. <u>N/A</u>		2. <u>N/A</u>	
Other Tests				All-weld-met	al tension test		
			1	Tensile strer	ngth, psi <u>80,79</u>	0 and 81,644	
				Yield point/s	trength, psi	1/A	
						1/A	
						662-2C	
Nelder's name	Mark Corr					Stamp no. M	
	ed by					Laboratory	
		T Sell Troid		Test Numbe		Laboratory	
				Per Tec			
Ne the under	inned partify that	the statements			the formation of the second	est welds were pre	nated walded
) Structural Weldin	
			5	Signed	Missission	i Space Services	
				TA		rer or Contractor	
			E	By ALL	when	-	
			1	Title Que	iny Assurance	Engineer	
					0		
				Date Oct	ober 16, 2003		

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	Review Date: July 1, 2024
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7.7 Weld Nos. PQR 2G, 3G, 4G

NASA	National Aero Space Admin John C. Star	istration Inis Space		P		06					=0	т,	DE		т		
Requested		e Center, MS 395	Ext. No.			(Area			k Orde		LJ	17		Date	1		
KEN BOU	JRQUE		3037		MSS		,			BTR PP	#1			11-1	4-02		
Specificat	ion SSC 34-0	04												ions			
Part Identi	ification										ion		suo	clus			
WELDER	CERTIFIC	ATION	r		- T					ion	Fus	~	ital	u In	Ħ		
Weld No.	Weld View	Material Type	Material Thickness	Diame Pipe		Film D Weld	ensity IQI	Accept	Reject	Lack of Penetration	Lack of Fusion	Porosity	Slag Inclusions	Tungsten Inclusions	Undercut	Cracks	Other
PQR 2G	A-B	C.S.	1"	N/A	1	3.2	N/A	x				*1					
PQR 3G	A-B				1	3.0		x									
PQR 4G	A-B	END	+	•		3.1	4	x									
		END															
					+				<u> </u>								
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Front .01	3 Size, 1") 0" Back .(C.1" Came	era No. Bl ures: Views	l Filn	tings: n Bran	kV N d KO	DAK	МА N Тур	e "T	ime 8 "Size	4.5	X17"	SFD	S/N 24" Load :	SING	reens: LE	
Pens: Ty Markers	• •		B SET Shi							A /.120' IP 965				No. N			buble
DOUBLE	E WALL						SUPER						VALL			HER	
Additiona *1= ACC	I Informati	on MARK ROUNDED	CORR SSN	#428-27- GATED	-4489 POR(OSITY	NOTI	ED IN	WEL	D. ALCO	Ĥi.	white	ing.				
Date Reco			RBREAU		1.		QA		100.00		MC	1	1	Dat	e Com	pleter	1
11-14-02			ARINI, LVII		(13		A.MAS	(MSS SARI				36-	>		11/14		

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7.8 Report no. 676-2, Position 2G (November 25, 2002)

				FICATE	OF ANALYSIS			
Association of the							Report No. Page Date Lab No.	1 of 1 11/25/02
Material S	SA 516 Gr. 70	Thickness	1.00"		Dia		Ht/ID No.	
Material S	SA 516 Gr. 70	Thickness	1.00"		Dia		Ht/ID No.	
Process F	FCAW	Filler Metal	E71T-1	THE IN			Position	2G
11 0				Welder			ID	
	Mississippi Space S		····· ··· ·····	PO	39699	earlier and contractions	Other	•••••
	Guided Bend & Tens						Test Date	11/25/02
	tel & Serial No.		Universal Te		93		D .	7/04/00
alibration Ce		Wobile Call	pration Servic)e			Date	7/31/02
		ASTM E-74	E ALTERED,		FROM, PUBLISHED	AND/OR USEE		FULL
Specification F	THIS CERTIFICAT Type		E ALTERED,	GUIDED BE Figure	END TEST No.	AND/OR USEL	D EXCEPT IN I	5
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7.9 Report no. 662-2B, Position 3G (November 20, 2002)

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Responsible Office: NASA SSC Center Operations, Operations and Maintenance Division SUBJECT: Flux Cored Arc Welding (FCAW) of Structural Carbon Steel

7.10 Report no. 662-2C, Position 4G (November 20, 2002)

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