SSTD-8070-0021-WELD
Rev. B
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
GAS TUNGSTEN ARC WELDING (GTAW) OF ALUMINUM (P-No. 23)

Approved by:

Approved in DDMS by Scott Olive	7-1-2019
NASA SSC Center Operations Design & Construction Project Management Division	Date

Concurrence by:

Approved in DDMS by Gina Ladner	7-17-2019
NASA SSC Center Operations Directorate Operations and Maintenance Division	Date
Approved in DDMS by Bartt Hebert	7-15-2019
NASA SSC Engineering & Test Directorate	Date
Approved in DDMS by Son Le	7-15-2019
NASA SSC Safety & Mission Assurance	Date

Issued by

ISSUED CEF	7-17-2019
Central Engineering Files	Date

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Document History Log

Status/Change/ Revision	Change Date	Originator/Phone	Description
Basic	06.01.2011	Doug Dike x8-2803	Initial release, supersedes SSC 34-019 and NSTL 34-021.
A	05.10.2016	Benjamin McGrath x8-2969	Five-year review. References and acronyms updated. Revised cover sheet to reflect approval by NASA SSC Center Operations Design & Construction Project Management Division; and concurrence by NASA SSC Center Operations Directorate Operations and Maintenance Division, NASA SSC Engineering & Test Directorate, and NASA SSC Safety & Mission Assurance. 5.0-f: Revised to read, "Qualification tests shall be performed on test coupons welded with argon as the backing gas." Updated attachments A1, A2, A3, and A4.
B	07.01.2019	Doug Dike x-8-2803	Deleted Grade 6061 and 6063 from title, and references throughout document. Updated references and acronyms. 5.0-b: Added "in accordance with ASME Boiler and Pressure Vessel Codes, Section IX, requirements." Updated WPS. Administrative change to PQR (Pg 1).

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1.0 PURPOSE

This John C. Stennis Space Center (SSC) standard (SSTD) provides for a qualified American Society of Mechanical Engineers (ASME) weld procedure for Gas Tungsten Arc Welding (GTAW) of Aluminum (P-No. 23) pipe or plate.

2.0 APPLICABILITY

a. This SSTD is valid for welding of all P-No. 23 Aluminum pipe or plate that will be used in, but not be limited to, nitrogen, helium, air, oxygen and hydrogen service.

b. This SSTD applies to all contractor and subcontractor personnel involved with the GTAW welding of aluminum pipe or plate.

3.0 REFERENCES AND APPLICABLE DOCUMENTS

Applicable documents shall be the latest version unless otherwise specified.

ASME Boiler and Pressure Vessel Codes, Section II, *Materials*
ASME Boiler and Pressure Vessel Codes, Section IX, *Welding, Brazing and Fusing Qualifications*
ASTM B209, *Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate*
ASTM B209M, *Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)*
ASTM B210, *Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes*
ASTM B210M, *Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric)*
ASTM B211, *Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire*
ASTM B211M, *Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod and Wire (Metric)*
ASTM B221, *Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes*
ASTM B221M, *Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)*
ASTM B234, *Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes for Surface Condensers, Evaporators, and Heat Exchangers*
ASTM B234M, *Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes for Surface Condensers, Evaporators, and Heat Exchangers (Metric)*
ASTM B241/B241M, *Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube*

RELEASED - Printed documents may be obsolete; validate prior to use.

ASTMB247, *Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings*

ASTM B247M, *Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings (Metric)*

ASTM B273/273M, *Standard Test Method for Shear Properties of Sandwich Core Materials*

ASTM B361, *Standard Specification for Factory-Made Wrought Aluminum and Aluminum-Alloy Welding Fittings*

ASTM B483/B483M, *Standard Specification for Aluminum and Aluminum-Alloy Drawn Tube and Drawn Pipe for General Purpose Applications*

ASTM B491/B491M, *Standard Specification for Aluminum and Aluminum-Alloy Extruded Round Tubes for General Purpose Applications*

ASTM B632/B632M, *Standard Specification for Aluminum-Alloy Rolled Tread Plate*

ASTM B744/B744M, *Standard Specification for Aluminum-Alloy Sheet for Corrugated Aluminum Pipe*

ASTM B745/B745M, *Standard Specification for Corrugated Aluminum Pipe for Sewers and Drains*

ASTM B746/B746M, *Standard Specification for Corrugated Aluminum Alloy Structural Plate for Field-Bolted Pipe, Pipe-Arches, and Arches*

ASTM B864/B864M, *Standard Specification for Corrugated Aluminum Box Culverts*

ASTM F626, *Standard Specification for Fence Fittings*

AWS A5.10/A5.10M, *Specification for Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods*

FED WW-T-700/6, *Tube, Aluminum Alloy, Drawn, Seamless, 6061*

MIL-DTL-25995, *Pipe, Aluminum Alloy, Drawn or Extruded*

SAE AMS4025, *Aluminum Alloy, Sheet and Plate 1.0Mg - 0.60Si - 0.28Cu - 0.20Cr (6061-O) Annealed – UNS A96061*

SAE AMS4026, *Aluminum Alloy, Sheet and Plate 1.0Mg - 0.60Si - 0.28Cu - 0.20Cr (6061; -T4 Sheet, -T451 Plate) Solution Heat Treated and Naturally Aged – UNS A96061*

SAE AMS4027, *Aluminum Alloy, Sheet and Plate 1.0Mg - 0.60Si - 0.28Cu - 0.20Cr (6061; -T6 Sheet, -T651 Plate) Solution and Precipitation Heat Treated – UNS A96061*

SAE AMS4079, *Aluminum Alloy, Drawn, Round, Seamless, Tubing 1.0Mg - 0.60Si - 0.28Cu - 0.20Cr (6061-O) Close Tolerance, Annealed – UNS A96061*

SAE AMS 4080, *Aluminum Alloy, Drawn Seamless Tubing 1.0Mg - 0.60 Si - 0.28Cu - 0.20Cr (6061-0) Annealed – UNS A96061*

SAE AMS 4081, *Aluminum Alloy Tubing, Hydraulic, Seamless, Drawn, Round 1.0Mg - 0.60Si - 0.28Cu - 0.20Cr (6061-T4) Solution Heat Treated and Naturally Aged – UNS A96061*

SAE AMS 4082*, Aluminum Alloy, Seamless Drawn Tubing 1.0Mg - 0.60Si - 0.28Cu - 0.20Cr (6061-T6) Solution and Precipitation Heat Treated– UNS A96061*

SAE AMS 4083, *Aluminum Alloy Tubing, Hydraulic, Seamless, Drawn, Round 1.0Mg - 0.60Si - 028Cu - 0.20Cr (6061-T6) Solution and Precipitation Heat Treated – UNS 96061*

SAE AMS 4113, *Aluminum Alloy, Extruded Profiles 1.0Mg - 0.60Si - 0.28Cu - 0.20Cr (6061-T6) Solution and Precipitation Heat Treated – UNS A96061*

SAE AMS4115, *Aluminum Alloy, Rolled or Cold-Finished, Bars, Rods, Wire, and Flash Welded Rings Annealed 1.0Mg - 0.60Si - 0.28Cu - 0.20Cr (6061-0) – UNS A96061*

SAE AMS4116, *Aluminum Alloy, Bars, Rods, and Wire 1.0Mg - 0.60Si - 0.30Cu - 0.20Cr (6061-T4) Cold Finished, Solution Heat Treated and Naturally Aged – UNS A96061*

SAE AMS 4117, *Aluminum Alloy, Rolled or Cold Finished Bars, Rods and Wire and Flash Welded Rings 1.0Mg - 0.60Si - 0.28Cu - 0.20Cr (6061; -T6, -T651) – UNS A96061*

SAE AMS4127, *Aluminum Alloy, Forgings and Rolled or Forged Rings (6061-T6) Solution and Precipitation Heat Treated – UNS A96061*

SAE AMS4128, *Aluminum Alloy Bars, Rolled or Cold Finished 1.0Mg – 0.60Si – 0.30Cu – 0.20Cr (6061-T451) Solution Heat Treated and Stress Relieved by Stretching – UNS A96061*

SAE AMS4150, *Aluminum Alloy, Extrusions and Rings 1.0Mg - 0.60Si - 0.28Cu - 0.20Cr (6061-T6) Solution and Precipitation Heat Treated – UNS A96061*

SAE AMS 4156, *Aluminum Alloy, Extrusions 0.68Mg - 0.40Si (6063-T6) Solution and Precipitation Heat Treated – UNS A96063*

SAE AMS 4160, *Aluminum Alloy, Extrusions 1.0Mg - 0.60Si - 0.28Cu - 0.20Cr (6061-0) Annealed – UNS A96061*

SAE AMS 4161, *Aluminum Alloy, Extrusions 1.0M - 0.60 - 0.28Cu - 0.20Cr (6061-T4) Solution Heat Treated and Naturally Aged – UNS A96061*

SAE AMS4172, *Aluminum Alloy, Extrusions 1.0Mg - 0.60Si - 0.28Cu - 0.20Cr (6061-T4511) Solution Heat Treated and Stress Relieved by Stretching – UNS A96061*

SAE AMS4173, *Aluminum Alloy, Extrusions 1.0Mg - 0.60Si - 0.30Cu - 0.20Cr (6061-T6511 or T6510) Solution Heat Treated, Stress Relieved by Stretching, Straightened, and Precipitation Heat Treated – UNS A96061*

SAE AMS4248, *Aluminum Alloy Hand Forgings and Rolled Rings 1.0M - 0.60Si - 0.28Cu - 0.20Cr (6061-T652) Solution Heat Treated, Stress Relief Compressed, and Precipitation Heat Treated – UNS A96061*

SAE AMS4312, *Aluminum Alloy, Rolled or Forged Rings 1.0Mg - 0.60Si - 0.28Cu - 0.20 Cr (6061-T651, 6061-T652) Solution Heat Treated, Mechanically Stress Relieved, and Precipitation Heat Treated – UNS 96061*

SAE AMS-A-22771, *Aluminum Alloy Forgings, Heat Treated*

SAE AMS-QQ-A-200, *Aluminum Alloy, Bar, Rod, Shapes, Structural Shapes, Tube, and Wire, Extruded: General Specification for*

SAE AMS-QQ-A-200/8, *Aluminum Alloy 6061, Bar, Rod, Shapes, Tube, and Wire, Extruded A96061*

SAE J454, *General Data on Wrought Aluminum Alloys*

SPR 1440.1, *SSC 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, *Qualifying Welders and Welding Procedures*

4.0 RESPONSIBILITIES

Responsibilities for the use and control of this SSTD and for the review and approval of revisions or cancellation of this SSTD shall be as specified in SSTD-8070-0005-CONFIG and the applicable documents referenced therein.

5.0 REQUIREMENTS AND PROCEDURES

a. All procedures shall be performed in compliance with applicable requirements in SPR 8715.1. If ever there is a conflict between this SSTD and the Stennis Procedural Requirement (SPR), the SPR takes precedence.

b. Items denoted as essential variables in the attached weld procedure specifications (WPS) shall not be altered when using the WPS. An alternate WPS may be used only if approved prior to use by the National Aeronautics and Space Administration (NASA) SSC Center Operations Directorate Project Management Division (PMD), the NASA SSC Engineering and Test Directorate (E&TD), the NASA SSC Safety and Mission Assurance (S&MA) Office, and in accordance with ASME Boiler and Pressure Vessel Codes, Section IX, requirements.

c. The attached Procedure Qualification Record (PQR) is the PQR for the original WPSs in this SSTD. When performing new qualifications, a new, approved PQR shall be completed showing all pertinent data and results of the weld procedure qualification.

d. Welders shall be qualified in accordance with SSTD-8070-0014-WELD.

e. Inspection methods for welds shall be in accordance with SSTD-8070-0013-WELD.

f. Qualification tests shall be performed on test coupons welded with argon as the backing gas.

6.0 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 NASA SSC Forms Management Officer. Quality Records are identified in the SSC Master Records Index.

RELEASED - Printed documents may be obsolete; validate prior to use.

d. The original, signed WPS, 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).

7.0 ACRONYMS AND ABBREVIATIONS

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
CEF	Central Engineering Files
E&TD	Engineering and Test Directorate
GTAW	Gas Tungsten Arc Welding
”	Inch
NASA	National Aeronautics and Space Administration
PMD	Project Management Division
PQR	Procedure Qualification Record
S&MA	Safety and Mission Assurance
SAE	Society of Automotive Engineers
SPR	John C. Stennis Space Center Procedural Requirement
SSC	John C. Stennis Space Center
SSTD	John C. Stennis Space Center Standard
WPS	Weld Procedure Specifications
WQR	Welder Qualification Report

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ATTACHMENTS

Attachment A: WPS

National Aeronautics and Space Administration
John C. Stennis Space Center
Stennis Space Center, MS 39529-6000

ASME - WELDING PROCEDURE SPECIFICATIONS (WPS)

Welding Procedure Specification Record Number	Date	Revision Number
SSTD-8070-0021-WELD	June 1, 2019	B

Qualified To: ASME Boiler and Pressure Vessel Code	Company Name: Syncom Space Services
Supporting PQR(s): SSTD-8070-0021-WELD (A)	Reference Docs.: SSTD-8070-0021-WELD
Scope: GTAW Welding Aluminum	Joint: Modified "J" Groove See Note A.

BASE METALS

		P-no.	Grp-no.
Type			
Welded To		23	
Backing	No		
Retainers			
Notes	See Note A.		

THICKNESS RANGE QUALIFIED

	As-welded Min.	As-welded Max.	With PWHT Min.	With PWHT Max.
Complete Pen.	.063"	0.560"	N/A	N/A
Complete Pen.				
Impact Tested				
Impact Tested				
Fillet Welds	All		N/A	N/A

DIAMETER RANGE QUALIFIED

	As-welded Min.	As-welded Max.	With PWHT Min.	With PWHT Max.
Nominal Pipe Size	All		N/A	N/A

FILLER METALS

Process	SFA	Classification	F-no.	A-no.	Chemical Analysis or Trade Name	As-welded Min.	As-welded Max.	With PWHT Min.	With PWHT Max.
GTAW	5.10	ER4043			See Note B.	.063"	0.560"	N/A	N/A
Cons. Insert		N/A							
Flux		N/A							

WELDING PROCEDURE

Welding Process	GTAW		
Type	Manual		
Minimum preheat/interpass temperature (°F)	120°F		
Maximum interpass temperature (°F)	300°F		
Tungsten Size			
Tungsten Type	100% Tungsten Electrode - Rev A		
Filler Metal Size (in.)	3/32" - 1/8" (See Note B.)		
Layer Number	6		
Position of Groove	All positions		
Weld Progression	Up / Down (See Note C.)		
Current/Polarity	AC		
Amperes	140 - 200		
Volts	10 - 20		
Travel Speed (in./min)	3 - 5 ipm		
Maximum Heat Input (kj/in)			
DC Pulsing Current			
Shielding: Gas Type	Argon 99.9%		
Flow Rate (cfh)	25 - 40 cfh		
Trailing: Gas Type	N/A		
Flow Rate (cfh)			
Backing: Gas Type	Argon 99.9% (See Note D.)		
Flow Rate (cfh)	10 - 20 cfh		
String or Weave	String or Weave		
Orifice/Gas Cup Size	1/4" - 3/4"		
Multi/Single Pass per Side	Multiple		
Weld Deposit Chemistry			
Notes	Contact Tube to Work Distance 1/4" - 3/4"		

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Continued on next page.

National Aeronautics and Space Administration
John C. Stennis Space Center
Stennis Space Center, MS 39529-6000

ASME - WELDING PROCEDURE SPECIFICATIONS (WPS)

Welding Procedure Specification Record Number	Date	Revision Number
SSTD-8070-0021-WELD	June 1, 2019	B
Qualified To	**Company Name**	
ASME Boiler and Pressure Vessel Code	Syncom Space Services	

BASE METALS

Peening	Not allowed.
Surface Preparation	All weld joint surfaces shall be cleaned of oil, grease, paint, markings, etc.
Initial/Interpass Cleaning	Grinding, Power Brushing
Back Gouging Method	None

POSTWELD HEAT TREATMENT

Temperature	None
Time and Temperature	None
Other	None

NOTES

A. Root Opening: 0 - 0.125"
Root Face Dimension: 1/16" - 1/8"
Groove Angle: 30° - 60°
Radius: 1/16"
Mechanical gouge or grinding to sound metal.

B. Weld Wire ER4043 only.

C. Progression not applicable for the 1G position.

D. Minimal 10 minute on back purge prior to welding.

Signature 1		Signature 2	
Engineer Name: Doug Dike	Signature	Quality Name: George Smith	Signature
Date: June 1, 2019		Date: June 1, 2019	
Signature 3		**Signature 4**	
Customer Reviewer Name: Benjamin McGrath	Signature	Customer Name	Signature
Date: June 1, 2019		Date	

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Continued on next page.

National Aeronautics and Space Administration
John C. Stennis Space Center
Stennis Space Center, MS 39529-6000

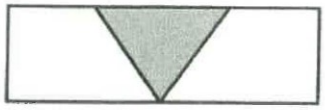
ASME - WELDING PROCEDURE SPECIFICATIONS (WPS)

Welding Procedure Specification Record Number	Date	Revision Number
SSTD-8070-0021-WELD	June 1, 2019	B
Qualified To	**Company Name**	
ASME Boiler and Pressure Vessel Code	Syncom Space Services	

Weld Joint Designs

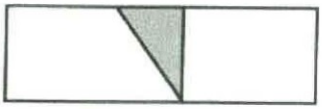
Attachment #1

Single-V Groove



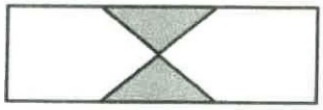
Groove Angle: 50 to 75 deg
Root Opening: 1/16 to 3/16 in.
Root Face: 0 to 1/16 in.
Misalignment: 1/16-in. max.

Single-Bevel Groove



Groove Angle: 37.5 to 45 deg
Root Opening: 1/16 to 3/16 in.
Root Face: 0 to 1/16 in.
Misalignment: 1/16-in. max.

Double-V Groove

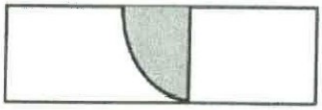


Groove Angle: 50 to 75 deg
Root Opening: 1/16 to 3/16 in.
Root Face: 0 to 1/16 in.
Misalignment: 1/16-in. max.

Double-Bevel Groove

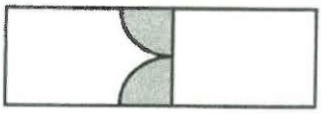
Groove Angle: 37.5 to 45 deg
Root Opening: 1/16 to 3/16 in.
Root Face: 0 to 1/16 in.
Misalignment: 1/16-in. max.

Single-J Groove



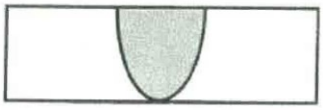
Groove Angle: 37.5 to 45 deg
Groove Radius: 3/8 in.
Root Opening: 1/16 to 3/16 in.
Root Face: 0 to 1/16 in.
Misalignment: 1/16-in. max.

Double-J Groove



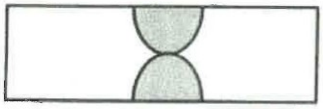
Groove Angle: 37.5 to 45 deg
Groove Radius: 3/8 in.
Root Opening: 1/16 to 3/16 in.
Root Face: 0 to 1/16 in.
Misalignment: 1/16-in. max.

Single-U Groove



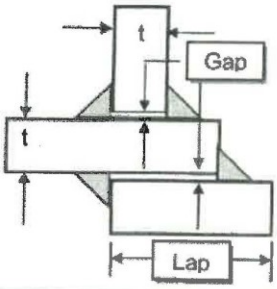
Groove Angle: 50 to 75 deg
Groove Radius: 3/8 in.
Root Opening: 1/16 to 3/16 in.
Root Face: 0 to 1/16 in.
Misalignment: 1/16-in. max.

Double-U Groove



Groove Angle: 50 to 75 deg
Groove Radius: 3/8 in.
Root Opening: 1/16 to 3/16 in.
Root Face: 0 to 1/16 in.
Misalignment: 1/16-in. max.

Fillet Weld T or Lap



Gap: 1/16-in. max. / Lap: 5 x t or 1 in. min.

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Attachment B: PQR

INSPECTION SPECIALISTS, INC.
MECHANICAL TESTING LABORATORY DIVISION

WELDING PROCEDURE SPECIFICATION (WPS) Yes [ ]
PREQUALIFIED ____ **QUALIFIED BY TESTING** x
or PROCEDURE QUALIFICATION RECORD (PQR) Yes [x]

WELDING PROCEDURE SPECIFICATION (WPS)
(See QW-200.1, Section IX, ASME Boiler and Pressure Vessel Code)

Identification # SSTD-8070-0021-WELD(A)
Revision A Date 12/7/11 By Doug Dyke
Company Name Jacobs Technology
Authorized by Travis G. Moore Date 4/15/11
Welding Process(es) GTAW
Type – Manual [x] Semi-Automatic [ ]
Supporting WPS No.(s) SSTD-8070-0021-WELD
Machine [ ] Automatic [ ]

JOINT DESIGN USED
Type Single –V- Groove
Single [x] Double Weld [ ]
Backing Yes [ ] No [x]
Backing Material
Root Opening 0.0625″ Root Face Dimension 1/16″
Groove Angle 60° Radius (J-U) N/A
Back Gouging: Yes [ ] No [x] Method

BASE METALS
Material Spec. Astm SB 210
Type or Grade Gr.6061
Thickness Groove 0.280″ Fillet N/A
Diameter (Pipe) 6.625″

FILLER METALS
AWS Specification 5.10
AWS Classification ER 4043

SHIELDING
Flux N/A Gas Argon
Composition 99.9%
Electrode-Flux (Class) Flow Rate 30 cfh
N/A Gas Cup Size ½″

PREHEAT
Preheat Temp., Min. ~~32°~~ 120°F 5/15/14
Interpass Temp., Min. 120° Max. 300°

POSITION
Position of Groove 6G Fillet N/A
Vertical Progression: Up [x] Down [ ]

ELECTRICAL CHARACTERISTICS
100% Tungsten Electrode-Rev A
Transfer Mode (GMAW) Short-Circuiting [ ]
Globular [ ] Spray [ ]
Current: AC [x] DCEP [ ] DCEN [ ] Pulsed [ ]
Other

TECHNIQUE
Stringer or Weave Bead Both
Multi-pass or Single Pass (per side) multiple
Number of Electrodes Single
Electrode Spacing Longitudinal N/A
Lateral N/A
Angle N/A

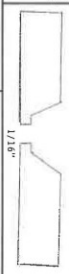
Contact Tube to Work Distance ¼″ – ¾″
Peening Not allowed
Interpass Cleaning Grinding, Power Brushing

POSTWELD HEAT TREATMENT
Temp. N/A
Time N/A

WELDING PROCEDURE

Pass or Weld Layer(s)	Process	Filler Metals Class	Filler Metals Diam.	Current Type & Polarity	Current Amps or Wire Feed Speed	Volts	Travel Speed
1	GTAW	ER 4043	1/8″	AC	160	14.1	4.0 IPM
2	GTAW	ER 4043	1/8″	AC	165	15.0	4.5 IPM
3	GTAW	ER 4043	3/32″	AC	170	15.2	4.5 IPM
4	GTAW	ER 4043	3/32″	AC	168	14.9	5.1 IPM
5	GTAW	ER 4043	3/32″	AC	172	14.9	5.2 IPM
6	GTAW	ER 4043	3/32″	AC	180	15.3	5.1 IPM

Joint Details



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Continued on next page.

PROCEDURE QUALIFICATION RECORD (PQR) # SSTD-8070-0021-WELD(A)
TEST RESULTS

TENSILE TEST

Specimen No.	Width	Thickness	Area	Ultimate Tensile Load. lb	Ultimate Unit Stress. psi	Character of Failure and Location
6218.90 T-1	0.751"	0.255"	0.1915"	4,606	24,052	Base
6218.90 T-2	0.749"	0.258"	0.1932"	4,674	24,193	Base

GUIDED BEND TEST

Specimen No.	Type of Bend	Result	Remarks
6218.90 RB-1	Root Bend	Acceptable	
6218.90 RB-2	Root Bend	Acceptable	
6218.90 FB-1	Face Bend	Acceptable	
6218.90 FB-2	Face Bend	Acceptable	

VISUAL INSPECTION
Appearance Acceptable
Undercut None
Piping Porosity None
Convexity Acceptable
Test Date 4/11/11
Witnessed By Tavis G. Moore

Other Tests

Radiographic-Ultrasonic Examination
RT Report No. N/A Result N/A
UT Report No. N/A Result N/A

FILLET WELD TEST RESULTS

Minimum size multiple pass
Macroetch
1. N/A 3. N/A
2. N/A

Maximum size single pass
Macroetch
1. N/A 3. N/A
2. N/A

All-Weld-Metal Tension Test
Tensile Strength, psi N/A
Yield Point/Strength, psi N/A
Elongation in 2 in., % N/A
Laboratory Test No. 6218.90

Welder's Name Robie Jones Soc. Sec. No. Stamp No. N/A

Tests Conducted By Inspection Specialists, Inc. - MTL Div.

AWS Travis G Moore CWI 99041251 QC1 EXP. 4/1/2014

Test Number 6218.90

Per Travis G Moore

We, the undersigned, certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of ASME Section IX (2010) ASME Boiler and PressureVessel Code.
year

Signed Benny McSwain
Manufacturer or Contractor

By

Title Level III

Date 12-7-11

Attachment C: Certificate of Analysis

INSPECTION SPECIALISTS, INC.

MECHANICAL TESTING LABORATORY DIVISION

CERTIFICATE OF ANALYSIS

Client: Jacobs Technology Job No: 6218.90

Client Representative: Benny Mcgrath Purchase Order:

Test Specification: ASME Section IX

Sample Identification: One (1) – 6.625″ x 0.280″ Procedure Qualification WPS # SSTD-8070-0021-WELD
Welder: Robbie Jones

The above referenced sample was prepared and tested in accordance with the welding procedure qualification requirements of ASME Section IX. Two (2) tensile test specimens, four (4) guided bend test specimens were prepared and tested. The results of these tests are reported herein.

TENSILE TEST

SPECIMEN ID	WIDTH INCHES	THICKNESS INCHES	AREA SQ. IN.	ULTIMATE LOAD POUNDS	TENSILE STRENGTH PSI	NATURE OF FRACTURE
6218.90 T-1	0.751″	0.255″	0.1915″	4,606	24,052	Base
6218.90 T-2	0.749″	0.258″	0.1932″	4,674	24,193	Base

GUIDED BEND TEST

SPECIMEN ID	TYPE TEST	TEST RESULT
6218.90 –R1	Root Bend	Acceptable
6218.90 –R2	Root Bend	Acceptable
6218.90 –F1	Face Bend	Acceptable
6218.90 –F2	Face Bend	Acceptable

The tests expressed herein meet or exceed the requirements of ASME Section IX.

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CERTIFIED BY:

Travis G. Moore, Lab Manager

Date: April 15, 2011 Certificate No: 1 of 1

ALL TEST SPECIMENS, SAMPLES, DROPS, ETC. WILL BE DISCARDED THIRTY (30) DAYS AFTER TESTING UNLESS OTHERWISE INSTRUCTED IN WRITING.

Attachment D: Welder Qualification Record

Welder Qualification Record

INSPECTION SPECIALISTS, INC.

MECHANICAL TESTING LABORATORY DIVISION
5201 Taravella Road • Marrero, Louisiana 70072
(504) 347-5600 • Fax (504) 348-8001

MTL Job No. 6218.90

Welder's Name Robie Jones Social Security No.

Employer Jacobs Technology

Project Welders Test

Type of Qualification

Process	GTAW					Procedure No.	SSTD-8070-0021-WELD
Position(s)	6G					Direction	N/A
Filler	ER-4043	A No.	N/A	F No.	22	Thickness Range	0.0625″ - 0.560″
Filler	N/A	A No.	N/A	F No.	N/A	Diameter Range	1″ - Unlimited
Materials	Aluminum Gr. 6061					P No's.	23
Wall Thickness	0.280″					Diameter	

Specified Test Procedure

	Filler Metal								
Pass No.	ASTM - AWS Spec	Diameter	Feed	Amperage	Voltage	Polarity	Manipulation	Direction	Travel Speed
1	ER-4043	1/8″	N/A	160	14.1	AC	Manual	Uphill	4.0 IPM
2	ER-4043	1/8″	N/A	165	15.0	AC	Manual	Uphill	4.5 IPM
3	ER-4043	3/32″	N/A	170	15.2	AC	Manual	Uphill	4.5 IPM
4	ER-4043	3/32″	N/A	168	14.9	AC	Manual	Uphill	5.1 IPM
5	ER-4043	3/32″	N/A	172	14.9	AC	Manual	Uphill	5.2 IPM
6	ER-4043	3/32″	N/A	180	15.3	AC	Manual	Uphill	5.1 IPM

Joint Preparation	Modified "J" Groove
Backing	None
Preheat	N/A
Interpass	160-280
Postheat	N/A
Filler Metal Trade Name	N/A
Flux for Submerged Arc Welding	N/A
Gas for Inert Gas Shielded Arc Welding	Argon 99.9 %

Test Results

Type of Test	Description of Results	Type of Test	Description of Results
Root Bend # 1	Acceptable		
Root Bend # 2	Acceptable		
Face Bend # 1	Acceptable		
Face Bend # 2	Acceptable		

Test Conducted By Inspection Specialists, Inc. – Mechanical Testing Laboratory Division

Date of Test 4/11/11 Place of Test Jacobs Tachnology

We certify that the above named welder, by virtue of the results of these tests, meets the welder performance requirements specified. We further certify that the statements of this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Asme Section IX.

Signed Travis G. Moore Travis G. Moore Date April 15, 2011

Approved Date

Travis G Moore
CWI 99041251
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