SSTD-8070-0015-WELD
Rev. C
JANUARY 2021

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 WELD (GTAW) PROCEDURE FOR CARBON STEEL (ASME P-No. 1, GROUP 1 OR 2)

Approved in DDMS by:

Brennan Sanders	1-8-2021
NASA SSC Center Operations Facilities Engineering Test Complex Support	Date
Todd Mannion	1-4-2021
NASA SSC Center Operations Directorate Facilities Services	Date
Bartt Hebert	1-7-2021
NASA SSC Engineering & Test Directorate	Date
Son Le	1-5-2021
NASA SSC Safety & Mission Assurance	Date

Issued by

ISSUED CEF	1-8-2021
Central Engineering Files	Date

Document History Log

Revision	Date	Originator/ Phone	Description
Basic	04.03.2012	Doug Dike Ext. 8-2803	Initial release. Supersedes SSC-34-008.
A	10.22.2015	Doug Dike Ext. 8-2803	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. WPS/PQR attachments clarified.
A-1	08.15.2017	George Smith 8-7680	Administrative changes to attachments to change contractor from FOSC to SACOM.
B	04.20.2020	Benny McGrath Ext. 8-2969	Five-year revision. Updated directorate titles on cover sheet as necessary. Updated references and acronyms. Minor administrative changes. 5.0-b: Added, “and in accordance with ASME Boiler and Pressure Vessel Codes, Section IX, requirements.” 5.0-c: Revised to reflect deletion of attached Welder Performance Qualification. 8.4 and 8.5: Deleted Welder Performance Qualifications. Updated WPS to SSC-937.
B-1	05.12.2020	Carol Wolfram 8-1620	Administrative Change. Header effective/review dates updated.
C	01.11.2021	Benny McGrath Ext. 8-2969	WPS updated: Non-essential variable, Position of Groove, changed from “1G” to “ALL”.

Table of Contents

1.0 PURPOSE

This John C. Stennis Space Center (SSC) standard (SSTD) provides for a qualified American Society of Mechanical Engineers (ASME) weld procedure of Gas Tungsten Arc Welding (GTAW) of carbon steel pipe or plate for 0.1875” to 1.50” wall thickness using argon as a backing gas.

2.0 APPLICABILITY

This SSTD is valid for welding of all carbon steel pipe or plate that will be used in, but not limited to, nitrogen, helium, air, and hydrogen service. This SSTD applies to all contractor and subcontractor personnel involved with the welding of carbon steel pipe.

3.0 REFERENCED AND APPLICABLE DOCUMENTS

Applicable documents shall be the latest version unless otherwise specified.

ASME Boiler and Pressure Vessel Codes, Section IX, *Welding, Brazing, and Fusing Qualifications*
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 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 NASA SSC Center Operations Facilities Engineering Test Complex Support, the NASA SSC Engineering and Test Directorate, the NASA SSC Safety and Mission Assurance Office, and in accordance with ASME Boiler and Pressure Vessel Codes, Section IX, requirements.

c. The attached Procedure Qualification Record (PQR), NASA 300-1, is from the original WPS in this SSTD. When performing a new welder performance qualification (WPQ) or a new WPS, these documents shall be completed showing all pertinent data and results of the approved weld PQR.

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 gases.

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.

d. The original, signed WPS and PQR (copies of which are provided in Attachment A of this SSTD) and the accompanying Certificate(s) of Analysis validation test documents shall be maintained in Central Engineering Files (CEF).

7.0 ACRONYMS & ABBREVIATIONS

ASME	American Society of Mechanical Engineers
CEF	Central Engineering Files
GTAW	Gas Tungsten Arc Weld
”	Inch
NASA	National Aeronautics and Space Administration
PQR	Procedure Qualification Record
SPR	John C. Stennis Space Center Procedural Requirement
SSC	John C. Stennis Space Center
SSTD	John C. Stennis Space Center Standard
WPQ	Welder Procedure Qualification
WPS	Weld Procedure Specifications

8.0 ATTACHMENTS

8.1 Welding Procedure Specification

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: SSTD-8070-0015-WELD	Date: September 23, 2020	Revision Number: 3
Qualified To: ASME Boiler and Pressure Vessel Code	Company Name: Syncom Space Services (S3)	
Supporting PQR(s): SSTD-8070-0015-WELD (A)	Reference Docs.: SSTD-8700-0015-WELD	
Scope: GTAW for Carbon Steel	Joint: Single V Groove, Double V Groove	

BASE METALS

		P-no.	Grp-no.
Type	Carbon Steel	P-1	1or2
Welded To	Carbon Steel	P-1	1or2
Backing	Not Permitted		
Retainers			
Notes			

THICKNESS RANGE QUALIFIED

	As-welded Min.	As-welded Max.	With PWHT Min.	With PWHT Max.
Complete Pen.	0.1875"	1.50"	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	5.18	ER70S-2	6	1		0.1875"	1.50"	N/A	N/A
Cons. Insert		N/A							
Flux		N/A							

WELDING PROCEDURE

Welding Process	GTAW		
Type	Manual		
Minimum preheat/interpass temperature (°F)	50°F Min. (See Note A.)		
Maximum interpass temperature (°F)	300°F Max.		
Tungsten Size	1/16" - 1/8"		
Tungsten Type	2% Thoriated (See Note B.)		
Filler Metal Size (in.)	1/16" - 5/32"		
Layer Number	1 - Cap		
Position of Groove	ALL		
Weld Progression	N/A		
Current/Polarity	DCEN		
Amperes	100 - 220		
Volts	8 - 25		
Travel Speed (in./min)	2 - 8 ipm		
Maximum Heat Input (kj/in)			
DC Pulsing Current			
Shielding: Gas Type	Argon ≥ 99.9% (See Note C.)		
Flow Rate (cfh)	10 - 60 CFH		
Trailing: Gas Type	N/A		
Flow Rate (cfh)	N/A		
Backing: Gas Type	Argon ≥ 99.9% (See Note D.)		
Flow Rate (cfh)	10 - 60 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	See Notes E.		

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ASME - WELDING PROCEDURE SPECIFICATIONS (WPS)

Welding Procedure Specification Record Number	Date	Revision Number
SSTD-8070-0015-WELD	September 23, 2020	3
Qualified To	**Company Name**	
ASME Boiler and Pressure Vessel Code	Syncom Space Services (S3)	

BASE METALS

Peening	Not allowed.
Surface Preparation	See Notes F.
Initial/Interpass Cleaning	Brushing or grinding
Back Gouging Method	N/A

POSTWELD HEAT TREATMENT

Temperature	None
Time and Temperature	None
Other	None

NOTES

A. Preheat maintenance as needed.

B. Tungsten should maintain to a pencil point.

C. High flow of shielding gas flow over molten puddle is required to eliminate nitrogen absorption from atmosphere.

D. Minimum 10 minutes of back purge prior to welding.

E. Contact Tube to Work Distance: 3/4" max

F. Remove all contamination and water from surface. Clean weld and adjacent base metal using steel brushes or grinding.

Signature 1		Signature 2	
Engineer Name: George Smith	Signature: George E. Smith	Quality Name: Richard Ladner	Signature: Richard Ladner
Date: 09/23/2020		Date: 09/23/2020	
Signature 3		**Signature 4**	
Customer Reviewer Name: Benjamin McGrath	Signature: Ben McG	Customer Name	Signature
Date: 09/23/2020		Date	

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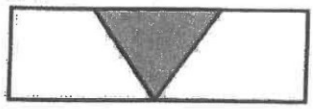
ASME - WELDING PROCEDURE SPECIFICATIONS (WPS)

Welding Procedure Specification Record Number	Date	Revision Number
SSTD-8070-0015-WELD	September 23, 2020	3
Qualified To	**Company Name**	
ASME Boiler and Pressure Vessel Code	Syncom Space Services (S3)	

Weld Joint Designs

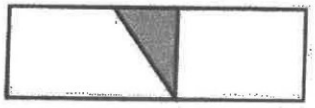
Attachment #1

Single-V Groove



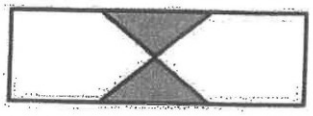
Groove Angle: 50 to 75 deg
Root Opening: 1/16 to 3/16 in.
Root Face: 0 to 1/16 in.
Misalignment: 1/16-in. max.

Single-Bevel Groove



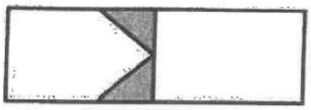
Groove Angle: 37.5 to 45 deg
Root Opening: 1/16 to 3/16 in.
Root Face: 0 to 1/16 in.
Misalignment: 1/16-in. max.

Double-V Groove



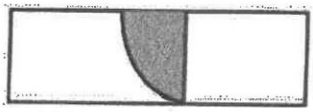
Groove Angle: 50 to 75 deg
Root Opening: 1/16 to 3/16 in.
Root Face: 0 to 1/16 in.
Misalignment: 1/16-in. max.

Double-Bevel Groove



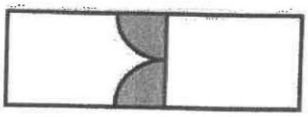
Groove Angle: 37.5 to 45 deg
Root Opening: 1/16 to 3/16 in.
Root Face: 0 to 1/16 in.
Misalignment: 1/16-in. max.

Single-J Groove



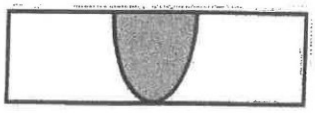
Groove Angle: 37.5 to 45 deg
Groove Radius: 3/8 in.
Root Opening: 1/16 to 3/16 in.
Root Face: 0 to 1/16 in.
Misalignment: 1/16-in. max.

Double-J Groove



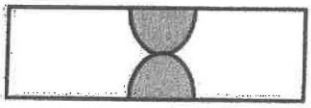
Groove Angle: 37.5 to 45 deg
Groove Radius: 3/8 in.
Root Opening: 1/16 to 3/16 in.
Root Face: 0 to 1/16 in.
Misalignment: 1/16-in. max.

Single-U Groove



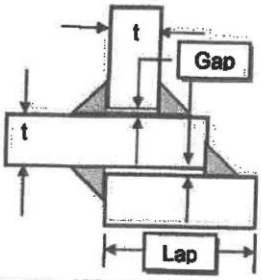
Groove Angle: 50 to 75 deg
Groove Radius: 3/8 in.
Root Opening: 1/16 to 3/16 in.
Root Face: 0 to 1/16 in.
Misalignment: 1/16-in. max.

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.

8.2 Welding Procedure Qualification Record

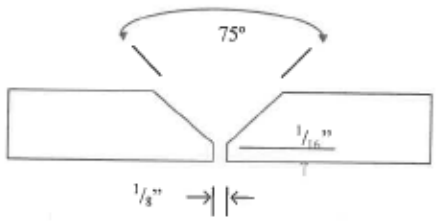
Accepted by Syncom Space Services LLC
George E. Smith 8/14/2017
Stephen A Koch 8/14/2017

INSPECTION SPECIALISTS, INC.
MECHANICAL TESTING LABORATORY DIVISION

PROCEDURE QUALIFICATION RECORD (PQR)
(See QW-200.2, Section IX, ASME Boiler and Pressure Vessel Code)
Record Actual Conditions Used to Weld Test Coupon.

Company Name: Jacobs Technology
Procedure Qualification Record No.: SSTD-8070-0015-WELD(A) Date: 10/11/11
WPS No.: SSTD-8070-0015-WELD
Welding Process(es): GTAW
Types (Manual, Automatic, Semi-Auto.): Manual

JOINTS (QW-402)



Groove Design of Test Coupon
(For combination qualifications, the deposited weld metal thickness shall be recorded for each filler metal or process used.)

BASE METALS (QW-403)
Material Spec.: ASTM A-36
Type or Grade: A-36
P-No.: 1 to P-No.: 1
Thickness of Test Coupon: 0.750"
Diameter of Test Coupon: N/A
Other:

POSTWELD HEAT TREATMENT (QW-407)
Temperature: N/A
Time: N/A
Other:

GAS (QW-408)

	Gas(es)	Percent Composition (Mixture)	Flow Rate
Shielding	Argon	99.9	20-60 CFH
Trailing	N/A	N/A	N/A
Backing	Argon	99.9	20-60 CFH

FILLER METALS (QW-404)
SFA Specification: 5.18
AWS Classification: ER70S-2
Filler Metal F-No.: 6
Weld Metal Analysis A-No.: 1
Size of Filler Metal: 3/32" - 1/8"
Other:
Deposited Weld Metal: 0.750"

ELECTRICAL CHARACTERISTICS (QW-409)
Current: DC
Polarity: EN
Amps.: 140 – 204 Volts: 15.1 – 20.2
Tungsten Electrode Size: 1/8"
Other:

POSITION (QW-405)
Position of Groove: 1G
Weld Progression (Uphill, Downhill): N/A
Other:

TECHNIQUE (QW-410)
Travel Speed: 3-5 IPM
String or Weave Bead: String & Weave
Oscillation: N/A
Multipass or Single Pass (per side): Multipass
Single or Multiple Electrodes: Single
Other:

PREHEAT (QW-406)
Preheat Temp.: 50°F Min.
Interpass Temp.: 176°F – 273°F
Other:

Travis G Neal

Bey McSet 10-14-11

QW-483 (Back)

PQR No. SSTD-8070-0015-WELD(A)

Tensile Test (QW-150)

Specimen No.	Width	Thickness	Area	Ultimate Total Load lb	Ultimate Unit Stress psi	Type of Failure & Location
6438.90 –T1	0.747"	0.725"	0.5416"	43,596	80,495	Base
6438.90 –T2	0.754"	0.724"	0.5459"	43,090	78,934	Base

Guided-Bend Tests (QW-160)

Type and Figure No.			Result
6438.90 –S1	Side Bend	QW-462.2	Acceptable
6438.90 –S2	Side Bend	QW-462.2	Acceptable
6438.90 –S3	Side Bend	QW-462.2	Acceptable
6438.90 –S4	Side Bend	QW-462.2	Acceptable

Toughness Tests (QW-170)

Specimen No.	Notch Location	Notch Type	Test Temp.	Impact Values	Lateral Exp.		Drop Weight	
					% Shear	Mils	Break	No Break
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Fillet-Weld Test (QW-180)

Result – Satisfactory: Yes N/A No N/A Penetration into Parent Metal: Yes N/A No N/A

Macro – Results N/A

Other Tests

Type of Test N/A

Deposit Analysis N/A

Other N/A

Welder's Name Scott Harriel & WC King Soc.Sec. No. Stamp No.

Tests conducted by: Inspection Specialists, Inc. – MTL Div. Laboratory Test No. 6438.90

We 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 Section IX of the ASME Code.

Manufacturer Jacobs Technology

Date October 11, 2011 By 10-14-15

Accepted by Syncom Space Services LLC

Smith 8/14/2017

8/14/2017

Travis G I
CWI 990
QC1 EXP. 4/1/2014

8.3 Certificate of Analysis

INSPECTION SPECIALISTS, INC.

MECHANICAL TESTING LABORATORY DIVISION

CERTIFICATE OF ANALYSIS

Client: Jacobs Technology Job No: 6438.90

Client Representative: Benny McGrath Purchase Order:

Test Specification: ASME Section IX

Sample Identification: One (1) – 0.750″ Plate Procedure Qualification WPS # SSTD-8070-0015-WELD
Welders: Scott Harriel & WC King

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 and 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
6438.90 –T1	0.747"	0.725"	0.5416"	43,596	80,495	Base
6438.90 –T2	0.754"	0.724"	0.5459"	43,090	78,934	Base

GUIDED BEND TEST

SPECIMEN ID	TYPE TEST	TEST RESULT
6438.90 –S1	Side Bend	Acceptable
6438.90 –S2	Side Bend	Acceptable
6438.90 –S3	Side Bend	Acceptable
6438.90 –S4	Side Bend	Acceptable

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

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

Ben McGrath 10-14-15

CERTIFIED BY:

Date: October 11, 2011 Certificate No: 1 of 1

Travis G. Moore, Lab Manager

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