



SSTD-8070-0039-WELD
Revision B
October 2018

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

COMPLIANCE IS MANDATORY

John C. Stennis Space Center ASME GTAW & SMAW Weld Procedure for Carbon Steel Pipe - Maximum 1-Inch Material Thickness

Approved by:

<u>Scott Olive in DDMS</u> NASA SSC Center Operations Design & Construction Project Management Division	<u>11-05-18</u> Date
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Concurrence by:

<u>Mike Killam in DDMS</u> NASA SSC Center Operations Directorate Operations and Maintenance Division	<u>11-05-18</u> Date
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<u>Bartt J. Hebert in DDMS</u> NASA SSC Engineering & Test Directorate	<u>10-30-18</u> Date
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<u>Son Le in DDMS</u> NASA SSC Safety & Mission Assurance	<u>11-02-18</u> Date
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Issued by

<u>ISSUED CEF</u> Central Engineering Files	<u>11-05-18</u> Date
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Stennis Standard	SSTD-8070-0039-WELD	B
	<i>Number</i>	<i>Rev.</i>
	Effective Date:	October 29, 2018
	Review Date:	October 29, 2023
Page 2 of 10		
Responsible Office: NASA SSC Center Operations Directorate Design & Construction Project Management Division		
SUBJECT: ASME GTAW & SMAW Weld Procedure for Carbon Steel Pipe - Maximum 1-Inch Material Thickness		

Document History Log

Revision	Date	Originator/ Phone	Description
Basic	10/16/08	Steve Rathbun x8-3572	Initial release. Supersedes SSC Standard 34-108-MI.
A	1/15/2014	D. Dike 8- 2803	Regular five year review. Updated references.
B	10/29/2018	D. Dike 8-2803	Five-year review. Revised document title and related references within the document; replacing “2-Inch Material Thickness” with “1-Inch Material Thickness.” Updated cover sheet to include concurrence by Safety & Mission Assurance. Updated references and acronyms. Minor administrative revisions. Updated WPS attachment to Form SSC-937.

Stennis Standard	SSTD-8070-0039-WELD	B
	<i>Number</i>	<i>Rev.</i>
	Effective Date:	October 29, 2018
	Review Date:	October 29, 2023
Page 3 of 10		
Responsible Office: NASA SSC Center Operations Directorate Design & Construction Project Management Division		
SUBJECT: ASME GTAW & SMAW Weld Procedure for Carbon Steel Pipe - Maximum 1-Inch Material Thickness		

Table of Contents

1.0	SCOPE	4
2.0	APPLICABILITY.....	4
3.0	REFERENCED AND APPLICABLE DOCUMENTS	4
4.0	RESPONSIBILITIES	4
5.0	REQUIREMENTS AND PROCEDURES	4
6.0	RECORDS AND FORMS.....	5
7.0	ACRONYMS AND ABBREVIATIONS.....	5
	ATTACHMENT A.1 - WPS WELD PROCEDURE 34-108-MI	6
	ATTACHMENT A.2 - PQR WELD PROCEDURE 34-108-MI	9

Stennis Standard	SSTD-8070-0039-WELD	B
	<i>Number</i>	<i>Rev.</i>
	Effective Date: October 29, 2018	
	Review Date: October 29, 2023	
		Page 4 of 10
Responsible Office: NASA SSC Center Operations Directorate Design & Construction Project Management Division		
SUBJECT: ASME GTAW & SMAW Weld Procedure for Carbon Steel Pipe - Maximum 1-Inch Material Thickness		

1.0 SCOPE

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) and Shielded Metal Arc Welding (SMAW) of carbon steel pipe up to a maximum of 1-inch wall thickness.

2.0 APPLICABILITY

This SSTD applies to all National Aeronautics and Space Administration (NASA) John C. Stennis Space Center (SSC) contractor and subcontractor personnel involved in the GTAW and SMAW welding of carbon steel pipe.

3.0 REFERENCED AND APPLICABLE DOCUMENTS

Referenced documents shall be the latest version unless otherwise specified.

ASME Section II, *Materials*

ASME Section V, *Nondestructive Examination*

ASME Section VIII Division 1, *Rules for Construction of Pressure Vessels*

ASME Section IX, *Welding, Brazing, and Fusing Procedures; Welders, Brazers; and Welding, Brazing and Fusing Operators*

SPR 1440.1, *Records Management Program Requirements*

SPR 8715.1, *SSC Safety and Health Procedural 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 SSC Standard 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, *SSC Safety and Health Procedural Requirements*. If ever there is a conflict between this SSTD and the Stennis Procedural Requirement (SPR), the SPR shall take precedence.
- b. Items denoted as essential variables in the attached 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 Directorate Project Management Division (PMD), the NASA SSC Engineering

Stennis Standard	SSTD-8070-0039-WELD	B
	<i>Number</i>	<i>Rev.</i>
	Effective Date: October 29, 2018	
	Review Date: October 29, 2023	
Page 5 of 10		
Responsible Office: NASA SSC Center Operations Directorate Design & Construction Project Management Division		
SUBJECT: ASME GTAW & SMAW Weld Procedure for Carbon Steel Pipe - Maximum 1-Inch Material Thickness		

and Test Directorate (E&TD), and the NASA SSC Safety and Mission Assurance (S&MA) Office.

- c. The attached PQR is for the original WPS in this standard. 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, *Qualifying Welders and Welding Procedures*.
- e. Inspection methods for welds shall be in accordance with SSTD-8070-0013-WELD, *Classes of Welding Inspection*.

6.0 RECORDS AND FORMS


Records and forms required by the procedures of this standard shall be maintained in accordance with SSC Procedural Requirement SPR 1440.1, *Records Management Program Requirements*. All records and forms are assumed to be the latest edition unless otherwise indicated. 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.

7.0 ACRONYMS AND ABBREVIATIONS





ASME	American Society of Mechanical Engineers
E&TD	Engineering and Test Directorate
GTAW	Gas Tungsten Arc Welding
NASA	National Aeronautics and Space Administration
PMD	Project Management Division
PQR	Procedure Qualification Record
S&MA	Safety and Mission Assurance
SMAW	Shielded Metal Arc Welding
SPR	John C. Stennis Space Center Procedural Requirement
SSC	John C. Stennis Space Center
SSTD	John C. Stennis Space Center Standard
WPS	Weld Procedure Specification

Stennis Standard	SSTD-8070-0039-WELD	B
	Number	Rev.
	Effective Date: October 29, 2018	
	Review Date: October 29, 2023	
Page 6 of 10		
Responsible Office: NASA SSC Center Operations Directorate Design & Construction Project Management Division		
SUBJECT: ASME GTAW & SMAW Weld Procedure for Carbon Steel Pipe - Maximum 1-Inch Material Thickness		


ATTACHMENT A.1 - WPS WELD PROCEDURE 34-108-MI

 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 34-108-M1		Date 9/21/2018	Revision Number C
Qualified To ASME Boiler and Pressure Vessel Code		Company Name Syncom Space Services	
Supporting PQR(s) 34-108-M1 Appendix A		Reference Docs. N/A	
Scope See Notes *		Joint Single/Double V/U Groove and All Fillets (See Notes **.)	
BASE METALS (QW-403)		THICKNESS RANGE QUALIFIED	
Type	SA-36 P-no. 1 Grp-no. 1 or 2	Min. As-welded	Max. With PWHT
Welded To	SA-36 P-no. 1 Grp-no. 1 or 2	Max.	Max.
Backing	NONE P-no. Grp-no.	Complete Pen. .188" 1"	Complete Pen. N/A N/A
Retainers		Impact Tested	Impact Tested
Notes		Impact Tested	Impact Tested
		Fillet Welds	Fillet Welds
		DIAMETER RANGE QUALIFIED	
		Min. As-welded	Max. With PWHT
		Max.	Max.
		Nominal Pipe Size No Min. No Max.	N/A N/A
FILLER METALS (QW-404)		THICKNESS RANGE QUALIFIED	
Process	SFA Classification F-no. A-no. Chemical Analysis or Trade Name	Min. As-welded	Max. With PWHT
GTAW	5.18 ER70S-3 6 1 NOT REQUIRED	Max. 3/32" 1/4"	Max. N/A N/A
SMAW	5.1 E7018 4 1 NOT REQUIRED	Max. 3/32" 3/4"	Max. N/A N/A
Cons. Insert	NOT USED		
Flux	NOT REQUIRED		
WELDING PROCEDURE			
Welding Process	GTAW	SMAW	
Type	Manual	Manual	
Minimum preheat/interpass temperature (°F)	50°F Min.	50°F Min.	
Maximum interpass temperature (°F)	NOT REQUIRED	NOT REQUIRED	
Tungsten Size	1/16" - 1/8"	NOT REQUIRED	
Tungsten Type	2% THORIATED	NOT REQUIRED	
Filler Metal Size (in.)	1/16" - 1/8"	1/16" - 3/16"	
Layer Number	1 - 2 LAYERS	REMAINDER	
Position of Groove	ALL	ALL	
Weld Progression	UPHILL(Downhill Not Allowed)	UPHILL(Downhill Not Allowed)	
Current/Polarity	DC/Straight Polarity	DC/Reverse Polarity	
Amperes	60 - 200	50 - 180	
Volts	10 - 30	10 - 40	
Travel Speed (in./min)	2 - 5 IPM	5 - 15 IPM	
Maximum Heat Input (kJ/in)			
DC Pulsing Current	Not Used	Not Used	
Shielding: Gas Type	ARGON 99.99%	NOT REQUIRED	
Flow Rate (cfh)	15 - 40	NOT REQUIRED	
Trailing: Gas Type	NOT REQUIRED	NOT REQUIRED	
Flow Rate (cfh)	NOT REQUIRED	NOT REQUIRED	
Backing: Gas Type	NOT REQUIRED	NOT REQUIRED	
Flow Rate (cfh)	NOT REQUIRED	NOT REQUIRED	
String or Weave	Stringer (Root/Hot Pass)	Stringer or Weave (Fill/Cap pass)	
Orifice/Gas Cup Size	4 - 8	NOT REQUIRED	
Multi/Single Pass per Side	(See Notes ***)	SINGLE	
Weld Deposit Chemistry			
Notes			

Stennis Standard	SSTD-8070-0039-WELD	B
	<i>Number</i>	<i>Rev.</i>
	Effective Date: October 29, 2018	
	Review Date: October 29, 2023	
Page 7 of 10		
Responsible Office: NASA SSC Center Operations Directorate Design & Construction Project Management Division		
SUBJECT: ASME GTAW & SMAW Weld Procedure for Carbon Steel Pipe - Maximum 1-Inch Material Thickness		

 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 34-108-M1		Date 9/21/2018	Revision Number C
Qualified To ASME Boiler and Pressure Vessel Code		Company Name Syncom Space Services	
BASE METALS (QW-403)			
Peening	Not allowed.		
Surface Preparation	Chipping, Manual or Pneumatic, Brushing or Grinding. (See Notes ****)		
Initial/Interpass Cleaning			
Back Gouging Method	Grinding or Arc Gouging followed by Grinding.		
NOTES			
*ASME GTAW and SMAW Weld Procedure for Carbon Steel Pipe - Max 2" Material Thickness.			
**Flat, Vertical and Overhead, Root gap 1/8" ± 1/32".			
***SINGLE - NO PASS GREATER THAN 1/2"			
****Repair - Grind or Arc Gouge defective area(s). Weld repair using this procedure, or repair as directed by Engineering.			
Signature 1		Signature 2	
Engineer Name Doug Dike	Signature 	Quality Name Stephen Koch	Signature 
Date 9/21/2018		Date 9/21/2018	
Signature 3		Signature 4	
Customer Reviewer Name Benjamin McGrath	Signature 	Customer Name	Signature
Date 9/21/2018		Date	

Stennis Standard	SSTD-8070-0039-WELD	B
	Number	Rev.
	Effective Date: October 29, 2018	
	Review Date: October 29, 2023	
		Page 8 of 10
Responsible Office: NASA SSC Center Operations Directorate Design & Construction Project Management Division		
SUBJECT: ASME GTAW & SMAW Weld Procedure for Carbon Steel Pipe - Maximum 1-Inch Material Thickness		




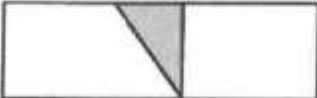





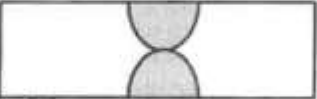
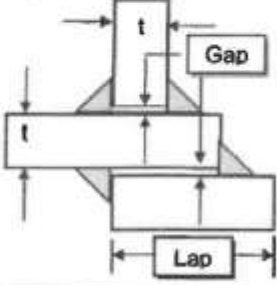
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Weld Joint Designs

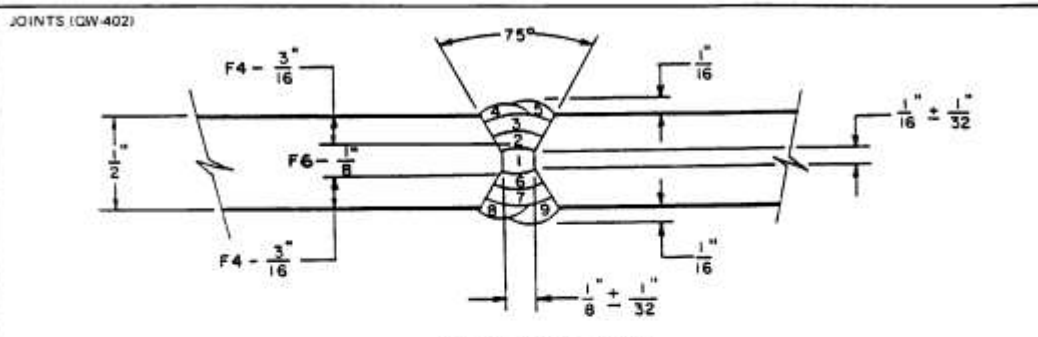
Attachment #1

Single-V Groove	Single-Bevel Groove	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.	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.	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	Single-J Groove	Double-J 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.	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.	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	Double-U Groove	Fillet Weld T or Lap
		
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.	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.	Gap: 1/16-in. max. / Lap: 5 x t or 1 in. min.

ATTACHMENT A.2 - PQR WELD PROCEDURE 34-108-MI

QW-483 SUGGESTED FORMAT FOR PROCEDURE QUALIFICATION RECORD (PQR)
 (See QW-201.2, Section IX, ASME Boiler and Pressure Vessel Code)
 Record Actual Conditions Used to Weld Test Coupon.

Company Name PAN AM WORLD SERVICES, INC.
 Procedure Qualification Record No. 34-108-MI APPENDIX A Date _____
 WPS No. 34-108-M1
 Welding Processes GAS TUNGSTEN ARC (GTAW) AND SHIELDED METAL ARC (SMAW)
 Types (Manual, Automatic, Semi-Auto.) MANUAL



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

BASE METALS (QW-403) Material Spec. <u>SA 36 TO SA 36</u> Type or Grade <u>NOT APPLICABLE</u> P-No. <u>1</u> to P-No. <u>1</u> Thickness of Test Coupon <u>1/2"</u> Diameter of Test Coupon <u>NOT APPLICABLE</u> Other _____		POSTWELD HEAT TREATMENT (QW-407) Temperature <u>NOT APPLICABLE</u> Time _____ Other _____																																								
FILLER METALS (QW-404) <table border="1"> <tr> <td>SFA Specification</td> <td><u>5.18</u></td> <td><u>5.1</u></td> </tr> <tr> <td>AWS Classification</td> <td><u>ER 70S-3</u></td> <td><u>E 7018</u></td> </tr> <tr> <td>Filler Metal F-No.</td> <td><u>6</u></td> <td><u>4</u></td> </tr> <tr> <td>Weld Metal Analysis A-No.</td> <td><u>1</u></td> <td><u>1</u></td> </tr> <tr> <td>Size of Filler Metal</td> <td></td> <td></td> </tr> <tr> <td>Other</td> <td><u>F6 3/32"</u></td> <td><u>F4 1/8"</u></td> </tr> <tr> <td>Deposited Weld Metal</td> <td><u>GTAW</u></td> <td><u>SMAW</u></td> </tr> </table>		SFA Specification	<u>5.18</u>	<u>5.1</u>	AWS Classification	<u>ER 70S-3</u>	<u>E 7018</u>	Filler Metal F-No.	<u>6</u>	<u>4</u>	Weld Metal Analysis A-No.	<u>1</u>	<u>1</u>	Size of Filler Metal			Other	<u>F6 3/32"</u>	<u>F4 1/8"</u>	Deposited Weld Metal	<u>GTAW</u>	<u>SMAW</u>	GAS (QW-408) <table border="1"> <thead> <tr> <th rowspan="2"></th> <th colspan="2">Percent Composition</th> <th rowspan="2">Flow Rate</th> </tr> <tr> <th>Gases</th> <th>(Mixture)</th> </tr> </thead> <tbody> <tr> <td>Shielding Gas</td> <td><u>ARGON</u></td> <td><u>99.998%</u></td> <td><u>35 CFH</u></td> </tr> <tr> <td>Trailing</td> <td><u>NOT USED</u></td> <td></td> <td></td> </tr> <tr> <td>Backing</td> <td><u>NOT USED</u></td> <td></td> <td></td> </tr> </tbody> </table>			Percent Composition		Flow Rate	Gases	(Mixture)	Shielding Gas	<u>ARGON</u>	<u>99.998%</u>	<u>35 CFH</u>	Trailing	<u>NOT USED</u>			Backing	<u>NOT USED</u>		
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POSITION (QW-405) Position of Groove <u>1G FLAT</u> Weld Progression (Uphill, Downhill) <u>UPHILL</u> Other <u>DOWNHILL NOT ALLOWED</u>		ELECTRICAL CHARACTERISTICS (QW-409) Current <u>DIRECT</u> Polarity <u>GTAW - STRAIGHT / SMAW - REVERSE</u> Amps. <u>F6 80-125 / F4 145-150</u> Volts <u>F6 20-32 / F4 18-28</u> Tungsten Electrode Size <u>3/32"</u> Other _____																																								
PREHEAT (QW-406) Preheat Temp. <u>73°F</u> Interpass Temp. <u>NOT REQUIRED</u> Other _____		TECHNIQUE (QW-410) Travel Speed <u>F6 - 2IPM / F4 - 6IPM</u> String or Weave Bead <u>F6 STRING / F4 WEAVE + STRINGER</u> Oscillation <u>NOT APPLICABLE</u> Multipass or Single Pass (per side) <u>SINGLE</u> Single or Multiple Electrodes <u>SINGLE</u> Other _____																																								

OW-483 (Back)

APPENDIX

Tensile Test (OW-150)

PQR No. 34-108-M1

A

Specimen No.	Width	Thickness	Area	Ultimate Total Load lb	Ultimate Unit Stress psi	Type of Failure & Location
T-1	.760	.500	.380	27,000	71,053	OW
T-2	.755	.493	.372	27,500	73,925	OW

Guided-Band Tests (OW-160)

Type and Figure No.	Result
SB # 1 OW 462.2	Satisfactory
SB # 2 OW 462.2	Satisfactory
SB # 3 OW 462.2	Satisfactory
SB # 4 OW 462.2	Satisfactory

Toughness Tests (OW-170)

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

Fillet-Weld Test (OW-180)

Result — Satisfactory: Yes _____ No _____ Penetration into Parent Metal: Yes _____ No _____
 Macro—Results _____

Other Tests

Type of Test _____
 Deposit Analysis _____
 Other _____

Welder's Name WALTER C. KING S.S. No. 427-94-7139 Stamp No. 19
 Tests conducted by: OIS mobile Lab, INC. Laboratory Test No. P.O. #L-20972
 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 PanAm World Services, Inc.

Date 10-2-87 By Richard J. Nyberg
 (Detail of record of tests are illustrative only and may be modified to conform to the type and number of tests required by the Code.)