SSTD-8070-0019-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 WELDING PROCEDURE FOR ASTM A514 (B) HSLA (T-1 Steel) PLATE & PIPE – MAXIMUM 2-INCH MATERIAL THICKNESS

Approved by:

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

Concurrence by:

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

Issued by

ISSUED CEF	7-17-2019
Central Engineering Files	Date

Document History Log

Status / Change / Revision	Change Date	Originator / Phone	Description
Basic	08/25/08	Doug Dike 8-2803	Initial release. Supersedes SSC STD 34-014.
A	01/30/15	Doug Dike 8-2803	Five-year revision. Updated references and acronyms. Added to 1.0, paragraph 2, that "SAE AMS 6386 is also a specification for T-1 steel in sheet and plate form, and material previously fabricated in accordance with SAE AMS 6386, Type 2, and ASTM A517 Grade B may be used interchangeably with ASTM A514 Grade B to qualify a welder or weld procedure under this standard." Updated WPS and PQR attachments.
B	06/27/19	Doug Dike 8-2803	Updated cover sheet to reflect Approval by PMD, with concurrence by OMD, E&TD, and S&MA. Updated references and acronyms. Minor administrative changes. 6.0-b: Added "and in accordance with ASME Boiler and Pressure Vessel Codes, Section IX, requirements." 6.0-d: Deleted "For each WPS requiring Charpy impact testing per Section QW-170 of the ASME Boiler & Pressure Vessel Code, the minimum toughness test temperature under the supporting PQR(s) shall be equal to or less than the minimum service temperature of the weldment or -320°F, whichever is greater." Merged WPSs (NASA 34-014-1-1-1 and NASA 34-041-2-1-1). Eliminated PQRDs, and references to same throughout document.

Table of Contents

1.0 PURPOSE

T-1 metal pipe has previously been identified in John C. Stennis Space Center (SSC) standards (SSTDs) as HSLA, HS-1A, ASTM A514, ASME SA517, ASTM A333, Low Alloy Steel Plate, ASME SA-6 as well as T-1. Some of these references are general in nature and others appear to be incorrect (e.g., A333 Grade 1 has a tensile strength of 55,000 which would not be considered T-1 steel). Prior uses of the ASTM designations are questionable; A514 and A517 are specifications for plate, not pipe.

There are still piping systems onsite that were fabricated per the requirements of the SSTDs noted below, and therefore must be maintained. Pipe fabricated from T-1 steel is no longer available at reasonable costs or delivery. Therefore, this procedure uses A514 Grade B plate to qualify a weld procedure and welder(s) with the intent to perform welding on steel pipe fabricated from T-1 steel. SAE AMS 6386 is also a specification for T-1 steel in sheet and plate form, and material previously fabricated in accordance with SAE AMS 6386, Type 2, and ASTM A517 Grade B may be used interchangeably with ASTM A514 Grade B to qualify a welder or weld procedure under this standard.

One (1) Weld Procedure Specification (WPS) was developed for welding of T-1 steel plate/pipe up to a maximum of 2” thickness.

The following documents were generated based on welding a ¼” plate and, per Code permits, qualified welders to weld up to ½” thick T-1 steel:

a. WPS NASA 34-014-1-1-1
b. Procedure Qualification Record (PQR) NASA 34-014-1-1

The following documents were generated based on welding 1” plate and, per Code permits, qualified Welders to weld T-1 steel from ½” thick to a maximum of 2” thick:

a. WPS NASA 34-014-1-1-1
b. PQR NASA 34-014-2-1

2.0 SCOPE

This SSTD provides for a qualified American Society of Mechanical Engineers (ASME) weld procedure for Gas Tungsten Arc Welding (GTAW) of ASTM A514 Grade B (UNS No. K11630) high-strength (tensile strength of 110,000 psi or more) steel plate (also known as T-1 steel) up to a maximum thickness of 2 inches. This SSTD provides a weld procedure for performing maintenance and modifications to existing piping systems onsite. This SSTD is not for new construction unless prior approval is obtained from NASA Engineering.

3.0 APPLICABILITY

This SSTD applies to all contractor and subcontractor personnel involved with the GTAW welding of T-1 steel.

4.0 REFERENCES AND APPLICABLE DOCUMENTS

Applicable documents shall be the latest version unless otherwise specified.

ASME Boiler and Pressure Vessel Code, Section IX, *Welding, Brazing, and Fusing Qualifications*
ASTM A333, *Standard Specification for Seamless and Welded Steel Pipe for Low-Temperature Service and other Applications with Required Notch Toughness*
ASTM A514, Grade B, *High-Yield-Strength, Quenched and Tempered Alloy Steel Plate*
ASTM A517, Grade B, *Standard Specification for Pressure Vessel Plates, Alloy Steel, High-Strength, Quenched and Tempered*
SAE AMS 6386, Type 2, *Steel Sheet and Plate, Low Alloy, Heat Treated, 90,000 psi (621 MPa) and 100,000 psi (690MPa) Yield Strength*
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*

5.0 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.

6.0 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 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 National Aeronautics and Space Administration (NASA) SSC Center Operations Directorate Project Management Division (PMD), the NASA SSC Center Operations Directorate Operations and Maintenance Division (OMD), 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 PQRs (NASA 34-014-1-1 and NASA 34-014-2-1) are the PQRs for the original WPS 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.

7.0 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 PQRs (copies of which are provided as attachments in Section 9.0 of this SSTD) shall be maintained in Central Engineering Files (CEF).

8.0 ACRONYMS AND ABBREVIATIONS

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
CEF	Central Engineering Files
E&TD	Engineering and Test Directorate
GTAW	Gas Tungsten Arc Welding
HSLA	High-strength low-alloy
NASA	National Aeronautics and Space Administration
OMD	Operations and Maintenance Division
PMD	Project Management Division
PQR	Procedure Qualification Record
psi	pounds per square inch
S&MA	Safety and Mission Assurance
SAE	Society of Automatic Engineers
SPR	John C. Stennis Space Center Procedural Requirement
SSC	John C. Stennis Space Center
SSTD	John C. Stennis Space Center Standard

9.0 WELDING PROCEDURES

NASA 34-014-1-1-1 WPS

NASA 34-014-1-1 PQR
For ¼" Welding Wall Thickness (Maximum of ½" Thick Plate/Pipe)

NASA 34-014-2-1 PQR
For ½" Welding Wall Thickness (Maximum of 1" Thick Plate/Pipe)

9.1 WPS # NASA 34-014-1-1-1

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
NASA 34-014-1-1-1	June 1, 2019	B
Qualified To	**Company Name**	
ASME Boiler and Pressure Vessel Code, Section IX, and B31.3	Syncom Space Services (S3)	
Supporting PQR(s)	**Reference Docs.**	
NASA 34-014-1-1 Rev-1 and NASA 34-014-2-1 Rev-1	SSTD-8070-0019-WELD	
Scope	**Joint**	
Groove, fillet, No PWHT (as-weld), Impact Testing	See Note A.	

BASE METALS

Type	See Note B.	P-no.	S11B	Grp-no.	SG4
Welded To	See Note B.	P-no.	S11B	Grp-no.	SG4
Backing	None	P-no.		Grp-no.	
Retainers	None				
Notes					

THICKNESS RANGE QUALIFIED

	As-welded Min.	As-welded Max.	With PWHT Min.	With PWHT Max.
Complete Pen.	0.063"	2.0"	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	THICKNESS RANGE QUALIFIED As-welded Min.	As-welded Max.	With PWHT Min.	With PWHT Max.
GTAW	5.28	ER120S-1	6	12	Bare Solid Wire	0.063"	2.0"	N/A	N/A
Cons. Insert		N/A			None				
Flux		N/A			None				

WELDING PROCEDURE

Welding Process		GTAW		
Type		Manual		
Minimum preheat/interpass temperature (°F)		200°F (See Note C.)		
Maximum interpass temperature (°F)		300°F (See Note C.)		
Tungsten Size		0.125"		
Tungsten Type		SFA 5.12 EWTh-2		
Filler Metal Size (in.)		1/16" - 5/32"		
Layer Number		All		
Position of Groove		All		
Weld Progression		-		
Current/Polarity		DC/SP		
Amperes		100 - 250		
Volts		12 - 20		
Travel Speed (in./min)		3 - 6		
Maximum Heat Input (kj/in)		100		
DC Pulsing Current		-		
Shielding:	Gas Type	Argon 99.998%		
	Flow Rate (cfh)	20 - 30		
Trailing:	Gas Type	None		
	Flow Rate (cfh)	-		
Backing:	Gas Type	Argon 99.998% (See Note D.)		
	Flow Rate (cfh)	8 - 15		
String or Weave		String or Weave		
Orifice/Gas Cup Size		8 - 12		
Multi/Single Pass per Side		Single or multiple passes.		
Weld Deposit Chemistry				

Notes

SSC-937 (05/2019) Page 1 of 3

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
NASA 34-014-1-1-1	June 1, 2019	B
Qualified To	**Company Name**	
ASME Boiler and Pressure Vessel Code, Section IX, and B31.3	Syncom Space Services (S3)	

BASE METALS

Peening	Not allowed.
Surface Preparation	See Note E.
Initial/Interpass Cleaning	Brushing and Grinding.
Back Gouging Method	None

POSTWELD HEAT TREATMENT

Temperature	None
Time and Temperature	None
Other	None

NOTES

A. Joints section of this WPS, Production drawings, Engineering specifications.

B. HSLA (quenched and tempered).

C. Preheat to 200°F minimum, not to exceed 300°F maximum. Keep as close to 200°F as possible. After welding, wrap with heat blanket and let cool slowly, until the temperature reaches 90°F or less. Do not perform NDT testing on welds until 48 hours or more time has lapsed.

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

E. All weld joint surfaces shall be cleaned of oil, grease, paint, markings, etc.

Signature 1		**Signature 2**	
Engineer Name: Doug Dike	Signature	Quality Name: George Smith	Signature: George E. Smith (S3 36 QA)
Date: June 1, 2019		Date: June 1, 2019	
Signature 3		**Signature 4**	
Customer Reviewer Name: Benjamin McGrath	Signature: Benjamin A. McGrath (T NASA 580)	Customer Name	Signature
Date: June 1, 2019		Date	

SSC-937 (05/2019)

Page 2 of 3

National Aeronautics and Space Administration
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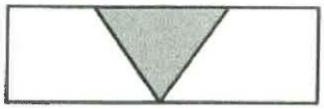
ASME - WELDING PROCEDURE SPECIFICATIONS (WPS)

Welding Procedure Specification Record Number	Date	Revision Number
NASA 34-014-1-1-1	June 1, 2019	B
Qualified To	**Company Name**	
ASME Boiler and Pressure Vessel Code, Section IX, and B31.3	Syncom Space Services (S3)	

Weld Joint Designs

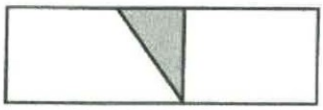
Attachment #1

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

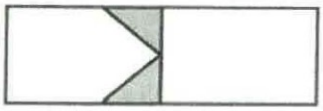


Groove Angle: 37.5 to 45 deg
Root Opening: 1/16 to 3/16 in.
Root Face: 0 to 1/16 in.
Misalignment: 1/16-in. max.

Double-V Groove

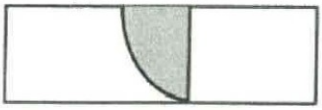
Groove Angle: 50 to 75 deg
Root Opening: 1/16 to 3/16 in.
Root Face: 0 to 1/16 in.
Misalignment: 1/16-in. max.

Double-Bevel Groove



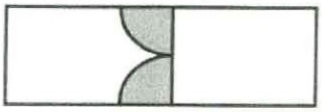
Groove Angle: 37.5 to 45 deg
Root Opening: 1/16 to 3/16 in.
Root Face: 0 to 1/16 in.
Misalignment: 1/16-in. max.

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

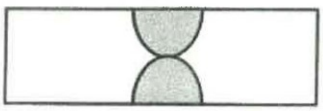


Groove Angle: 37.5 to 45 deg
Groove Radius: 3/8 in.
Root Opening: 1/16 to 3/16 in.
Root Face: 0 to 1/16 in.
Misalignment: 1/16-in. max.

Single-U Groove

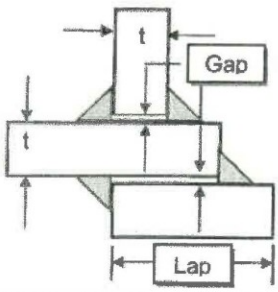
Groove Angle: 50 to 75 deg
Groove Radius: 3/8 in.
Root Opening: 1/16 to 3/16 in.
Root Face: 0 to 1/16 in.
Misalignment: 1/16-in. max.

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.

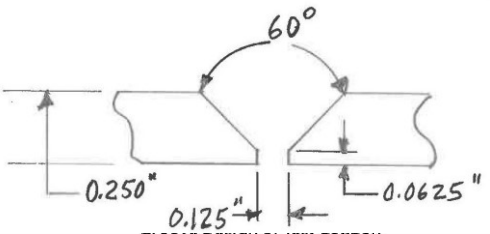
SSC-937 (05/2019) Page 3 of 3

9.2 Jacobs Technology PQR # NASA 34-014-1-1

FORM QW-483 SUGGESTED FORMAT FOR PROCEDURE QUALIFICATION RECORDS (PQR)
(See QW-200.2, Section IX, ASME Boiler and Pressure Vessel Code)
Record Actual Variables Used to Weld Test Coupon

Organization Name: Jacobs Technology
Procedure Qualification Record No.: NASA 34-014-1-1 Rev 1 Date: 11/15/2014
WPS No.: NASA 34-014-1-1-1 Rev. 1
Welding Process(es): GTAW
Types (Manual, Automatic, Semi-Automatic): Manual

JOINTS (QW-402)



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

BASE METALS (QW-403)
Material Spec.: ASTM A-514 (B)
Type/Grade, or UNS Number:
P-No. 11B Group No. 4 to P-No. 11B Group No. 4
Thickness of Test Coupon: 0.25"
Diameter of Test Coupon: N/A
Maximum Pass Thickness:
Other:

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

GAS (QW-408)

	Gas(es)	Percent Composition (Mixture)	Flow Rate
Shielding	Argon	99.998%	25 cfh
Trailing			
Backing	Argon	99.998%	8 cfh
Other			

FILLER METALS (QW-404) SFA: 1 | 2
Specification: 5.28
AWS Classification: ER120S-1
Filler Metal F-No.: 6
Weld Metal Analysis A-No.: 12
Size of Filler Metal: 3/32"
Filler Metal Product Form: N/A
Supplemental Filler Metal: N/A
Electrode Flux Classification: N/A
Flux Type: N/A
Flux Trade Name: N/A
Weld Metal Thickness Other: 0.5"

ELECTRICAL CHARACTERISTICS (QW-409)
Current: DC
Polarity: SP
Amps.: 110-150 Volts: 14 - 14.1
Tungsten Electrode Size: 3/32"
Mode of Metal Transfer for GMAW (FCAW): N/A
Heat Input:
Other:

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

TECHNIQUE (QW-410)
Travel Speed: 6 - 8.3 ipm
String or Weave Bead: Weave
Oscillation: N/A
Multipass or Single Pass (Per Side): Multipass
Single or Multiple Electrodes: Single
Other:

PREHEAT (QW-406)
Preheat Temperature: 200°F
Interpass Temperature: 300 F max
Other:

(07/13)

FORM QW-483 (Back)

PQR No. _____

Tensile Test (QW-150)

Specimen No.	Width	Thickness	Area	Ultimate Total Load	Ultimate Unit Stress, (psi or MPa)	Type of Failure and Location
T-1	0.754	0.226	0.1704	19,492 lbs	114,000	Ductile base metal
T-2	0.752	0.232	0.1745	20,378 lbs	116,779	Ductile base metal

Guided-Bend Tests (QW-160)

Type and Figure No.	Result
2 transverse face bends per QW 161.2 and QW-462.3(a) 2	Acceptable
transverse root bends per QW 161.3 and QW-462.3(a)	Acceptable

Toughness Tests (QW-170)

Specimen No.	Notch Location	Specimen Size	Test Temperature	Impact Values			Drop Weight Break (Y/N)
				ft-lb or J	% Shear	Mils (in.) or mm	
Base Metal 1	Base Metal	0.394 x 0.197	-50°F	29	100	48	Break
Base Metal 2	Base Metal	0.394 x 0.197	-50°F	24	100	51	Break
Base Metal 3	Base Metal	0.394 x 0.197	-50°F	28	100	44	Break
HAZ1	HAZ	0.394 x 0.197	-50°F	25	60	23	Break
HAZ2	HAZ	0.394 x 0.197	-50°F	15	60	30	Break
HAZ3	HAZ	0.394 x 0.197	-50°F	12	40	15	Break
Weld Metal 1	Weld Metal	0.394 x 0.197	-50°F	52	100	32	Break
Weld Metal 2	Weld Metal	0.394 x 0.197	-50°F	44	100	34	Break
Weld Metal 3	Weld Metal	0.394 x 0.197	-50°F	40	100	28	Break

Comments _____

Fillet-Weld Test (QW-180)

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

Macro — Results _____

Other Tests

Type of Test Vickers (HV) 10kg Hardness Test - See Rev 0 for results

Deposit Analysis _____

Other _____

Welder's Name Kevin Jurich Clock No. _____ Stamp No. 19

Tests Conducted by Southern Inspection Laboratory Test No. 01100107

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 Boiler and Pressure Vessel Code.

Organization Southern Inspection

Date 11/27/2007 Certified by Original signed by Rennis Branson

(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.)

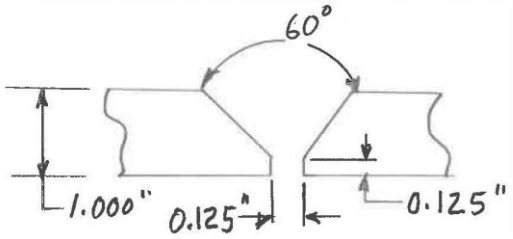
(07/13)

9.3 Jacobs Technology PQR # NASA 34-014-2-1

FORM QW-483 SUGGESTED FORMAT FOR PROCEDURE QUALIFICATION RECORDS (PQR)
(See QW-200.2, Section IX, ASME Boiler and Pressure Vessel Code)
Record Actual Variables Used to Weld Test Coupon

Organization Name: Jacobs Technology
Procedure Qualification Record No.: NASA 34-014-2-1 Rev 1 Date: 11/15/2014
WPS No.: NASA 34-014-2-1-1 Rev 1
Welding Process(es): GTAW
Types (Manual, Automatic, Semi-Automatic): Manual

JOINTS (QW-402)



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

BASE METALS (QW-403)
Material Spec.: ASTM A-514(B)
Type/Grade, or UNS Number:
P-No. 11B Group No. 4 to P-No. 11B Group No. 4
Thickness of Test Coupon: 1.00"
Diameter of Test Coupon: N/A
Maximum Pass Thickness:
Other:

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

GAS (QW-408)

	Gas(es)	Percent Composition (Mixture)	Flow Rate
Shielding	Argon	99.998%	25 cfh
Trailing			
Backing	Argon	99.998%	8 cfh
Other			

FILLER METALS (QW-404)	1	2
SFA Specification	5.28	
AWS Classification	ER120S-1	
Filler Metal F-No.	6	
Weld Metal Analysis A-No.	12	
Size of Filler Metal	0.125	
Filler Metal Product Form	N/A	
Supplemental Filler Metal	N/A	
Electrode Flux Classification	N/A	
Flux Type	N/A	
Flux Trade Name	N/A	
Weld Metal Thickness	1.00"	
Other		

ELECTRICAL CHARACTERISTICS (QW-409)
Current: DC
Polarity: SP
Amps.: 250 Volts: 20
Tungsten Electrode Size: 0.125
Mode of Metal Transfer for GMAW (FCAW): N/A
Heat Input:
Other:

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

TECHNIQUE (QW-410)
Travel Speed: 3 ipm
String or Weave Bead: Weave
Oscillation: N/A
Multipass or Single Pass (Per Side): Multipass
Single or Multiple Electrodes: Single
Other:

PREHEAT (QW-406)
Preheat Temperature: 200°F
Interpass Temperature: 300°F max
Other:

(07/13)

FORM QW-483 (Back)

PQR No. _____

Tensile Test (QW-150)

Specimen No.	Width	Thickness	Area	Ultimate Total Load	Ultimate Unit Stress, (psi or MPa)	Type of Failure and Location
T-1	0.753	0.981	0.7387	85.942 lbs	116,342	Ductile base metal
T-2	0.755	0.986	0.7444	88,157 lbs	118,426	Ductile base metal

Guided-Bend Tests (QW-160)

Type and Figure No.	Result
4 transverse side bends per QW 161.1 and QE-462.2	Acceptable

Toughness Tests (QW-170)

Specimen No.	Notch Location	Specimen Size	Test Temperature	Impact Values			
				ft-lb or J	% Shear	Mils (in.) or mm	Drop Weight Break (Y/N)
Base Metal 1	Base Metal	0.394 x 0.394	-50°F	76	100	58	Break
Base Metal 2	Base Metal	0.394 x 0.394	-50°F	69	100	46	Break
Base Metal 3	Base Metal	0.394 x 0.394	-50°F	64	100	43	Break
HAZ 1	HAZ	0.394 x 0.394	-50°F	89	40	56	Break
HAZ 2	HAZ	0.394 x 0.394	-50°F	97	50	61	Break
HAZ 3	HAZ	0.394 x 0.394	-50°F	94	40	59	Break
Weld Metal 1	Weld Metal	0.394 x 0.394	-50°F	140	100	69	Break
Weld Metal 2	Weld Metal	0.394 x 0.394	-50°F	130	100	60	Break
Weld Metal 3	Weld Metal	0.394 x 0.394	-50°F	140	100	87	Break

Comments _____

Fillet-Weld Test (QW-180)

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

Macro — Results _____

Other Tests

Type of Test Vickers (HV) 10kg Hardness Test - See Rev 0 for results.

Deposit Analysis _____

Other _____

Welder's Name Kevin Jurisch Clock No. _____ Stamp No. 19

Tests Conducted by Southern Inspection Laboratory Test No. 01100207

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 Boiler and Pressure Vessel Code.

Organization Southern Inspection

Date 11/27/2007 Certified by Original signed by Rennis Branson

(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.)

(07/13)