



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

SSTD-8070-0020-WELD
Rev. B
MARCH 2022

COMPLIANCE IS MANDATORY

John C. Stennis Space Center GAS TUNGSTEN ARC WELDING (GTAW) PROCEDURE FOR ASME P-No. 8 STAINLESS STEEL TO ASME P-No. 1 CARBON STEEL

Approved by:

<u>Scott Olive</u>	<u>4-6-2022</u>
NASA SSC Center Operations	Date
Directorate Facilities Engineering	
Test Complex Support	

<u>Todd Mannion</u>	<u>4-6-2022</u>
NASA SSC Center Operations Directorate	Date
Facility Services Branch	

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NASA SSC Engineering & Test Directorate	Date

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NASA SSC Safety & Mission Assurance	Date

Issued by

<u>ISSUED CEF</u>	<u>4-6-2022</u>
Central Engineering Files	Date

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SUBJECT: GTAW Procedure for ASME P-No. 8 Stainless Steel to ASME P-No. 1 Carbon Steel		

Document History Log

Status/Change/ Revision	Change Date	Originator / Phone	Description
Basic	05.22.2012	Doug Dike x8-2803	Initial release, supersedes SSC-34-018.
A	04.11.2017	Larry DeQuay x8-1956	Five-year review. Updated cover sheet to reflect approval by NASA SSC PMD; with concurrence from NASA SSC E&TD, NASA SSC OMD, and NASA SSC S&MA. Administrative changes throughout document. Updated acronyms, as well as WPS, PQR, Certificate of Analysis, and WPQ attachments.
A-1	8.17.2017	George Smith X8-1680	Administrative change on attachments to change contract named from FOSSC to SACOM.
B	03.31.2022	Benny McGrath X8-2969	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." Updated WPS to SSC-937.

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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 ASME P-No. 8 Stainless Steel to ASME P-No. 1 Carbon Steel pipe or plate with a thickness range of 0.1875" to 1.00".

2.0 APPLICABILITY

This SSTD applies to all National Aeronautics and Space Administration (NASA) SSC contractor and subcontractor personnel involved in the GTAW welding of stainless steel to carbon steel.

3.0 REFERENCES 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 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.

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- c. The attached Procedure Qualification Record (PQR) is the PQR 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.

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, PQR and WPQ (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
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
SPR	John C. Stennis Space Center Procedural Requirement
SSC	John C. Stennis Space Center
SSTD	John C. Stennis Space Center Standard
WPQ	Welder Performance Qualification
WPS	Weld Procedure Specifications

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ATTACHMENT A

A.1 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 SSTD-8070-0020-WELD		Date February 9, 2022	Revision Number 2																																																								
Qualified To ASME Boiler and Pressure Vessel Group		Company Name Syncom Space Services (S3)																																																									
Supporting PQR(s) SSTD-8070-0020-WELD (A)		Reference Docs.																																																									
Scope GTAW P-No. 8 Stainless Steel to P-No. 1 Carbon Steel		Joint Single V Groove																																																									
BASE METALS Type Stainless Steel P-no. 8 Grp-no. _____ Welded To Carbon Steel P-no. 1 Grp-no. _____ Backing Not Permitted P-no. _____ Grp-no. _____ Retainers _____ Notes _____		THICKNESS RANGE QUALIFIED <table border="1"> <thead> <tr> <th></th> <th>Min.</th> <th>As-welded</th> <th>Max.</th> <th>Min.</th> <th>With PWHT</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td>Complete Pen.</td> <td>0.1875"</td> <td></td> <td>1.00"</td> <td>N/A</td> <td></td> <td>N/A</td> </tr> <tr> <td>Complete Pen.</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Impact Tested</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Impact Tested</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Fillet Welds</td> <td>All</td> <td></td> <td></td> <td>N/A</td> <td></td> <td>N/A</td> </tr> </tbody> </table> DIAMETER RANGE QUALIFIED <table border="1"> <thead> <tr> <th></th> <th>Min.</th> <th>As-welded</th> <th>Max.</th> <th>Min.</th> <th>With PWHT</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td>Nominal Pipe Size</td> <td>All</td> <td></td> <td>N/A</td> <td>N/A</td> <td></td> <td>N/A</td> </tr> </tbody> </table>			Min.	As-welded	Max.	Min.	With PWHT	Max.	Complete Pen.	0.1875"		1.00"	N/A		N/A	Complete Pen.							Impact Tested							Impact Tested							Fillet Welds	All			N/A		N/A		Min.	As-welded	Max.	Min.	With PWHT	Max.	Nominal Pipe Size	All		N/A	N/A		N/A
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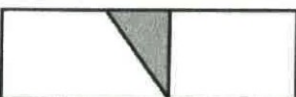

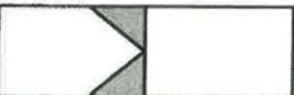

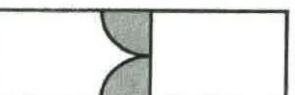

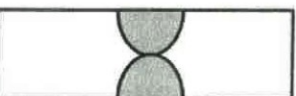
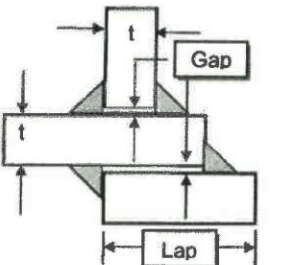
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Welding Procedure Specification Record Number SSTD-8070-0020-WELD		Date February 9, 2022	Revision Number 2
Qualified To ASME Boiler and Pressure Vessel Group		Company Name Syncom Space Services (S3)	
BASE METALS Peening <u>Not allowed.</u> Surface Preparation <u>N/A</u> Initial/Interpass Cleaning <u>See Note E.</u> Back Gouging Method <u>N/A</u>			
POSTWELD HEAT TREATMENT Temperature <u>None</u> Time and Temperature <u>None</u> Other <u>None</u>			
NOTES A. ER309 is acceptable, but requires Engineering approval. B. Preheat maintenance as needed. C. High flow of shielding gas flow over molten puddle is required to eliminate nitrogen absorption from atmosphere. D. Minimum 10 minutes of back purging prior to welding. E. Brushing or grinding using 300 series Stainless Steel brushes and aluminum oxide wheels. When cleaning the P-No. 8 base metal side of the weld joint, the grinding wheels and brushes shall neither have been previously used on carbon steel nor had contact with the P-No. 1 base metal side of the joint.			
Signature 1 Engineer Name <u>Matthew Medick</u> <u>ERIC CRANFORD</u> Signature <u>[Signature]</u> Date <u>3/7/2022</u>			
Signature 2 Quality Name <u>George Smith</u> Signature <u>[Signature]</u> Date <u>2-17-2022</u>			
Signature 3 Customer Reviewer Name <u>Benjamin A. McGrath</u> Signature <u>[Signature]</u> Date <u>2-11-22</u>			
Signature 4 Customer Name _____ Signature _____ Date _____			
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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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A.2 PQR

Accepted by Syncom Space Services LLC
George E. Smith 8/16/2017
Jody J. 8/16/2017
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 <u>Jacobs Technology</u>	
Procedure Qualification Record No. <u>SSTD-8070-0020-WELD(A)</u>	Date <u>7/11/11</u>
WPS No. <u>SSTD-8070-0020-WELD</u>	
Welding Process(es) <u>GTAW</u>	
Types (Manual, Automatic, Semi-Auto.) <u>Manual</u>	

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)		POSTWELD HEAT TREATMENT (QW-407)	
Material Spec. <u>ASTM A240</u>	/ <u>ASTM A-36</u>	Temperature <u>N/A</u>	
Type or Grade <u>304</u>	/ <u>A-36</u>	Time <u>N/A</u>	
P-No. <u>8</u>	to P-No. <u>1</u>	Other	
Thickness of Test Coupon <u>0.500"</u>			
Diameter of Test Coupon <u>N/A</u>			
Other			

FILLER METALS (QW-404)		GAS (QW-408)	
SFA Specification <u>5.9</u>		Percent Composition	
AWS Classification <u>ER-312</u>		Shielding	Gas(es) <u>Argon</u> (Mixture) <u>99.9</u> Flow Rate <u>20-60 CFH</u>
Filler Metal F-No. <u>6</u>		Trailing	<u>N/A</u> <u>N/A</u> <u>N/A</u>
Weld Metal Analysis A-No. <u>8</u>		Backing	<u>Argon</u> <u>99.9%</u> <u>20-60 CFH</u>
Size of Filler Metal <u>3/32" - 1/8"</u>			
Other			
Deposited Weld Metal <u>0.500"</u>			

POSITION (QW-405)		ELECTRICAL CHARACTERISTICS (QW-409)	
Position of Groove <u>1G</u>		Current <u>DC</u>	
Weld Progression (Uphill, Downhill) <u>N/A</u>		Polarity <u>EN</u>	
Other		Amps. <u>97 - 177</u> Volts <u>12.5 - 14.6</u>	
		Tungsten Electrode Size <u>1/8"</u>	
		Other	

PREHEAT (QW-406)		TECHNIQUE (QW-410)	
Preheat Temp. <u>50°F Min.</u>		Travel Speed <u>4-11 IPM</u>	
Interpass Temp. <u>150°F - 271°F</u>		String or Weave Bead <u>String & Weave</u>	
Other		Oscillation <u>N/A</u>	
		Multipass or Single Pass (per side) <u>Multipass</u>	
		Single or Multiple Electrodes <u>Single</u>	
		Other	

Travis G Moore
CW1 99041251
QC1 EXP. 4/1/2014

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Stennis Standard	SSTD-8070-0020-WELD	B
	Number	Rev.
	Effective Date:	March 31, 2022
	Review Date:	March 31, 2027
Page 10 of 12		
Responsible Office: NASA SSC Center Operations Directorate		
SUBJECT: GTAW Procedure for ASME P-No. 8 Stainless Steel to ASME P-No. 1 Carbon Steel		

Accepted by Syncom Space Services LLC QW-483 (Back)
George E. Smith 8/16/2017 *gale* 8/16/2017
 Tensile Test (QW-150) PQR No. SSTD-8070-0020-WELD(A)

Specimen No.	Width	Thickness	Area	Ultimate Total Load lb	Ultimate Unit Stress psi	Type of Failure & Location
6326.90 -T1	0.755"	0.488"	0.3684"	24,775	67,300	Base
6326.90 -T2	0.755"	0.483"	0.3647"	24,825	68,070	Base

Guided-Bend Tests (QW-160)

Type and Figure No.	Result
6326.90 -S1 Side Bend QW-462.2	Acceptable
6326.90 -S2 Side Bend QW-462.2	Acceptable
6326.90 -S3 Side Bend QW-462.2	Acceptable
6326.90 -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	

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 Mark Corr Soc. Sec. No. Stamp No. JT34
 Tests conducted by: Inspection Specialists, Inc. - MTL Div. Laboratory Test No. 5671.90
 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 July 11, 2011 *Travis G Moore* By
 **Travis G Moore**
 CWI 99041251
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A.3 Certificate of Analysis



INSPECTION SPECIALISTS, INC.
MECHANICAL TESTING LABORATORY DIVISION

CERTIFICATE OF ANALYSIS

Client: Jacobs Technology Job No: 6326.90

Client Representative: Benny McGrath Purchase Order: _____

Test Specification: ASME Section IX


Sample Identification: One (1) – 0.500" Plate Procedure Qualification WPS # SSTD-8070-0020-WELD
Welder: Mark Corr Welder ID. # JT34

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
6326.90 -T1	0.755"	0.488"	0.3684"	24,775	67,300	Base
6326.90 -T2	0.755"	0.483"	0.3647"	24,825	68,070	Base

GUIDED BEND TEST		
SPECIMEN ID	TYPE TEST	TEST RESULT
6326.90 -S1	Side Bend	Acceptable
6326.90 -S2	Side Bend	Acceptable
6326.90 -S3	Side Bend	Acceptable
6326.90 -S4	Side Bend	Acceptable

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



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CWI 99041251
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CERTIFIED BY:

Travis G. Moore, Lab Manager



Date: July 11, 2011 Certificate No: 1 of 2

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

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	Number	Rev.
	Effective Date:	March 31, 2022
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SUBJECT: GTAW Procedure for ASME P-No. 8 Stainless Steel to ASME P-No. 1 Carbon Steel		

A.4 WPQ

 INSPECTION SPECIALISTS, INC. <small>MECHANICAL TESTING LABORATORY DIVISION</small>		WELDER PERFORMANCE QUALIFICATION (WPQ) (See QW-301, Section IX, ASME Boiler and Pressure Vessel Code)																			
Welder's Name <u>Mark Corr</u>		Identification No. <u>JT34</u>																			
Test Description																					
Identification of WPS followed <u>SSTD-8070-0020-WELD</u> Specification of base metal(s) <u>ASTM A240 Gr. 304 to ASTM A-36</u>		<input checked="" type="checkbox"/> Test Coupon <input type="checkbox"/> Production Weld Thickness <u>0.500"</u>																			
Testing Conditions and Qualification Limits																					
Welding Variables (QW-305) Welding process(es) <u>GTAW</u> Type (ie; manual, semi-auto) used <u>Manual</u> Backing (metal, weld metal, double-welded, etc.) <u>Without</u> <input checked="" type="checkbox"/> Plate <input type="checkbox"/> Pipe (enter diameter if pipe or tube) Base metal P- or S-Number to P- or S-Number <u>P8 - P1</u> Filler metal or electrode specifications(s) (SFA) (info. only) <u>5.9</u> Filler metal or electrode classification(s) (info. only) <u>ER-312</u> Filler metal F-Number(s) <u>F6</u> Consumable insert (GTAW or PAW) <u>None</u> Filler type (solid/metal or flux cored/powder) (GTAW or PAW) <u>Solid</u> Deposit thickness for each process Process 1: <u>GTAW</u> 3 layers minimum <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Process 2: 3 layers minimum <input type="checkbox"/> Yes <input type="checkbox"/> No Position qualified (2G, 6G, 3F, etc.) <u>1G</u> Vertical progression (uphill or downhill) <u>N/A</u> Type of fuel gas (OFW) <u>N/A</u> Inert gas backing (GTAW, PAW, GMAW) <u>Argon 99.9%</u> Transfer mode (spray/globular or pulse to short circuit-GMAW) <u>N/A</u> GTAW current type/polarity (AC, DCEP, DCEN) <u>DCEN</u>		Actual Values GTAW Manual Without 0.500" P8 - P1 5.9 ER-312 F6 None Solid 0.500" 1G N/A N/A Argon 99.9% N/A DCEN																			
		Range Qualified GTAW Manual With or Without 2.875" - Unlimited P1-P11, P34, P41-P47 & S1 F6 None Solid GTAW 0.1875" - 1.0" 1G N/A N/A Argon 99.9% N/A DCEN																			
RESULTS																					
Visual Examination of Completed Weld (QW-302.4) <u>Acceptable</u>																					
<input checked="" type="checkbox"/> Bend test; <input type="checkbox"/> Transverse root and face [QW-462.3(a)]; <input type="checkbox"/> Longitudinal root and face [QW-462.3(b)]; <input checked="" type="checkbox"/> Side (QW-462.2); <input type="checkbox"/> Pipe bend specimen, corrosion-resistant overlay [QW-462.5(c)]; <input type="checkbox"/> Plate bend specimen, corrosion-resistant overlay [QW-462.5(d)]; <input type="checkbox"/> Macro test for fusion [QW-462.5(b)]; <input type="checkbox"/> Macro test for fusion [QW-462.5(e)]																					
<table border="1"> <thead> <tr> <th>Type</th> <th>Result</th> <th>Type</th> <th>Result</th> <th>Type</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>Tensile 1</td> <td>Acceptable</td> <td>Side Bend 1</td> <td>Acceptable</td> <td>Side Bend 3</td> <td>Acceptable</td> </tr> <tr> <td>Tensile 2</td> <td>Acceptable</td> <td>Side Bend 2</td> <td>Acceptable</td> <td>Side Bend 4</td> <td>Acceptable</td> </tr> </tbody> </table>		Type	Result	Type	Result	Type	Result	Tensile 1	Acceptable	Side Bend 1	Acceptable	Side Bend 3	Acceptable	Tensile 2	Acceptable	Side Bend 2	Acceptable	Side Bend 4	Acceptable		
Type	Result	Type	Result	Type	Result																
Tensile 1	Acceptable	Side Bend 1	Acceptable	Side Bend 3	Acceptable																
Tensile 2	Acceptable	Side Bend 2	Acceptable	Side Bend 4	Acceptable																
Alternative radiographic examination results (QW-191) <u>N/A</u>																					
Fillet weld - fracture test (QW-180) <u>N/A</u> Length and percent of defects <u>N/A</u>																					
Macro examination (QW-184) <u>N/A</u> Fillet size (in.) <u>N/A</u> x <u>N/A</u> Concavity/convexity (in.) <u>N/A</u>																					
Other tests <u>N/A</u>																					
Film or specimens evaluated by <u>N/A</u> Company <u>N/A</u>																					
Mechanical tests conducted by <u>Inspection Specialists, Inc.</u> Laboratory test no. <u>6326.90</u>																					
Welding supervised by <u>Travis G. Moore</u>																					
We certify that the statements in this record are correct and that the test coupons were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.																					
Signed <u>Inspection Specialists, Inc.</u>		Organization <u>Jacobs Technology</u>																			
By <u>Travis G. Moore</u>		By _____																			
Date <u>July 11, 2011</u>		Date _____																			
 Travis G. Moore CWI 99041251 QC1 EXP. 4/1/2014																					

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