



National Aeronautics and
Space Administration

John C. Stennis Space Center
Stennis Space Center, MS
39529-6000

**SSTD-8070-0041-WELD Rev. Basic
SEPTEMBER 2014**

COMPLIANCE IS MANDATORY

John C. Stennis Space Center ASME WELD PROCEDURE FOR JOINING STAINLESS STEEL BY GAS TUNGSTEN ARC WELDING (GTAW) WIRE

Original signed by:

<u>Scott Olive</u> NASA SSC Center Operations Design & Construction Project Management Division	<u>9-10-14</u> Date
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<u>Richard Harris</u> NASA SSC Center Operations Directorate Operations and Maintenance Division	<u>9-11-14</u> Date
--	------------------------

<u>Bartt J. Hebert</u> NASA SSC Engineering & Test Directorate	<u>9-10-14</u> Date
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<u>Freddie Douglas</u> NASA SSC Safety & Mission Assurance	<u>9-16-14</u> Date
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Issued by

<u>Issued CEF</u> Central Engineering Files	<u>9-16-14</u> Date
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Responsible Office: NASA SSC Center Operations Directorate		
SUBJECT: ASME Weld Procedure for Joining Stainless Steel By GTAW Wire		

Document History Log

Change/ Revision	Change Date	Originator/ Phone	Description
Basic	09/5/2014	Doug Dike Ext. 8-2803	Initial release, supersedes SSC STD 34-110-D1.

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1.0 PURPOSE

This John C. Stennis Space Center (SSC) standard (SSTD) outlines the qualified American Society of Mechanical Engineers (ASME) welding procedure for joining stainless steel by Gas Tungsten Arc Welding (GTAW) wire at SSC.

2.0 APPLICABILITY

This SSTD applies to all contractor and subcontractor personnel involved with the welding of stainless steel by GTAW wire.

3.0 REFERENCES

All references are assumed to be the latest version unless otherwise indicated.

ASME Boiler and Pressure Vessel Code, Section II, *Materials*

ASME Boiler and Pressure Vessel Code, Section IX, *Welding, Brazing and Fusing Qualifications*

SPR 1440.1, *SSC Records Management Program Requirements*

SSTD-8070-0005-CONFIG, *SSC 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

- a. Users of this SSTD shall comply with its requirements, ensure use of the correct version of this standard and the documents it references, and inform the appropriate organization of needed changes in accordance with SSTD-8070-0005-CONFIG.
- b. Responsibilities for the use and control of this SSTD and for the review and approval of revisions or cancellation of this standard shall be as specified in SSTD-8070-0005-CONFIG and the applicable documents referenced therein.

5.0 REQUIREMENTS AND PROCEDURES

- a. 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 Design and Construction Project Management Division (PMD), the NASA SSC Center Operations Directorate Operations and Maintenance Division (OMD), the NASA SSC Engineering

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

- b. The attached Procedure Qualification Record (PQR) and Welder Performance Qualification (WPQ) are the PQRs and WPQs for the original WPSs in this SSTD. When performing new qualifications, a new, approved PQR and WPQ shall be completed showing all pertinent data and results of the weld procedure qualification.
- c. Welders shall be qualified in accordance with SSTD-8070-0014-WELD.
- d. Inspection methods for welds shall be in accordance with SSTD-8070-0013-WELD.

6.0 RECORDS AND FORMS

Records and forms required by the procedures of this standard shall be maintained in accordance with SPR 1440.1. 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	NASA SSC Engineering and Test Directorate
GTAW	Gas Tungsten Arc Welding
NASA	National Aeronautics and Space Administration
OMD	Operations and Maintenance Directorate
PMD	Project Management Division
PQR	Procedure Qualification Record
S&MA	NASA SSC Safety and Mission Assurance Office
SSC	John C. Stennis Space Center
SSTD	John C. Stennis Space Center Standard
SPR	Stennis Procedural Requirements
WPQ	Welder Performance Qualification
WPS	Weld Procedure Specification

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8.0 WELDING PROCEDURE SPECIFICATION (WPS)

DD 4/2/14 Beg Miller 4-11-14
Jacobs Technology

QW-482 SUGGESTED FORMAT FOR WELDING PROCEDURE SPECIFICATION (WPS)
(See QW-201.1, Section IX, ASME Boiler and Pressure Vessel Code)

Company Name: JOHNSON CONTROLS WORLD SERVICES INC. By: A. D. GELSOMINO
Welding Procedure Specification No. 34-110-D1 Date 08 JAN 1988 Supporting PQR No. (s) 34-110-D1
Revision No. Rev. 1 Date 31 DEC 1997 APPENDIX A & B
Welding Process(es) GTAW Type(s) MANUAL
(Automatic, Manual, Machine, or Semi-Auto.)

JOINTS (QW402)	<u>SINGLE/DOUBLE V-GROOVE</u>	<u>ALL FILLETS</u>	Details
Joint Design	<u>SINGLE/DOUBLE U-GROOVE</u>		
Backing (Yes)	<u>(No) NO</u>		
Backing Material (Type)	<u>FILLER METAL/ NONE</u>		(Refer to both backing and retainers.)
<input type="checkbox"/> Metal <input type="checkbox"/> Nonfusing Metal <input type="checkbox"/> Nonmetallic <input type="checkbox"/> Other			
Sketches, Production Drawings, Weld Symbols or Written Description should show the general arrangement of the parts to be welded. Where applicable, the root spacing and the details of weld groove may be specified.			
(At the option of the Mfr., sketches may be attached to illustrate joint design, weld layers and bead sequence, e.g. for notch toughness procedures, for multiple process procedures, etc.)			
*BASE METALS (QW403)			
P.No. <u>8</u> Group No. <u>1</u> to P.No. <u>8</u> Group No. <u>1</u>			
OR			
Specification type and grade <u>NOT REQUIRED</u>			
to Specification type and grade <u>NOT REQUIRED</u>			
OR			
Chem. Analysis and Mech. Prop. <u>NOT REQUIRED</u>			
to Chem. Analysis and Mech. Prop. <u>NOT REQUIRED</u>			
Thickness Range:			
Base Metal:	Groove <u>3/16" TO 8"</u>	Fillet <u>ALL</u>	
Pipe Dia. Range:	Groove <u>ALL DIAMETERS</u>	Fillet <u>ALL</u>	
Other _____			
*FILLER METALS (QW404)			
Spec. No. (SFA)	<u>5.9</u>		
AWS No. (Class)	<u>ER 308</u>		
F.No.	<u>6</u>		
A.No.	<u>8</u>		
Size of Filler Metals	<u>1/16" TO 3/16"</u>		
Deposited Weld Metal	<u>GTAW</u>		
Thickness Range:	<u>8" max</u>		
Groove	<u>NOT REQUIRED</u>		
Fillet	<u>NOT REQUIRED</u>		
Electrode-Flux (Class)	<u>NOT REQUIRED</u>		
Flux Trade Name	<u>NOT REQUIRED</u>		
Consumable Insert	<u>NOT USED</u>		
Other _____			

*Each base metal-filler metal combination should be recorded individually.

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QW-482 (Back) WPS No. 34-110-D1 Rev. REV. 1

POSITIONS (QW-405) Position(s) of Groove <u>ALL</u> Welding Progression: Up <u>UP</u> Down _____ Position(s) of Fillet <u>ALL</u>		POSTWELD HEAT TREATMENT (QW-407) Temperature Range <u>NOT REQUIRED</u> Time Range _____																				
PREHEAT (QW-406) Preheat Temp. Min. <u>50° F</u> Interpass Temp. Max. <u>NOT APPLICABLE</u> Preheat Maintenance <u>NOT APPLICABLE</u> (Continuous or special heating where applicable should be recorded)		GAS (QW-408) <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2"></th> <th colspan="3">Percent Composition</th> </tr> <tr> <th>Gas(es)</th> <th>(Mixture)</th> <th>Flow Rate</th> </tr> </thead> <tbody> <tr> <td>Shielding</td> <td>ARGON</td> <td>99.998</td> <td>10.45CFH</td> </tr> <tr> <td>Trailing</td> <td colspan="2" style="text-align: center;">NOT REQUIRED</td> <td></td> </tr> <tr> <td>Backing</td> <td>ARGON</td> <td>99.998</td> <td>5.30CFH</td> </tr> </tbody> </table>			Percent Composition			Gas(es)	(Mixture)	Flow Rate	Shielding	ARGON	99.998	10.45CFH	Trailing	NOT REQUIRED			Backing	ARGON	99.998	5.30CFH
	Percent Composition																					
	Gas(es)	(Mixture)	Flow Rate																			
Shielding	ARGON	99.998	10.45CFH																			
Trailing	NOT REQUIRED																					
Backing	ARGON	99.998	5.30CFH																			
ELECTRICAL CHARACTERISTICS (QW-409) Current AC or DC <u>DC</u> Polarity <u>STRAIGHT</u> Amps (Range) <u>VARIABLE</u> Volts (Range) <u>VARIABLE</u> (Amps and volts range should be recorded for each electrode size, position, and thickness, etc. This information may be listed in a tabular form similar to that shown below.) Tungsten Electrode Size and Type <u>3/32" TO 1/8" 2% THORIATED-EWTH-2</u> <small>(Pure Tungsten, 2% Thoriated, etc.)</small> Mode of Metal Transfer for GMAW <u>NOT APPLICABLE</u> <small>(Spray arc, short circuiting arc, etc.)</small> Electrode Wire feed speed range <u>NOT APPLICABLE</u>																						
TECHNIQUE (QW-410) String or Weave Bead <u>ROOT-STRINGER/COVER-STRINGER OR WEAVE</u> Orifice or Gas Cup Size <u>#4 TO #7</u> Initial and Interpass Cleaning (Brushing, Grinding, etc.) <u>BRUSH WITH S.S. WIRE</u> Method of Back Gouging <u>GRINDING AND BRUSHING WITH S.S. WIRE</u> Oscillation <u>NOT APPLICABLE</u> Contact Tube to Work Distance <u>NOT APPLICABLE</u> Multiple or Single Pass (per side) <u>MULTIPLE - NO PASS GREATER THAN 1/2" THICK</u> Multiple or Single Electrodes <u>SINGLE</u> Travel Speed (Range) <u>NOT REQUIRED</u> Peening <u>NOT ALLOWED</u> Other <u>REPAIR - GRIND FOLLOWED BY BRUSHING WITH S.S. WIRE WELD; REPAIR PER THIS PROCEDURE OR REPAIR AS DIRECTED BY THE ENGINEER.</u>																						
Weld Layer(s)	Process	Filler Metal		Current		Volt Range	Travel Speed Range	Other (e.g., Remarks, Comments, Hot Wire Addition, Technique, Torch Angle, Etc.)														
		Class	Dia.	Type Polar.	Amp. Range																	
ALL	GTAW	ER308	1/16" TO 3/16"	STRAIGHT	VARIABLE	VARIABLE	2.8IPM															

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9.0 PROCEDURE QUALIFICATION RECORD (PQR)

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.

Buyer's mark 9-12-14

Company Name ~~RAN AM WORLD SERVICES INC~~ Jacobs Technology Date 11 JAN 1988

Procedure Qualification Record No. 34-110-DI APPENDIX A

WPS No. 34-110-DI

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. <u>SA 240</u> Type or Grade <u>304</u> P-No. <u>8</u> to P-No. <u>8</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) SFA Specification <u>5.9</u> AWS Classification <u>ER 308</u> Filler Metal F-No. <u>6</u> Weld Metal Analysis A-No. <u>8</u> Size of Filler Metal <u>3/32"</u> Other _____ Deposited Weld Metal _____		GAS (QW-408) <table border="1"> <thead> <tr> <th rowspan="2"></th> <th colspan="3">Percent Composition</th> </tr> <tr> <th>Gas(es)</th> <th>(Mixture)</th> <th>Flow Rate</th> </tr> </thead> <tbody> <tr> <td>Shielding</td> <td><u>ARGON</u></td> <td><u>99.9998 %</u></td> <td><u>30 CFH</u></td> </tr> <tr> <td>Trailing</td> <td><u>N/A</u></td> <td></td> <td></td> </tr> <tr> <td>Backing</td> <td><u>N/A</u></td> <td></td> <td></td> </tr> </tbody> </table>			Percent Composition			Gas(es)	(Mixture)	Flow Rate	Shielding	<u>ARGON</u>	<u>99.9998 %</u>	<u>30 CFH</u>	Trailing	<u>N/A</u>			Backing	<u>N/A</u>		
	Percent Composition																					
	Gas(es)	(Mixture)	Flow Rate																			
Shielding	<u>ARGON</u>	<u>99.9998 %</u>	<u>30 CFH</u>																			
Trailing	<u>N/A</u>																					
Backing	<u>N/A</u>																					
POSITION (QW-405) Position of Groove <u>IG-FLAT</u> Weld Progression (Uphill, Downhill) <u>NOT APPLICABLE</u> Other _____		ELECTRICAL CHARACTERISTICS (QW-409) Current <u>DIRECT</u> Polarity <u>STRAIGHT</u> Amps <u>VARIABLE</u> Volts <u>VARIABLE</u> Tungsten Electrode Size <u>3/32"</u> Other _____																				
PREHEAT (QW-406) Preheat Temp. <u>85°</u> Interpass Temp. <u>NOT REQUIRED</u> Other _____		TECHNIQUE (QW-410) Travel Speed <u>2" I.P.M.</u> Spring or Weave Bead <u>ROOT STRING / CAP WEAVE</u> Oscillation <u>NOT APPLICABLE</u> Multipass or Single Pass (per side) <u>MULTIPASS</u> Single or Multiple Electrodes <u>SINGLE</u> Other _____																				

(12/86)

This form (E00007) may be obtained from the Order Dept., ASME, 345 E. 47th St., New York, N.Y. 10017

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QW-483 (Back)

Tensile Test (QW-160)

PQR No. 34-110-D1
Appendix A

Specimen No.	Width	Thickness	Area	Ultimate Total Load lb	Ultimate Unit Stress psi	Type of Failure & Location
T1	.750	.480	.360	31,100	86,389	QW
T2	.746	.485	.362	32,500	89,779	IW

Guided-Bend Tests (QW-160)

Type and Figure No.	Result
Root 1 QW 462.3 (a)	Satisfactory
Root 2 QW 462.3 (a)	Satisfactory
Face 1 QW 462.3 (a)	Satisfactory
Face 2 QW 462.3 (a)	Satisfactory

Toughness Tests (QW-170)

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

Fillet-Weld Test (QW-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 Stamp No. 19
Tests conducted by: OIS Mobile-Lab, Inc. Laboratory Test No. N/A

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
Pan Am World Services, Inc.
 Date 1/11/88 By R. Myberg WJ 4/14/14
Boyd
4511-10

(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.)

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QW-483 PROCEDURE QUALIFICATION RECORD (PQR)
 (See QW-201.2, Section IX, 1974 ASME Boiler and Pressure Vessel Code)

Company Name _____
 Procedure Qualification Record No. _____ Date _____
 WPS No. _____
 Welding Process(es) _____
 Types (Manual, Automatic, Semi-Auto.) _____

JOINTS (QW-402)	
Groove Design Used	
BASE METALS (QW-403) Material Spec. _____ Type or Grade _____ P No. _____ to P No. _____ Thickness _____ Diameter _____ Other _____	POSTWELD HEAT TREATMENT (QW-407) Temperature _____ Time _____ Other _____
FILLER METALS (QW-404) Weld Metal Analysis A No. _____ Size of Electrode _____ Filler Metal F No. _____ SFA Specification _____ AWS Classification _____ Other _____	GAS (QW-408) Type of Gas or Gases _____ Composition of Gas Mixture _____ Other _____
POSITION (QW-405) Position of Groove _____ Weld Progression (Uphill, Downhill) _____ Other _____	ELECTRICAL CHARACTERISTICS (QW-409) Current _____ Polarity _____ Amps _____ Volts _____ Other _____
PREHEAT (QW-406) Preheat Temp. _____ Interpass Temp. _____ Other _____	TECHNIQUE (QW-410) Travel Speed _____ String or Weave Bead _____ Oscillation _____ Multipass or Single Pass (per side) _____ Single or Multiple Electrodes _____ Other _____

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QW-483 (Back)

Tensile Test (QW-150)

Specimen No.	Width	Thickness	Area	Ultimate Total Load lb.	Ultimate Unit Stress psi	Character of Failure & Location
T1	.750	.480	.360	31,100	86,389	OW
T2	.746	.485	.362	32,500	89,779	TW

Guided Bend Tests (QW-160)

Type and Figure No.	Result
Root 1 QW 462.3 (a)	Satisfactory
Root 2 QW 462.3 (a)	Satisfactory
Face 1 QW 462.3 (a)	Satisfactory
Face 2 QW 462.3 (a)	Satisfactory

Toughness Tests (QW-170)

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

FILLET WELD TEST (QW-180)

Result - Satisfactory _____ Penetration into Parent Metal _____
Yes, No Yes, No

Type and Character of Failure _____ Macro-Results _____

Welder's Name _____ Clock No. _____ Stamp No. _____

Tests conducted by: OIS Mobile-Lab, Inc. Laboratory Test No. N/A
per: *[Signature]* R. M. Walker

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. Yes *[Signature]*

Signed *Jacobs Technology*
Pen Am World Services, Inc.
(Manufacturer)

Date 1/11/88

By *[Signature]*

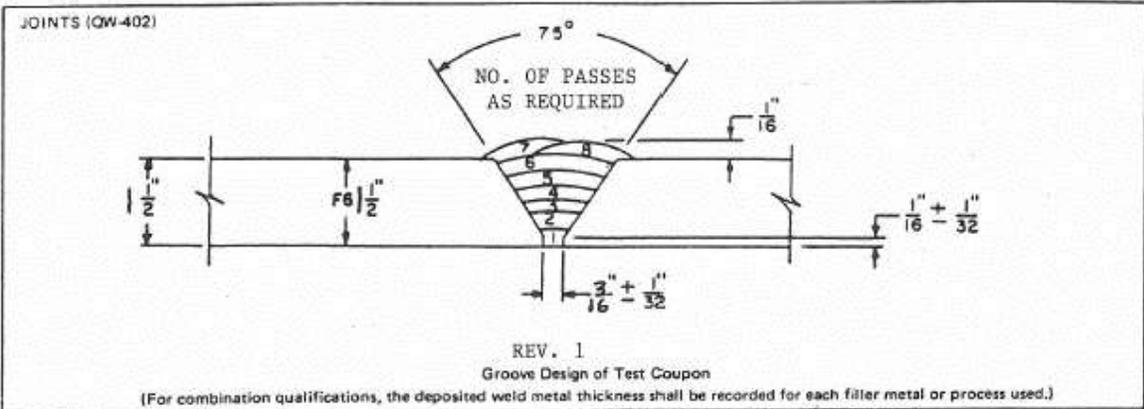
(Detail of record of tests are illustrative only and may be modified to conform to the type and number of tests required by the Code.)

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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 JOHNSON CONTROLS WORLD SERVICES INC. Jacobs Technology *Raymond 4-11-14*
 Procedure Qualification Record No. 34-110-D1 APPENDIX B Date 23 OCT 1997
 WPS No. 34-110-D1 REV. 1
 Welding Process(es) GTAW
 Types (Manual, Automatic, Semi-Auto.) MANUAL



BASE METALS (QW-403) Material Spec. <u>SA 240</u> Type or Grade <u>304</u> P-No. <u>8</u> to P-No. <u>8</u> Thickness of Test Coupon <u>1-1/2"</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) SFA Specification <u>5.9</u> AWS Classification <u>ER 308 L</u> Filler Metal F-No. <u>6</u> Weld Metal Analysis A-No. <u>8</u> Size of Filler Metal <u>3/32" - 3/16"</u> Other _____ Deposited Weld Metal _____		GAS (QW-408) <table border="1"> <thead> <tr> <th></th> <th>Gas(es)</th> <th>Percent Composition (Mixture)</th> <th>Flow Rate</th> </tr> </thead> <tbody> <tr> <td>Shielding</td> <td><u>ARGON</u></td> <td><u>99.9998%</u></td> <td><u>30 CFH</u></td> </tr> <tr> <td>Troiling</td> <td><u>N/A</u></td> <td></td> <td></td> </tr> <tr> <td>Backing</td> <td><u>N/A</u></td> <td></td> <td></td> </tr> </tbody> </table>			Gas(es)	Percent Composition (Mixture)	Flow Rate	Shielding	<u>ARGON</u>	<u>99.9998%</u>	<u>30 CFH</u>	Troiling	<u>N/A</u>			Backing	<u>N/A</u>		
	Gas(es)	Percent Composition (Mixture)	Flow Rate																
Shielding	<u>ARGON</u>	<u>99.9998%</u>	<u>30 CFH</u>																
Troiling	<u>N/A</u>																		
Backing	<u>N/A</u>																		
POSITION (QW-405) Position of Groove <u>IG-FLAT</u> Weld Progression (Uphill, Downhill) <u>NOT APPLICABLE</u> Other _____		ELECTRICAL CHARACTERISTICS (QW-409) Current <u>DIRECT</u> Polarity <u>STRAIGHT</u> Amps. <u>VARIABLE</u> Volts <u>VARIABLE</u> Tungsten Electrode Size <u>3/32"</u> Other _____																	
PREHEAT (QW-406) Preheat Temp. <u>55°</u> Interpass Temp. <u>350°F</u> Other _____		TECHNIQUE (QW-410) Travel Speed <u>2" I.P.M.</u> String or Weave Bead <u>ROOT STRING/CAP WEAVE</u> Oscillation <u>NOT APPLICABLE</u> Multipass or Single Pass (per side) <u>MULTIPASS</u> Single or Multiple Electrodes <u>SINGLE</u> Other _____																	

(12/86) This form (E00007) may be obtained from the Order Dept., ASME, 345 E. 47th St., New York, N.Y. 10017

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QW-483 (Back)

Tensile Test (QW-150)

PQR No. 34-110-D1
Appendix B

Specimen No.	Width	Thickness	Area	Ultimate Total Load lb	Ultimate Unit Stress psi	Type of Failure & Location
T-1	.747	1.495	1.116	102,600	91,935	BASE METAL
T-2	.752	1.499	1.127	102,300	90,771	BASE METAL

Guided-Bend Tests (QW-160)

Type and Figure No.	Result
SIDE BEND QW 462.2 1	SATISFACTORY
SIDE BEND QW 462.2 2	SATISFACTORY
SIDE BEND QW 462.2 3	SATISFACTORY
SIDE BEND QW 462.2 4	SATISFACTORY

Toughness Tests (QW-170)

Specimen No.	Notch Location	Notch Type	Test Temp.	Impact Values	Lateral Exp.		Drop Weight	
					% Shear	Mils	Break	No Break
WELD - B1	WELD	CHARPY V	-315°F	54	30	22		
WELD - B2	WELD	"	"	64	20	27		
WELD - B3	WELD	"	"	42	30	21		
HAZ - B1	HAZ	"	"	191	100	77		
HAZ - B2	HAZ	"	"	166	100	60		
HAZ - B3	HAZ	"	"	211	100	76		

Fillet-Weld Test (QW-180)

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

Other Tests

Type of Test _____
Deposit Analysis _____
Other _____

Welder's Name KEVIN JURICH/TOMMY WATKINS Clock No. _____ Stamp No. 55/23
Tests conducted by: MECHANICAL TESTING LABORATORY Laboratory Test No. 1339.90

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 JOHNSON CONTROLS WORLD SERVICES INC.

Date 10/23/97 By Richard D. [Signature] By [Signature]
(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.)

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10.0 CERTIFICATE OF ANALYSIS



INSPECTION SPECIALISTS, INC.
MECHANICAL TESTING LABORATORY DIVISION

5201 TARAVELLA ROAD • MARRERO, LA 70072-4240 • TEL: (504) 347-6600 • FAX: (504) 348-8001

CERTIFICATE OF ANALYSIS

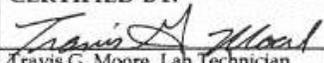
Client: Johnson Controls World Services Inc. Job No: 1339.90
 Client Representative: Richard Nyberg Purchase Order: P-R100153674
 Test Specification: ASME Section IX
 Sample Identification: One (1) - 1 1/2" x 20" 16" Plate Procedure Qualification
Proc. #SSC-34-110D-1 Rev. 1

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, two (2) sets of three (3) charpy v-notch impact test specimens, and one (1) macro etch test specimen were prepared and tested. The results of these tests are reported herein.

<i>TENSILE TEST</i>						
SPECIMEN ID	WIDTH INCHES	THICKNESS INCHES	AREA SQ. IN.	ULTIMATE LOAD POUNDS	TENSILE STRENGTH PSI	NATURE OF FRACTURE
1339.90-T1	0.747	1.495	1.116	102,600	91,935	Base
1339.90-T2	0.752	1.499	1.127	102,300	90,771	Base

<i>GUIDED BEND TEST</i>		
SPECIMEN ID	TYPE TEST	TEST RESULT
1339.90-S1	Side Bend	Satisfactory
1339.90-S2	Side Bend	Satisfactory
1339.90-S3	Side Bend	Satisfactory
1339.90-S4	Side Bend	Satisfactory

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

CERTIFIED BY:

 Travis G. Moore, Lab Technician Date: October 23, 1997 Certificate No: 1 of 3

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

VISUAL INSPECTION, NONDESTRUCTIVE AND DESTRUCTIVE TESTING SPECIALISTS

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5201 TARAVELLA ROAD • MARRERO, LA 70072-4240 • TEL: (504) 347-6800 • FAX: (504) 348-8001

CERTIFICATE OF ANALYSIS

Client: Johnson Controls World Services Inc. Job No: 1339.90
 Client Representative: Richard Nyberg Purchase Order: P-R100153674
 Test Specification: ASME Section IX
 Sample Identification: One (1) - 1 1/2" x 20" 16" Plate Procedure Qualification
Proc. #SSC-34-110D-1 Rev. 1

CHARPY V-NOTCH IMPACT TEST
(10MM X 10MM X 55MM)

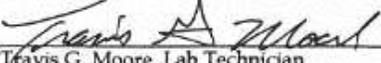
SPECIMEN ID	FOOT POUNDS	LATERAL EXPANSION	PERCENT OF SHEAR
1339.90-Weld 1	54	22	30
1339.90-Weld 2	64	27	20
1339.90-Weld 3	42	21	30
AVERAGE	53.3	23.3	26.6
1339.90-HAZ 1	191	77	100
1339.90-HAZ 2	166	60	100
1339.90-HAZ 3	211	76	100
AVERAGE	189.3	71.0	100.0

Test Temperature: -315°F

MACRO ETCH TEST

SPECIMEN ID	TEST RESULT
1339.90-M1	Satisfactory

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

CERTIFIED BY:

 Travis G. Moore, Lab Technician Date: October 23, 1997 Certificate No: 2 of 3

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

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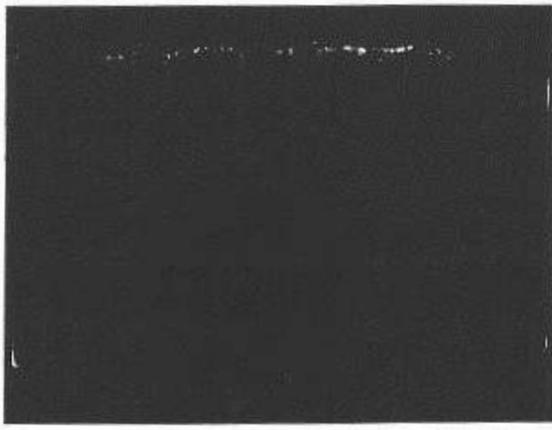
CERTIFICATE OF ANALYSIS

Client: Johnson Controls World Services Inc. Job No: 1339.90

Client Representative: Richard Nyberg Purchase Order: P-R100153674

Test Specification: ASME Section IX

Sample Identification: One (1) - 1 1/2" x 20" 16" Plate Procedure Qualification
Proc. #SSC-34-110D-1 Rev. 1



CERTIFIED BY:
Travis G. Moore Date: October 23, 1997 Certificate No: 3 of 3
Travis G. Moore, Lab Technician

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