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Space Administration

**John C. Stennis Space Center**  
Stennis Space Center, MS  
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**SSTD-8070-0035-WELD Rev. Basic**  
**September 2013**

## **COMPLIANCE IS MANDATORY**

### **John C. Stennis Space Center** **ASME Procedure for Welding Monel Alloy (P-42) to** **Stainless Steel (P-8)**

#### **Original signed by**

Scott Olive  
NASA SSC Center Operations Directorate  
Design & Construction Project Management  
Division

9-23-13  
Date

Bartt J. Hebert  
NASA SSC Engineering & Test  
Directorate

9-25-13  
Date

Rich Harris  
NASA SSC Center Operations Directorate  
Operations & Maintenance Division

9-23-13  
Date

#### **Issued by**

Issued CEF  
Central Engineering Files

9-25-13  
Date

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SUBJECT: ASME Procedure for Welding Monel Alloy to Stainless Steel		

## Document History Log

Change/ Revision	Change Date	Originator/ Phone	Description
Basic	09.20.2013	Doug Dike, Ext. 8-2803	Initial release, superseding SSC STD 34-041. <b><i>CEF Archive Information:</i></b> Part of Appendix B, Standards and Specifications Plan to Contract NAS13-400.

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## 1.0 PURPOSE

This John C. Stennis Space Center (SSC) standard (SSTD) outlines the qualified Gas Tungsten Arc Welding (GTAW) procedure for use in welding Monel Alloy to Stainless Steel at SSC.

## 2.0 APPLICABILITY

This SSTD applies to all contractor and subcontractor personnel involved with the welding of Monel Alloy to Stainless Steel at SSC.

## 3.0 REFERENCES

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

- ASME Boiler and pressure Vessel Codes, Section II, *Materials*
- ASME Boiler and Pressure Vessel Codes, Section IX, *Welding and Brazing Qualifications*
- ASTM A167, *Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip*
- ASTM A182, *Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service*
- ASTM A213, *Standard Specification for Seamless Ferritic and Austenitic Alloy Steel Boiler, Superheater, and Heat Exchanger Tubes*
- ASTM A240, *Standard Specification for Chromium and Chromium Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and General Applications*
- ASTM A249, *Standard Specification for Welded Austenitic Steel Boiler, Superheater, Heat Exchanger, and Condenser Tubes*
- ASTM A269, *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service*
- ASTM A270, *Standard Specification for Seamless and Welded Austenitic Stainless Steel Sanitary Tubing*
- ASTM A276, *Standard Specification for Stainless Steel Bars and Shapes*
- ASTM A312, *Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes*
- ASTM A313, *Standard Specification for Stainless Steel Spring Wire*
- ASTM A314, *Standard Specification for Stainless Steel Billets and Bars for Forging*
- ASTM A320, *Standard Specification for Alloy Steel and Stainless Steel Bolting for Low Temperature Service*
- ASTM A336, *Standard Specification for Alloy Steel Forgings for Pressure and High Temperature Parts*
- ASTM A358, *Standard Specification for Electric Fusion Welded Austenitic Chromium Nickel Stainless Steel Pipe for High Temperature Service and General Applications*
- ASTM A368, *Standard Specification for Stainless Steel Wire Strand*

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- ASTM A376, *Standard Specification for Seamless Austenitic Steel Pipe for High Temperature Central Station Service*
- ASTM A403, *Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings*
- ASTM A409, *Standard Specification for Welded Large Diameter Austenitic Steel Pipe for Corrosive or High Temperature Service*
- ASTM A473, *Standard Specification for Stainless Steel Forgings*
- ASTM A478, *Standard Specification for Chromium Nickel Stainless Steel Weaving and Knitting Wire*
- ASTM A479, *Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels*
- ASTM A492, *Standard Specification for Stainless Steel Rope Wire*
- ASTM A493, *Standard Specification for Stainless Steel Wire and Wire Rods for Cold Heading and Cold Forging*
- ASTM A511, *Standard Specification for Seamless Stainless Steel Mechanical Tubing*
- ASTM A554, *Standard Specification for Welded Stainless Steel Mechanical Tubing*
- ASTM A580, *Standard Specification for Stainless Steel Wire*
- ASTM A632, *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing (Small Diameter) for General Service*
- ASTM A666, *Standard Specification for Annealed or Cold Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar*
- ASTM A688, *Standard Specification for Seamless and Welded Austenitic Stainless Steel Feedwater Heater Tubes*
- ASTM A793, *Standard Specification for Rolled Floor Plate, Stainless Steel*
- ASTM A813, *Standard Specification for Single or Double Welded Austenitic Stainless Steel Pipe*
- ASTM A814, *Standard Specification for Cold Worked Welded Austenitic Stainless Steel Pipe*
- ASTM A774, *Standard Specification for As Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures*
- ASTM A778, *Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products*
- ASTM B127, *Standard Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet, and Strip*
- ASTM B163, *Standard Specification for Seamless Nickel and Nickel Alloy Condenser and Heat Exchanger Tubes*
- ASTM B164, *Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire*
- ASTM B165, *Standard Specification for Nickel-Copper Alloy (UNS N04400) Seamless Pipe and Tube*
- ASTM B366, *Standard Specification for Factory Made Wrought Nickel and Nickel Alloy Fittings*
- ASTM B564, *Standard Specification for Nickel Alloy Forgings*
- ASTM B725, *Standard Specification for Welded Nickel (UNS N02200/UNS N02201) and Nickel Copper Alloy (UNS N04400) Pipe*

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ASTM B730, *Standard Specification for Welded Nickel (UNS N02200/UNS N02201) and Nickel Copper Alloy (UNS N04400) Tube*

ASTM F96, *Standard Specification for Electronic Grade Alloys of Copper and Nickel in Wrought Forms*

AWS Welding Handbook

FED QQ-N-281, *Federal Specification: Nickel-Copper Alloy Bar, Rod, Plate, Sheet, Strip, Wire, Forgings, and Structural and Special Shaped Sections*

MIL-N-24106, *Nickel-Copper Alloy Bars, Rods and Forgings*

MIL-S-23195, *Steel Bars and Forgings, Corrosion Resistant*

MIL-S-23196, *Steel Plate, Corrosion Resistant, Austenitic (UNS S30400, UNS S30403, S31600 S34700, and S34800)*

MIL-T-1368, *Tube and Pipe, Nickel-Copper Alloy, Seamless and Welded*

MIL-T-23520, *Tube and Pipe, Nickel-Copper Alloy, Seamless, Air Melted*

SAE J405, *Chemical Compositions of SAE Wrought Stainless Steels*

SPR 1440.1, *SSC Records Management Program Requirements*

SPR 8715.1, *Safety and Health Program Requirements*

SSTD-8070-0013-WELD, *Classes of Welding Inspection*

SSTD-8070-0014-WELD, *Qualifying Welders and Weld Procedures*

SSTD-8070-0005-CONFIG, *SSC Preparation, Review, Approval, and Release of SSC Standards*

#### **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 SSC Standard 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. This procedure shall be used for welding any UNS N04400 base metal (Monel 400) meeting one or more of the following specifications:

AMS 4544, 4574, 4575, 4675, 4730, 4731

ASME SB127, SB163, SB164, SB165, SB564

ASTM B127, B163, B164, B165, B366, B564, B725, B730

FED QQ-N-281

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MIL-N-24106, MIL-5-1368, MIL-5-23520

- b. The stainless steel to be welded shall meet one or more of the following specifications:

AISI 340L, 304, 316L, 316, 317L, 317, 321, 347, 348, XM-15, XM-21

AMS 5501, 5511, 5513, 5560, 5563, 5564, 5565, 5566, 5567, 5639, 5647, 5697, 7228, 7245

ASME SA-182, SA-213, SA-240, SA-249, SA-312, SA-320, SA-336, SA-351, SA-358, SA-376, SA-403, SA-409, SA-430, SA-451, SA-479, SA-688

ASTM A167, A182, A213, A240, A249, A269, A270, A271, A276, A312, A313, A314, A320, A336, A358, A368, A376, A403, A409, A430, A473, A478, A479, A492, A493, A511, A554, A580, A632, A666, A688, A793, A813, A814, A851, A774, A778

SAE J405

UNS S30400, S30403, S30452, S31600, S31603, S31700, S31703, S32100, S34700, S3480, S38100

- c. 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, the NASA SSC Engineering and Test Directorate (E&TD), and the NASA SSC Safety and Mission Assurance (S&MA) Office.
- d. The attached Procedure Qualification Records (PQR), No. 34-041 Monel/SSteel/GTAW, is the PQR for the original qualification of this WPS. When performing new qualifications, a new PQR should be filled out showing all pertinent data and results of the weld procedure qualification.
- f. Welders shall be qualified in accordance with SSTD-8070-0014-WELD, *Qualifying Welders and Welding Procedures*.
- g. Inspection methods for welds shall be in accordance with SSTD-8070-0013-WELD, *Classes of Welding Inspection*.

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- h. All procedures shall be performed in compliance with applicable requirements in SPR 8715.1, *SSC Safety and Health Program Requirements*. If ever there is a conflict between this standard and the SPR, the SPR shall superseded this standard.

## 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.

The original, signed WPSs and PQRs (copies of which are provided in Attachments A and B of this SSTD) shall be maintained in CEF together with the original, signed hardcopy of this SSTD.

## 7.0 ACRONYMS AND ABBREVIATIONS

AISI	American Iron and Steel Institute
AMS	Alpha Magnetic Spectrometer
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
E&TD	Engineering & Test Directorate
GTAW	Gas Tungsten Arc Welding
MIL	Military
NASA	National Aeronautics and Space Administration
PQR	Procedure Qualification Record
S&MA	Safety & Mission Assurance
SSC	John C. Stennis Space Center
SSTD	John C. Stennis Space Center Standard
SPR	Stennis Procedural Requirements
WPQ	Welder Performance Qualification
WPS	Weld Procedure Specifications

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## ATTACHMENT A: WELDING PROCEDURE SPECIFICATIONS (WPS)

### QW-482 SUGGESTED FORMAT FOR WELDING PROCEDURE SPECIFICATIONS (WPS) (See QW-200.1, Section IX, ASME Boiler and Pressure Vessel Code)

Company Name	NASA, JOHN C. STENNIS SPACE CENTER	By	K.A. Broom
Welding Procedure Specification No.	34-041	Date	08/5/1993
Revision No.	A	Date	8/19/2013
Supporting PQR No.(s)	34-Monel/SSSteel		
Welding Process(es)	GTAW	Type(s)	Manual
(Automatic, Manual, Machine, or Semi-Automatic)			
JOINTS (QW-402)		Details	
Joint Design <u>Single/Double V Groove, Single/Double U Groove, All Fillets</u>		Two layers of buttering shall be applied to the groove face of the stainless steel. Buttering shall be applied with electrodes of ER Ni-Cu-7 and shall be done in the flat position.	
Root Spacing _____			
Backing: Yes _____ No <u>X</u>			
Backing Material (Type) <u>None</u> <small>(Refer to both backing and retainers)</small>			
<input type="checkbox"/> Metal <input type="checkbox"/> Nonfusing Metal <input type="checkbox"/> Nonmetallic <input type="checkbox"/> Other		Figure 1 shows typical groove detail examples.	
Sketches, Production Drawings, Weld Symbols, or Written Description should show the general arrangement of the parts to be welded. Where applicable, the details of weld groove may be specified.			
[At the option of the manufacturer, 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 (QW-403)			
P-No.	<u>42</u>	Group No.	_____ to P-No. <u>8</u> Group No. <u>1</u>
OR			
Specification and type/grade or UNS Number <u>Monel to 304L</u>			
to Specification and type/grade or UNS Number _____			
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>4.8 mm (0.188") to 14.7 mm (0.58")</u>	Fillet	<u>All</u>
Maximum Pass Thickness $\leq \frac{1}{2}$ inch (13 mm) (Yes) <input type="checkbox"/> (No) <input type="checkbox"/>			
Other <u>Pipe Dia. Range: Groove, 25.4 mm (1") and larger; Fillet, all. No pass greater than 12.7 mm (1/2") thick</u>			
*FILLER METALS (QW-404)			
Spec. No. (SFA)	<u>1</u>	<u>2</u>	
AWS No. (Class)	<u>5.14</u>	<u>5.14</u>	
F-No.	<u>ER NiCu-7</u>	<u>ER NiCu-7</u>	
A-No.	<u>42</u>	<u>42</u>	
Size of Filler Metals	<u>2.0 mm (5/64") - 3.2 mm (1/8")</u>	<u>2.0 mm (5/64") - 3.2 mm (1/8")</u>	
Filler Metal Product Form			
Supplemental Filler Metal			
Weld Metal	<u>1.6 mm (0.062") - 2.4 mm (0.094")</u>	<u>2.4 mm (0.094") - 14.2 mm (0.56")</u>	
Thickness Range:			
Groove			
Fillet			
Electrode-Flux (Class)	<u>N/A</u>	<u>N/A</u>	
Flux Type	<u>N/A</u>	<u>N/A</u>	
Flux Trade Name	<u>N/A</u>	<u>N/A</u>	
Consumable Insert	<u>N/A</u>	<u>N/A</u>	
Other			

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

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**QW-482 (Back)**

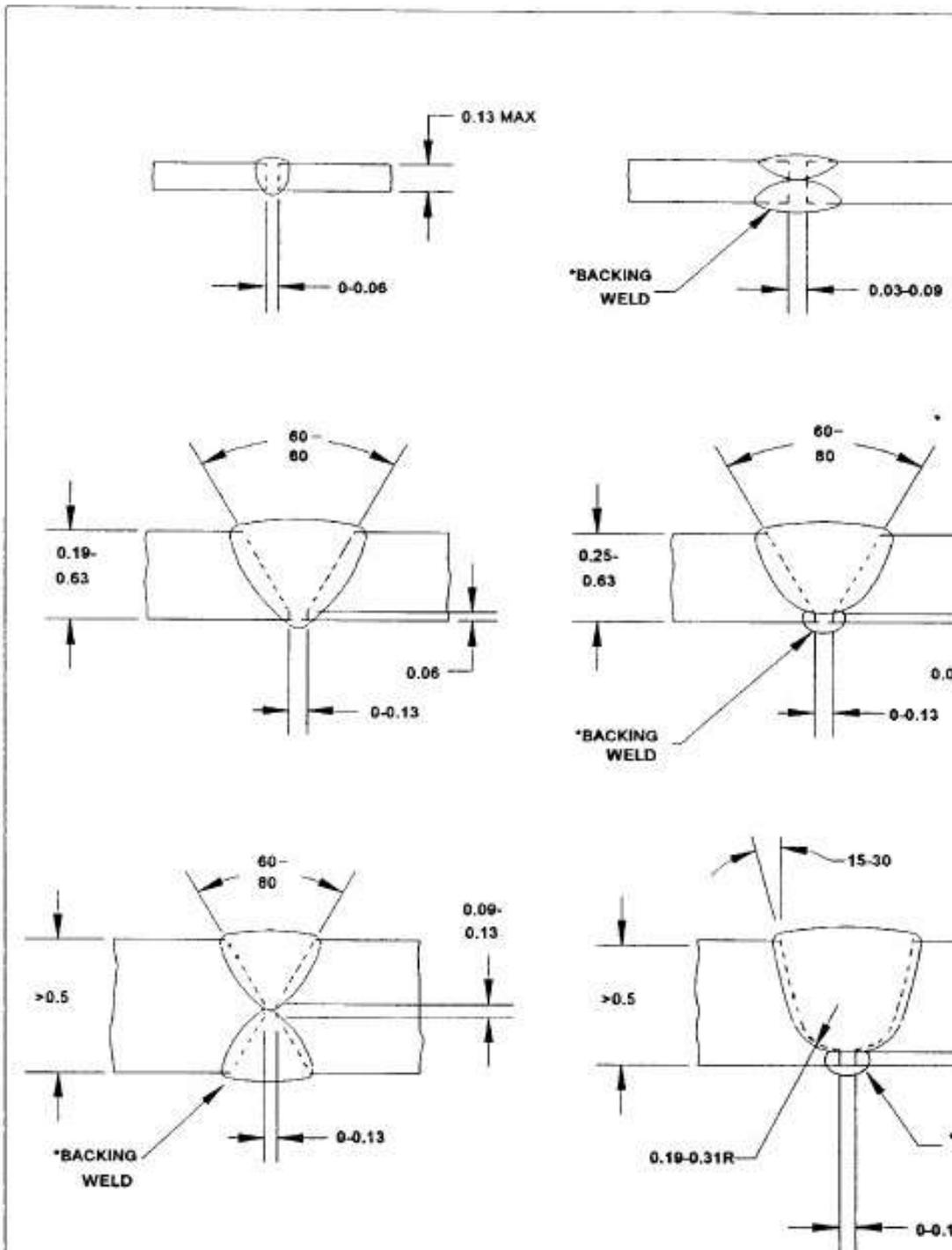
WPS No. 34-041 Rev. A

<b>POSITIONS (QW-405)</b> Position(s) of Groove <u>ALL</u> Welding Progression: Up <u>UP</u> Down _____ Position(s) of Fillet <u>ALL</u> Other _____				<b>POSTWELD HEAT TREATMENT (QW-407)</b> Temperature Range _____ N/A Time Range _____ N/A Other _____																										
<b>PREHEAT (QW-406)</b> Preheat Temperature, Minimum <u>60 F</u> Interpass Temperature, Maximum <u>200 F</u> Preheat Maintenance _____ Other _____ (Continuous or special heating, where applicable, should be recorded)				<b>GAS (QW-408)</b> <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>99.99%</td> <td>30-35</td> </tr> <tr> <td>Trailing</td> <td>None</td> <td>None</td> <td>None</td> </tr> <tr> <td>Backing</td> <td>Argon</td> <td>99.99%</td> <td>10</td> </tr> <tr> <td>Other</td> <td>_____</td> <td>_____</td> <td>_____</td> </tr> </tbody> </table>					Percent Composition			Gas(es)	(Mixture)	Flow Rate	Shielding	Argon	99.99%	30-35	Trailing	None	None	None	Backing	Argon	99.99%	10	Other	_____	_____	_____
	Percent Composition																													
	Gas(es)	(Mixture)	Flow Rate																											
Shielding	Argon	99.99%	30-35																											
Trailing	None	None	None																											
Backing	Argon	99.99%	10																											
Other	_____	_____	_____																											
<b>ELECTRICAL CHARACTERISTICS (QW-409)</b> _____ _____																														
Weld Pass(es)	Process	Filler Metal		Current Type and Polarity	Amps (Range)	Wire Feed Speed (Range)	Energy or Power (Range)	Volts (Range)	Travel Speed (Range)	Other (e.g., Remarks, Comments, Hot Wire Addition, Technique, Torch Angle, etc.)																				
		Classification	Diameter																											
Root Pass	GTAW	ER NiCu-7	1.6mm-3.2 mm	DCEN (-)	70-130	N/A		13-20	75-127mm/min	Travel 3-5 i.p.m.																				
Fill	GTAW	ER NiCu-7	1.8mm-3.2 mm	DCEN (-)	70-130			13-20	75-127mm/min	Travel 3-5 i.p.m.																				
Cap	GTAW	ER NiCu-7	1.6mm-3.2 mm	DCEN (-)	70-130			13-20	75-127mm/min	Travel 3-5 i.p.m.																				
Amps and volts, or power or energy range, should be recorded for each electrode size, position, and thickness, etc.																														
Pulsing Current _____ Heat Input (max.) _____ Tungsten Electrode Size and Type _____ 2.4 mm (3/32") to 3.2 mm (1/8") Thoriated EWTH-2 <small>(Pure Tungsten, 2% Thoriated, etc.)</small> Mode of Metal Transfer for GMAW (FCAW) _____ N/A <small>(Spray Arc, Short Circuiting Arc, etc.)</small> Other _____																														
<b>TECHNIQUE (QW-410)</b> String or Weave Bead _____ String Bead Orifice, Nozzle, or Gas Cup Size _____ 4 to 8 Initial and Interpass Cleaning (Brushing, Grinding, etc.) _____ Aluminum oxide grinding wheels only for mechanical grinding. Virgin S/S Brush 2" both sides of weld joint; use only brushes and grinding wheels not previously used on carbon steel when base metal being brushed or ground in stainless or a specialty alloy. Method of Back Gouging _____ Thermal or Mechanical if required (Grind 1.6 mm (1/16") # thermal) Oscillation _____ Oscillation not used with this procedure Contact Tube to Work Distance _____ None Multiple or Single Pass (Per Side) _____ Either - Maximum deposit per pass = 1/4" Multiple or Single Electrodes _____ Single Electrode Spacing _____ Peening _____ Peening not used with this procedure Other: Apply two layers of bitbering to the groove face of the stainless steel. Repair: Grind followed by brushing with S/S brush. Repair per this procedure or repair as directed by Engineer.																														

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Figure 1



TYPICAL DETAILS FOR WELDED BUTT JOINTS

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## ATTACHMENT B: WELDING PROCEDURE QUALIFICATION RECORD (PQR)

**QW-483 SUGGESTED FORMAT FOR WELDING 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.

Welding Procedure Qualification Record No. 34-MONEL/SSTEEL/GTAW Date 07-15-1993

WPS No. 34-041

Welding Process(es) GTAW

Types (Manual, Automatic, Semi-Auto) Manual

JOINTS (QW-402)

<p><b>BASE METALS (QW-403)</b></p> <p>Material Spec. <u>UNS N04400 to S30403</u></p> <p>Type or Grade <u>Monel 400 to 304L</u></p> <p>P-No. <u>42</u> to P-No. <u>8</u></p> <p>Thickness of Test Coupon <u>SCH 40 (.280")</u></p> <p>Diameter of Test Coupon <u>150 mm (6")</u></p>	<p><b>POSTWELD HEAT TREATMENT (QW-407)</b></p> <p>Temperature <u>NOT APPLICABLE</u></p> <p>Time _____</p> <p>Other _____</p>												
<p><b>FILLER METALS (QW-404)</b></p> <p>SFA Specification <u>SFA-5.14</u></p> <p>AWS Classification <u>ER NiCu-7</u> Filler Metal F-No. <u>42</u> Weld Metal Analysis A-No. <u>NiCu</u> Size of Filler Metal <u>2.3mm (3/32") &amp; 3.1mm (1/8")</u> Other _____ Deposited Weld Metal _____</p>	<p><b>GAS (QW-408)</b></p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Gas(es)</th> <th style="text-align: left;">(Mixture)</th> <th style="text-align: left;">Flow Rate</th> </tr> </thead> <tbody> <tr> <td>Shielding <u>ARGON</u></td> <td><u>99.99%</u></td> <td><u>0.566m<sup>3</sup>/h (20CFH)</u></td> </tr> <tr> <td>Trailing <u>N/A</u></td> <td></td> <td></td> </tr> <tr> <td>Backing <u>ARGON</u></td> <td><u>99.99%</u></td> <td><u>0.991m<sup>3</sup>/h (35CFH)</u></td> </tr> </tbody> </table>	Gas(es)	(Mixture)	Flow Rate	Shielding <u>ARGON</u>	<u>99.99%</u>	<u>0.566m<sup>3</sup>/h (20CFH)</u>	Trailing <u>N/A</u>			Backing <u>ARGON</u>	<u>99.99%</u>	<u>0.991m<sup>3</sup>/h (35CFH)</u>
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<p><b>POSITION (QW-405)</b></p> <p>Position of Groove <u>6G</u></p> <p>Weld Progression (Uphill, Downhill) <u>UPHILL</u></p> <p>Other _____</p>	<p><b>ELECTRICAL CHARACTERISTICS (QW-409)</b></p> <p>Current <u>DC</u></p> <p>Polarity <u>DCEN (-)</u></p> <p>Amps. <u>100 - 138</u> volts <u>15 - 18</u></p> <p>Tungsten Electrode Size <u>2.4mm (3/32")</u></p> <p>Other _____</p>												
<p><b>PREHEAT (QW-406)</b></p> <p>Preheat Temp. <u>75° F</u></p> <p>Interpass Temp. <u>200° F MAX</u></p>	<p><b>TECHNIQUE (QW-410)</b></p> <p>Travel Speed <u>75 - 125 mm/min (3 - 5 i.p.m.)</u></p> <p>String or Weave Bead <u>String Bead</u></p> <p>Oscillation <u>Not Applicable</u></p> <p>Multipass or Single Pass (per side) <u>Multiple</u></p> <p>Single or Multiple Electrodes <u>Single</u></p> <p>Other <u>Applied two layers of buttering to the groove face of the stainless steel. Applied with specified electrodes in the flat position.</u></p>												

**PQR No. 34-Monel/SSSteel/GTAW**

**QW-483 (Back)**

**Tensile Test (QW-150)**

Specimen No.	Width in.	Thickness in.	Area in <sup>2</sup>	Ultimate Total Load lb	Ultimate Unit Stress psi	Character of Failure & Location
T 1	(0.497)	(0.277)	0.1377	10,300	74,800	BASE
T 2	(0.505)	(0.283)	0.1429	10,700	74,878	BASE

**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
N/A								

**FILLET WELD TEST (QW-180)**

Result - Satisfactory   N/A   Penetration into Parent Metal   Yes, No    
 Type and Character of Failure   Yes, No   Macro-Results   Yes, No    
 Welder's Name   BILL BUFKIN   Clock No.   2735   Stamp No.   W - 1    
 Tests conducted by:   MECHANICAL TEST LABORATORY   Laboratory Test No.   07F05.1 (.2)    
 per: \_\_\_\_\_

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.

Signed   Johnson Controls World Services    
(Manufacturer)

Date \_\_\_\_\_ By \_\_\_\_\_