SSTD-8070-0017-WELD Rev. A-1
June 2015

National Aeronautics and
Space Administration

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

John C. Stennis Space Center
GAS TUNGSTEN ARC WELDING OF AUSTENITIC STAINLESS STEEL PIPE/PLATE

Original signed by:

_see revision A_____ _____
NASA SSC Center Operations Directorate Date
Operations & Maintenance Division

Issued by:

Issued CEF_____ 6-29-2015__
Central Engineering Files Date

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Document History Log

Status/Change/ Revision	Change Date	Originator/Phone	Description
Basic	02.12.2010	Doug Dike x8-2803	Initial release, supersedes SSC STD 34-010. Grammatical and format changes made, added "plate" to the standard, and updated Attachments A and B.
A	10-17-12	Benny Mcgrath	Add WPS- 8-8-GT-LT-1, PQR-WP10208, PQR-MT10391 and PQR- AFRL8A. These WPS and PQR'S will update the procedure thickness range from .600" max thickness to 1.5" max thickness. Delete: SSC-34-004 class of weld inspection and Add SSTD-8070-0013-WELD class of weld inspection. Delete : SSC Standard 34-002, *Introduction of Welding Standards*
A-1	06-29-2015	R. Carol Wolfram 8-1164	Administrative Changes: Rescanned Attachments A and B to improve legibility. Updated Table of Contents.

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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 austenitic stainless steel pipe or plate from 0.063-inch to 1.500-inch wall thickness using argon, helium, or nitrogen as a backing gas..

2.0 APPLICABILITY

This SSTD is valid for welding of all austenitic stainless steel pipe or plate that will be used in, but not be limited to, nitrogen, helium, air, oxygen, hydrogen. This SSTD applies to all contractor and subcontractor personnel involved with the GTAW welding of stainless steel pipe.

3.0 REFERENCES AND APPLICABLE DOCUMENTS

Applicable documents shall be the latest version unless otherwise specified.

ASME Boiler and Pressure Vessel Codes, Section IX
SPR 1440.1, *SSC Records Management Program Requirements*
SPR 8715.1, *SSC Safety and Health Program Requirements*
SSTD-8070-0013-WELD, *Classes of Welding Inspection*
SSTD-8070-0005-CONFIG, *Preparation, Review, Approval and Release of SSC Standards*
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, *SSC Safety and Health Program Requirements*. 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, the NASA SSC Engineering and Test Directorate (E&TD), and the NASA SSC Safety and Mission Assurance (S&MA) Office.

c. The attached WPS NASA 300-1-1-1, WPS NASA 300-2-1-1, WPS 8-8-GT-LT-1 and Procedure Qualification Record (PQR), and NASA 300-1-1, NASA 300-2-1, WP10208, MT10391, AFRL8A and Procedure Qualification Record Data (PQRD) NASA 300-1 and NASA 300-2 are the WPS, PQRs and PQRDs within this SSTD. When performing new qualifications, a new, approved WPS, PQR and PQRD shall be completed showing all pertinent data and results of the weld procedure qualification.

d. For each WPS requiring Charpy impact testing per ASME Boiler & Pressure Vessel Code Section IX, 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.

e. Welders shall be qualified in accordance with SSTD-8070-0014-WELD, *Qualifying Welders and Welding Procedures*.

f. Inspection methods for welds shall be in accordance with SSTD-8070-0013-WELD Classes *of Welding Inspection*.

g. Qualification tests shall be performed on test coupons welded with nitrogen, argon or helium as the backing gas.

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

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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
NASA	National Aeronautics and Space Administration
PQR	Procedure Qualification Record
PQRD	Procedure Qualification Record Data
psi	pounds per square inch
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
WPS	Weld Procedure Specifications

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ATTACHMENT A Nitrogen Backing Gas with Argon Shielding Gas

A.1 WPS NASA 300-1-1-1

SOUTHERN INSPECTION

Southern Inspection & Testing, Inc.
1236 Mac Arthur Ave., Harvey, LA 70058, (504) 347-1752
Welding Procedure Specification - Page 1
WeldOffice WPS

WPS record number Date	NASA 300-1-1-1 Revision 1 8/27/2008	Qualified to Company name	ASME Section IX and B31.3, ASME Section VIII Jacobs Technology
Supporting PQR(s) Reference docs.	NASA 300-1-1 - Rev 1		
Scope	Groove, fillet, no PWHT (As-welded), impact testing		
Joint	Joint details for this welding procedure specification in JOINTS section of this WPS		

BASE METALS (QW-403)

Type	Austenitic stainless steel	P-no. 8	Grp-no. 1
Welded to	Austenitic stainless steel	P-no. 8	Grp-no. 1
Backing	None	P-no.	Grp-no.
Retainers Notes	None		

THICKNESS RANGE QUALIFIED (in.)

	As-welded Min.	As-welded Max.	With PWHT Min.	With PWHT Max.
Complete pen.	0.063	0.8	-	-
Impact tested	0.3	0.8	-	-
Partial pen.	0.063	0.8	-	-
Fillet welds	no min.	no max.	-	-

DIAMETER RANGE QUALIFIED (in.)

	As-welded Min.	As-welded Max.	With PWHT Min.	With PWHT Max.
Nominal pipe size	no min.	no max.	-	-

FILLER METALS (QW-404)

	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	5.9	ER308L	6	8	Oxford Alloys/308L	no min.	0.8	-	-
Cons. insert Flux	- -	- -	- -	- -	-	- Optional - - None -			
Consumable insert size (in.)									

WELDING PROCEDURE

Welding process		GTAW
Type		Manual
Minimum preheat/interpass temperature	(°F)	50
Maximum interpass temperature	(°F)	400
Tungsten size	(in.)	0.09375
Tungsten type		SFA 5.12 :EWTh-2
Filler metal size	(in.)	0.09375
Layer number		All
Position of groove		All
Weld progression		Uphill
Current/polarity		DCEN (straight polarity)
Amperes		130 - 160
Volts		14.2 - 15.4
Travel speed	(in./min)	4 - 5
Maximum heat input	(kJ/in.)	29.568
DC pulsing current		
Shielding:	Gas type	99.998% Ar.
	Flow rate (cfh)	10
Trailing:	Gas type	None
	Flow rate (cfh)	-
Backing:	Gas type	Nitrogen
	Flow rate (cfh)	35
String or weave		Weave
Orifice/gas cup size		6
Multi/Single pass per side		Multiple passes
Weld deposit chemistry		
Notes		

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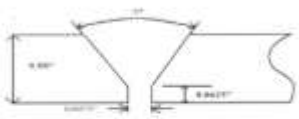
SOUTHERN INSPECTION

Southern Inspection & Testing, Inc.
1236 Mac Arthur Ave., Harvey, LA 70058, (504) 347-1752
Welding Procedure Specification - Page 2
WeldOffice WPS

WPS record number	NASA 300-1-1-1	Revision 1	Qualified to	ASME Section IX and B31.3, ASME Section VIII
Date	6/27/2008		Company name	Jacobs Technology

JOINTS (QW-402) Typical joint(s). See actual production drawings and engineering specifications for details.



PREHEAT TABLE

Applicable standard	
ASME B31.3	50 (°F)
ASME Section VIII Div. 1	50 (°F)
ASME Section VIII Div. 2	50 (°F)

TECHNIQUE (QW-410)

Peening	Not Applicable
Surface preparation	All weld joint surfaces shall be cleaned of oil, grease, paint, markings, etc.
Initial/interpass cleaning	Brushing and Grinding
Back gouging method	None

NOTES

Welding Engineer		QA Manager	
Name: Renno Brenson	Signature	Name: Glen Packer	Signature
Date: 6/27/2008		Date: 8/11/09	
Customer		**Inspector**	
Name: Douglas G. Dike	Signature	Name: Benjamine McGrath	Signature
Date: 8/11/09		Date: 6/27/2008 8/11/09	

WeldOffice WPS 2006.12.016
Catalog # WPS0000

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A.2 PQR NASA 300-1-1

Southern Inspection & Testing, Inc.
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Procedure Qualification Record (PQR) - Details of Welding Test
WeldOffice WPS

PQR record number	NASA 300-1-1	Revision: 1	WPS record number	NASA 300-1-1-1	Revision: 1
Date	8/27/2008		Company name	Jacobs Technology	
			Welding standard	ASME Section IX and B31.3, ASME Section VIII	

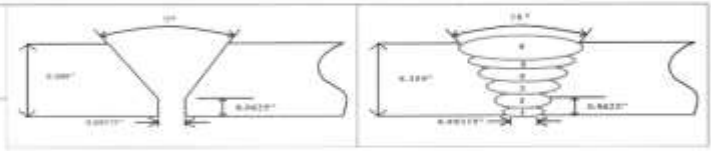
NASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Gro no.	Size	form	Thick. (in.)	Dia. (in.)
	Pipe	SA-312 (TP304L)	8	1	3	B/S	0.300	3.6
Welded to:	Pipe	SA-312 (TP304L)	8	1	3	B/S	0.300	3.6

and tested	Without PWHT, With impacts, With hardness
Notes	

JOINTS (QW-402)

Joint design	Single-V-groove
Backing	None
Retainers	None
Groove angle (deg.)	75
Root opening (in.)	0.09375
Root face (in.)	0.0625



WELDING PROCEDURES

Welding process	GTAW
Type	Manual

FILLER METALS (QW-404)

SFA specification	5.9
AWS classification	ER308L
Filler metal F-number	6
Weld metal A-number	8
Filler metal nominal composition	
Filler metal trade name	Oxford Alloys/308L
Filler metal size (in.)	0.09375
Deposited thickness (in.)	0.30
Maximum pass thickness (in.)	0.167
Weld deposit chemistry	

POSITION (QW-405)

Position of groove	5G
Weld progression	Up/Vd

PREHEAT (QW-406)

Preheat temperature (°F)	70
Maximum interpass temperature (°F)	300

GAS (QW-408)

Shielding gas	Type	99.995% Ar
	Flow rate (cfh)	10
Trailing gas	Type	None
	Flow rate (cfh)	-
Backing gas	Type	Nitrogen
	Flow rate (cfh)	35

ELECTRICAL (QW-409)

Filler metal size (in.)	0.09375
Amperes	130 - 160
Volts	14.2 - 15.4
Travel speed (in/min)	4 - 6
Maximum heat input (kJ/in.)	29.988
Tungsten size (in.)	0.09375
Tungsten type	SFA 5.12 EWTh-2
Current/polarity	DCEN (straight polarity)
DC pulsing current	

TECHNIQUE (QW-410)

String or weave	Weave
Orifice/gas cup size	8
Multi/Single pass per side	Multiple passes
Peening	Not Applicable
Initial/interpass cleaning	Brushing and Grinding
Back gouging method	None

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SOUTHERN INSPECTION

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Procedure Qualification Record (PQR) - Test Results (As Welded)

WeldOffice WPS

PQR record number	NASA 300-1-1	Revision: 1	WPS record number	NASA 300-1-1-1	Revision: 1
Date	8/27/2008		Company name	Jacobs Technology	
			Welding standard	ASME Section IX and B31.3, ASME Section VIII	

TENSILE TESTS (QW-150) — Reduced section

Specimen number	Width (in.)	Thickness (in.)	Area (in²)	Ultimate total load (lb)	Ultimate unit stress (psi)	Type of failure and location
T-1	0.751	0.228	0.1712	14400	84000	Ductile-Base Metal
T-2	0.748	0.232	0.1731	14400	83200	Ductile-Base Metal

Comments: 2 reduced section tension tests per QW-151.2 and QW-462.1(b)

GUIDED BEND TESTS (QW-160)

Type of test	Acceptance criteria	Result	Comments
2 transverse face bends per QW-151.2 and QW-462.3(a)	QW-163 (mc. CRC)	Acceptable	see - ASME IX - QW-451.1
2 transverse root bends per QW-151.2 and QW-462.3(a)	QW-163 (mc. CRC)	Acceptable	see - ASME IX - QW-451.1

Comments:

TOUGHNESS TESTS (QW-170)

Specimen number	Notch location	Notch type	Specimen size (in.) x (in.)	Test temperature (°F)	Impact values (ft-lb)	(% Shear)	(mils)	Drop weight break
Weld Metal-1	Weld Metal	Charpy V	0.394 x 0.197	-320	75	100	37	Break
Weld Metal-2	Weld Metal	Charpy V	0.394 x 0.197	-320	86	100	38	Break
Weld Metal-3	Weld Metal	Charpy V	0.394 x 0.197	-320	74	100	39	Break
HAZ-1	HAZ	Charpy V	0.394 x 0.197	-320	96	100	26	Break
HAZ-2	HAZ	Charpy V	0.394 x 0.197	-320	102	100	23	Break
HAZ-3	HAZ	Charpy V	0.394 x 0.197	-320	91	100	27	Break

Comments:

HARDNESS TEST

Type (Scale)	Distance from surface	SA-312 (TP304L)	HAZ	Weld	HAZ	SA-312 (TP304L)
Vickers (HV) 10kg	0.0625"	138	182	190	185	138
Vickers (HV) 10kg	0.1875"	148	150	187	180	138
Vickers (HV) 10kg	0.250"	144	151	180	180	140

Comments:

CERTIFICATION

Welder's name	ID Number	Stamp number		
Kevin Jurich	000-00-0000	"W"	Mechanical testing by	Southern Inspection R Branson
			Laboratory test number	00802508
			Test file number	NASA 300-1
			Tests conducted by	Ronnie Branson

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.

Welding Engineer		QA Manager	
Name: Ronnie Branson	Signature: Ronnie Branson	Name: Glen Parker	Signature: Glen Parker
Date: 8/27/2008		Date: 8/11/09	
Customer		**Inspector**	
Name: Douglas G. Dikes	Signature: [signature]	Name: Benjamin McGrath	Signature: Benjamin McGrath
Date: 8/11/09		Date: 8/27/2008 8/11/09	

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Catalog # PQR00002 — Page 2 of 2

A.3 PQRD NASA 300-1

Southern Inspection & Testing, Inc.
1236 Mac Arthur Ave., Harvey, LA 70058, (504) 347-1752
PQRD - Welding Conditions
WeldOffice WPS

PQRD number	NASA 300-1	Revision 1	Date	6/19/2008
PQR number	NASA 300-1-1	Revision 1	Welding standard	ASME Section IX and B31.3, ASME Section VIII
WPS number	NASA 300-1-1-1	Revision 1	Company name	Jacobs Technology
			To be tested	Without PWHT

WELDING PROCESSES

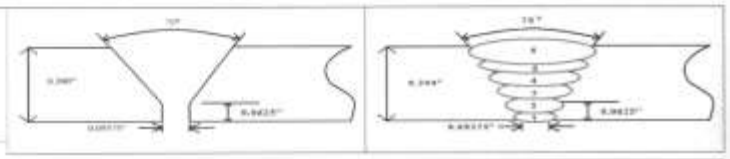
Welding process	GTAW
Type	Manual

BASE METALS (QW-403)

		Welded to:		
Product form	Pipe		Product form	Pipe
Material control number	Heat # PX286		Material control number	Heat # PX286
Specification (type or grade)	SA-312 (TP304L)		Specification (type or grade)	SA-312 (TP304L)
Nominal composition	18Cr-8Ni		Nominal composition	18Cr-8Ni
Trade name			Trade name	
P number	8		P number	8
G number	1		G number	1
AWS group number	U		AWS group number	U
Nominal pipe/tube size	3		Nominal pipe/tube size	3
Schedule	80S		Schedule	80S
Length (in.)	6		Length (in.)	6
Width (OD) (in.)	3.5		Width (OD) (in.)	3.5
Thickness (in.)	0.300		Thickness (in.)	0.300

JOINTS (QW-402)

Joint design	Single-V-groove
Backing:	None
Retainers	None
Groove angle (deg.)	75
Root opening (in.)	0.09375
Root face (in.)	0.0625



CLEANING/ROOT TREATMENT

Surface preparation	All weld joint surfaces shall be cleaned of oil, grease, paint, markings, etc.
Initial/interpass cleaning	Brushing and Grinding Use Stainless Steel Brush Do Not Contaminate.
Back gouging method	None

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Catalog # PQ300001 Page 1 of 3

SOUTHERN INSPECTION

Southern Inspection & Testing, Inc.

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PQRD - Welding Parameters

WeldOffice WPS

PQRD number	NASA 300-1	Revision 1	Date	8/19/2008

PASS INFORMATION							
Pass number		1	2	3	4	5	6
Layer number		1	2	3	4	5	6
WELDING PROCESSES							
Welding process		GTAW	GTAW	GTAW	GTAW	GTAW	GTAW
Type		Manual	Manual	Manual	Manual	Manual	Manual
FILLER METALS (QW-404)							
Material control number							
SFA specification		5.9	5.9	5.9	5.9	5.9	5.9
AWS classification		ER308L	ER308L	ER308L	ER308L	ER308L	ER308L
Filler metal F-number		6	6	6	6	6	6
Weld metal A-number		8	8	8	8	8	8
Filler metal nominal composition							
Filler metal trade name		Oxford Alloys/308L	Oxford Alloys/308L	Oxford Alloys/308L	Oxford Alloys/308L	Oxford Alloys/308L	Oxford Alloys/308L
Filler metal size	(in.)	0.09375	0.09375	0.09375	0.09375	0.09375	0.09375
Length of filler metal consumed	(in.)						
Deposited thickness	(in.)	0.050	0.050	0.050	0.050	0.050	0.050
Maximum pass thickness	(in.)	0.187	0.187	0.187	0.187	0.187	0.187
Weld deposit chemistry							
Flux nominal composition							
Flux trade name							
POSITION (QW-405)							
Position of groove		6G	6G	6G	6G	6G	6G
Weld progression		Uphill	Uphill	Uphill	Uphill	Uphill	Uphill
PREHEAT (QW-406)							
Preheat temperature	(°F)	70	70	70	70	70	70
Maximum interpass temperature	(°F)	300	300	300	300	300	300
GAS (QW-408)							
Shielding gas: Type		99.998% Ar,	99.998% Ar,	99.998% Ar,	99.998% Ar,	99.998% Ar,	99.998% Ar,
Flow rate	(cfh)	10	10	10	10	10	10
Trailing gas: Type		None	None	None	None	None	None
Flow rate	(cfh)	-	-	-	-	-	-
Backing gas: Type		Nitrogen	Nitrogen	Nitrogen	Nitrogen	Nitrogen	Nitrogen
Flow rate	(cfh)	35	35	35	35	35	35
ELECTRICAL (QW-409)							
Filler metal size	(in.)	0.09375	0.09375	0.09375	0.09375	0.09375	0.09375
Amperes		130	135	140	145	154	160
Volts		14.2	14.3	14.5	14.7	15	15.4
Travel speed	(in./min)	4	5	5	5	5	5
Maximum heat input	(kJ/in.)	27.89	23.188	24.36	25.578	27.72	29.568
Tungsten size	(in.)	0.09375	0.09375	0.09375	0.09375	0.09375	0.09375
Tungsten type		SFA 5.12 EWTh-2	SFA 5.12 EWTh-2	SFA 5.12 EWTh-2	SFA 5.12 EWTh-2	SFA 5.12 EWTh-2	SFA 5.12 EWTh-2
Current/polarity		DCEN (straight polarity)	DCEN (straight polarity)	DCEN (straight polarity)	DCEN (straight polarity)	DCEN (straight polarity)	DCEN (straight polarity)
DC pulsing current							
TECHNIQUE (QW-410)							
String or weave		Weave	Weave	Weave	Weave	Weave	Weave
Orifice/gas cup size		8	8	8	8	8	8
Multi/Single pass per side		Single pass	Single pass	Single pass	Single pass	Single pass	Single pass
Peening		Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Initial/Interpass cleaning		Brushing and Grinding	Brushing and Grinding	Brushing and Grinding	Brushing and Grinding	Brushing and Grinding	Brushing and Grinding
Back gouging method		None	None	None	None	None	None
PASS PERFORMED/WITNESSED BY							
Welders name		Kevin Jurich	Kevin Jurich	Kevin Jurich	Kevin Jurich	Kevin Jurich	Kevin Jurich
Recorder/witnessed by		Benjamin McGrath	Benjamin McGrath	Benjamin McGrath	Benjamin McGrath	Benjamin McGrath	Benjamin McGrath
Date		8/19/2008	8/19/2008	8/19/2008	8/19/2008	8/19/2008	8/19/2008
Data entry by		Rennis Branson	Rennis Branson	Rennis Branson	Rennis Branson	Rennis Branson	Rennis Branson

WeldOffice WPS 2008.12.016

Catalog #: P12000000

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ATTACHMENT B Argon Shielding and Backing Gas

B.1 WPS NASA 300-2-1-1

Note: WPS NASA 300-2-1-1 was redlined to allow the use of helium as a backing gas as well as argon. Per ASME Section IX, Paragraph QW 408.9 backing gas is not an essential variable for GTAW process for P-8 metals so the WPS could be redlined without re-qualification of the welding procedure. (See attached)

Southern Inspection & Testing, Inc.
1239 Mac Arthur Ave., Harvey, LA 70058, (504) 347-1732
Welding Procedure Specification - Page 1
WeldOffice WPS

WPS record number Date	NASA 300-2-1-1 2/5/2009	Revision: 1	Qualified to Company name	ASME Section IX and B31.3, ASME Section VIII Jacobs Technology
Supporting PQR(s) Reference docs	NASA 300-2-1 - Rev 1			

Scope	Groove, no PWHT (As-welded), impact testing
Joint	Joint details for this welding procedure specification in JOINTS section of this WPS

BASE METALS (QW-403)

Type	Austenitic stainless steel	P-no. 8	Grp-no. 1
Welded to	Austenitic stainless steel	P-no. 8	Grp-no. 1
Backing	None	P-no.	Grp-no.
Retainers Notes	None		

THICKNESS RANGE QUALIFIED

	As-welded Min.	As-welded Max.	WA PWHT Min.	WA PWHT Max.
Complete pen.	0.063	0.8	-	-
Impact tested	0.3	0.8	-	-
Partial pen.	0.063	0.8	-	-
Fillet welds	-	-	-	-

DIAMETER RANGE QUALIFIED

	As-welded Min.	As-welded Max.	WA PWHT Min.	WA PWHT Max.
Nominal pipe size	no min	no max.	-	-

FILLER METALS (QW-404)

	SFA	Classification	F-no.	A-no.	Chemical analysis or Trade name	As-welded Min.	As-welded Max.	WA PWHT Min.	WA PWHT Max.
GTAW	5.9	ER308L	6	8	Oxford Alloys(308L)	no min	0.8	-	-
Core, insert Flux	- -	- -	- -	- -	- -	- Optional - - None -			
Consumable insert size									

WELDING PROCEDURE

Welding process		GTAW
Type		Manual
Minimum preheat/interpass temperature	(°F)	50
Maximum interpass temperature	(°F)	300
Tungsten size	(in.)	0.09375
Tungsten type		SFA 5.12 EWTh-2
Filler metal size	(in.)	0.09375
Layer number		All
Position of groove		5-G
Weld progression		Uphill
Current/polarity		DCEN (straight polarity)
Amperes		130 - 160
Volts		14.2 - 15.4
Travel speed	(in./min)	4 - 8
Maximum heat input	(kJ/in.)	29.568
DC pulsing current		
Shielding:	Gas type	99.9% Ar
	Flow rate (cfh)	10
Trailing:	Gas type	None
	Flow rate (cfh)	-
Backing:	Gas type	99.9% Ar & Helium
	Flow rate (cfh)	8
String or weave		Weave
Orifice/gas cup size		8
Multi/Single pass per side		Multiple passes
Weld deposit chemistry		
Notes		

1/20/10
1/12/10

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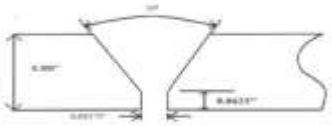
RELEASED - Printed documents may be obsolete; validate prior to use.

SOUTHERN INSPECTION

Southern Inspection & Testing, Inc.
1236 Mac Arthur Ave., Harvey, LA 70058, (504) 347-1752
Welding Procedure Specification - Page 2
WeldOffice WPS

WPS record number	NASA 300-2-1-1	Revision 1	Qualified to	ASME Section IX and B31.3, ASME Section VIII
Date	2/5/2009		Company name	Jacobs Technology

JOINTS (QW-402) Typical joint(s). See actual production drawings and engineering specifications for details.



PREHEAT TABLE

Applicable standard	
ASME B31.3	50 (°F).
ASME Section VIII Div. 1	50 (°F).
ASME Section VIII Div. 2	50 (°F).

TECHNIQUE (QW-410)

Peening	Not Applicable
Surface preparation	All weld joint surfaces shall be cleaned of oil, grease, paint, markings, etc.
Initial/interpass cleaning	Brushing and Grinding
Back gouging method	None

NOTES

Rev-1 A) Changed from Nitrogen to Argon as backing gas as I was told it was Nitrogen it was not.
B) Changed Company Name From NASA Stennis Space Center to Jacobs Technology.
C) Added ASME Section VII AS applicable standard.

Welding Engineer		QA Manager	
Name: Rennis Branson	Signature: Rennis Branson	Name: Glen Parker	Signature: Glen Parker
Date: 2/5/2009		Date: 8/11/09	
Customer		**Inspector**	
Name: Douglas G. Dike	Signature: [signature]	Name: Benjamine McGrath	Signature: Benjamine McGrath
Date: 8/11/09		Date: 2/5/2009 8/11/09	

WeldOffice WPS 2008.12.016
Catalog n° WPS00000

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B.2 PQR NASA 300-2-1

Southern Inspection & Testing, Inc.
1236 Mac Arthur Ave., Harvey, LA 70058, (504) 347-1752
Procedure Qualification Record (PQR) - Details of Welding Test
WeldOffice WPS

PQR record number	NASA 300-2-1	WPS record number	NASA 300-2-1-1
Date	3/5/2009	Company name	Jacobs Technology
Revision: 1		Welding standard	ASME Section IX and B31.3, ASME Section VIII

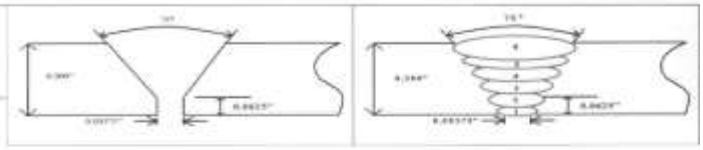
BASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Group no.	Size	Sch.	Thick. (in.)	Dia. (in.)
	Pipe	SA-312 (TP304L)	8	1	3	80S	0.300	3.5
Welded to	Pipe	SA-312 (TP304L)	8	1	3	80S	0.300	3.5

and tested	Without PWHT. With impacts. With hardness
Notes	

JOINTS (QW-402)

Joint design	Single-V-groove
Backing	None
Retainers	None
Groove angle (deg.)	75
Root opening (in.)	0.06375
Root face (in.)	0.0625



WELDING PROCEDURES

Welding process	GTAW
Type	Manual

FILLER METALS (QW-404)

SFA specification	5.9
AWS classification	ER308L
Filler metal F-number	6
Weld metal A-number	8
Filler metal nominal composition	
Filler metal trade name	Oxford Alloys/308L
Filler metal size (in.)	0.06375
Deposited thickness (in.)	0.30
Maximum pass thickness (in.)	0.187
Weld deposit chemistry	

POSITION (QW-405)

Position of groove	6G
Weld progression	Uphill

PREHEAT (QW-406)

Preheat temperature (°F)	70
Maximum interpass temperature (°F)	300

GAS (QW-408)

Shielding gas	Type		99.9% Ar
	Flow rate	(cfh)	15
Trailing gas	Type		None
	Flow rate	(cfh)	-
Backing gas	Type		99.9% Ar
	Flow rate	(cfh)	30

ELECTRICAL (QW-409)

Filler metal size (in.)	0.06375
Amperes	65- 150
Volts	13 - 15.3
Travel speed (in./min)	4 - 5
Maximum heat input (kJ/in.)	30.4605
Tungsten size (in.)	0.06375
Tungsten type	SFA 5.12 EWTh-2
Current/polarity	DCEN (straight polarity)
DC pulsing current	

TECHNIQUE (QW-410)

String or weave	Weave
Orifice/gas cup size	8
Initial/interpass clean	Multiple passes
Peening	Not Applicable
Initial/interpass cleaning	Brushing and Grinding
Back gouging method	None

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Catalog #: PQR00003

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SOUTHERN INSPECTION

Southern Inspection & Testing, Inc.

1236 Mac Arthur Ave., Harvey, LA 70058, (504) 347-1752

Procedure Qualification Record (PQR) - Test Results (As Welded)

WeldOffice WPS

PQR record number	NASA 300-2-1	Revision: 1	WPS record number	NASA 300-2-1-1	Revision: 1
Date	2/5/2009		Company name	Jacobs Technology	
			Welding standard	ASME Section IX and B31.3, ASME Section VIII	

TENSILE TESTS (QW-150)

Reduced section

Specimen number	Width (in.)	Thickness (in.)	Area (in²)	Ultimate total load (lb)	Ultimate unit stress (psi)	Type of failure and location
T-1	.599	.211	0.1268	9081	69000	Ductile-Base Metal
T-2	.499	.164	0.0819	7752	94500	Ductile-Base Metal

Comments: 2 reduced section tension tests per QW-151.2 and QW-462.1(b)

GUIDED BEND TESTS (QW-160)

Type of test	Acceptance criteria	Result	Comments
2 transverse face bends per QW-161.2 and QW-462.3(a)	QW-163 (incl. CRO)	Acceptable	see - ASME IX - QW-461.1
2 transverse root bends per QW-161.3 and QW-462.3(a)	QW-163 (incl. CRO)	Acceptable	see - ASME IX - QW-461.1

Comments:

TOUGHNESS TESTS (QW-170)

Specimen number	Notch location	Notch type	Specimen size (W x Th.)	Test temperature (°F)	Impact values (ft lb)	(% Shear)	(Mils)	Drop weight break
Weld Metal-1	Weld Metal	Charpy V	0.394 x 0.197	-320	38	85	37	
Weld Metal-2	Weld Metal	Charpy V	0.394 x 0.197	-320	40	85	37	
Weld Metal-3	Weld Metal	Charpy V	0.394 x 0.197	-320	40	85	37	
HAZ-1	HAZ	Charpy V	0.394 x 0.197	-320	81	100	60	
HAZ-2	HAZ	Charpy V	0.394 x 0.197	-320	72	100	63	
HAZ-3	HAZ	Charpy V	0.394 x 0.197	-320	66	100	62	

Comments:

HARDNESS TEST

Type (Scale)	Distance from surface	SA-312 (TP304L)	HAZ	Weld	HAZ	SA-312 (TP304L)
Vickers (HV) 10kg	0.0025"	140	160	155	170	138
Vickers (HV) 10kg	0.1875"	145	160	152	172	140
Vickers (HV) 10kg	0.250"	142	171	161	175	141

Comments:

CERTIFICATION

Welder's name	ID Number	Stamp number		
Chad Northup	000000000	"JT00"	Mechanical testing by	Southern Inspection R Branson
			Laboratory test number	00000108
			Test file number	NASA 300-2
			Tests conducted by	Rennie Branson

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.

Welding Engineer		QA Manager	
Name: Rennie Branson	Signature: Rennie Branson	Name: Glen Parker	Signature: Glen Parker
Date: 2/5/2009		Date: 8/11/09	

Customer		Inspector	
Name: Douglas G. Ake	Signature:	Name: Benjamine McGrath	Signature: Benjamine McGrath
Date: 8/11/09		Date: 2/5/2009 8/11/09	

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B.3 PQRD NASA 300-2

SOUTHERN INSPECTION

Southern Inspection & Testing, Inc.
1236 Mac Arthur Ave., Harvey, LA 70058, (504) 347-1752
PQRD - Welding Conditions
WeldOffice WPS

PQRD number	NASA 300-2	Revision: 1	Date	12/16/2008
PQR number	NASA 300-2-1	Revision: 1	Welding standard	ASME Section IX and B31.3, ASME Section VIII
WPS number	NASA 300-2-1-1	Revision: 1	Company name	Jacobs Technology
			To be tested	Without PWHT

WELDING PROCESSES

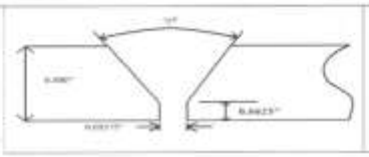
Welding process	GTAW
Type	Manual

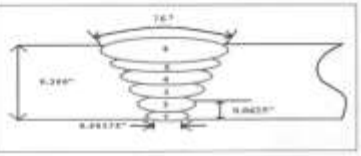
BASE METALS (QW-403)

			Welded to:		
Product form		Pipe		Product form	Pipe
Material control number		Heat # PX286		Material control number	Heat # PX286
Specification (type or grade)		SA-312 (TP304L)		Specification (type or grade)	SA-312 (TP304L)
Nominal composition		18Cr-8Ni		Nominal composition	18Cr-8Ni
Trade name				Trade name	
P number		8		P number	8
G number		1		G number	1
AWS group number		U		AWS group number	U
Nominal pipe/tube size		3		Nominal pipe/tube size	3
Schedule		80S		Schedule	80S
Length	(in.)	6		Length	(in.) 6
Width (OD)	(in.)	3.5		Width (OD)	(in.) 3.5
Thickness	(in.)	0.300		Thickness	(in.) 0.300

JOINTS (QW-402)

Joint design		Single-V-groove
Backing		None
Retainers		None
Groove angle	(deg.)	75
Root opening	(in.)	0.09375
Root face	(in.)	0.0625





CLEANING/ROOT TREATMENT

Surface preparation	All weld joint surfaces shall be cleaned of oil, grease, paint, markings, etc.
Initial/interpass cleaning	Brushing and Grinding Use Stainless Steel Brush Do Not Contaminate.
Back gouging method	None

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Catalog # PQR000051 Page 1 of 3

SOUTHERN INSPECTION

Southern Inspection & Testing, Inc.

1236 Mac Arthur Ave., Harvey, LA 70058, (504) 347-1752

PQRD - Welding Parameters

WeldOffice WPS

PQRD number	NASA 300-2	Revision 1	Date	12/16/2008

PASS INFORMATION							
Pass number		1	2	3	4	5	6
Layer number		1	2	3	4	5	6
WELDING PROCESSES							
Welding process		GTAW	GTAW	GTAW	GTAW	GTAW	GTAW
Type		Manual	Manual	Manual	Manual	Manual	Manual
FILLER METALS (QW-404)							
Material control number							
SFA specification		5.9	5.9	5.9	5.9	5.9	5.9
AWS classification		ER308L	ER308L	ER308L	ER308L	ER308L	ER308L
Filler metal F-number		6	6	6	6	6	6
Weld metal A-number		8	8	8	8	8	8
Filler metal nominal composition							
Filler metal trade name		Oxford Alloys/308L	Oxford Alloys/308L	Oxford Alloys/308L	Oxford Alloys/308L	Oxford Alloys/308L	Oxford Alloys/308L
Filler metal size	(in.)	0.09375	0.09375	0.09375	0.125	0.125	0.125
Length of filler metal consumed	(in.)						
Deposited thickness	(in.)	0.050	0.050	0.050	0.050	0.050	0.050
Maximum pass thickness	(in.)	0.187	0.187	0.187	0.187	0.187	0.187
Weld deposit chemistry							
Flux nominal composition							
Flux trade name							
POSITION (QW-405)							
Position of groove		6G	6G	6G	6G	6G	6G
Weld progression		Uphill	Uphill	Uphill	Uphill	Uphill	Uphill
PREHEAT (QW-406)							
Preheat temperature	(°F)	70	70	70	70	70	70
Maximum interpass temperature	(°F)	200	201	280	243	300	285
GAS (QW-408)							
Shielding gas: Type		99.9% Ar,	99.9% Ar,	99.9% Ar,	99.9% Ar,	99.9% Ar,	99.9% Ar,
Flow rate	(cfh)	10	10	10	10	10	10
Trailing gas: Type		None	None	None	None	None	None
Flow rate	(cfh)	-	-	-	-	-	-
Backing gas: Type		99.9% Ar,	99.9% Ar,	99.9% Ar,	99.9% Ar,	99.9% Ar,	99.9% Ar,
Flow rate	(cfh)	35	35	35	35	35	35
ELECTRICAL (QW-409)							
Filler metal size	(in.)	0.09375	0.09375	0.09375	0.125	0.125	0.125
Amperes		80	92	120	150	156	159
Volts		13	13	14	14	15	15.3
Travel speed	(in./min)	4	5	5	5	5	5
Maximum heat input	(kJ/in.)	15.6	14.352	20.16	25.2	28.08	29.1924
Tungsten size	(in.)	0.09375	0.09375	0.09375	0.09375	0.09375	0.09375
Tungsten type		SFA 5.12 EWTh-2	SFA 5.12 EWTh-2	SFA 5.12 EWTh-2	SFA 5.12 EWTh-2	SFA 5.12 EWTh-2	SFA 5.12 EWTh-2
Current/polarity		DCEN (straight polarity)	DCEN (straight polarity)	DCEN (straight polarity)	DCEN (straight polarity)	DCEN (straight polarity)	DCEN (straight polarity)
DC pulsing current							
TECHNIQUE (QW-410)							
String or weave		Weave	Weave	Weave	Weave	Weave	Weave
Orifice/gas cup size		8	8	8	8	8	8
Multi/Single pass per side		Single pass	Single pass	Single pass	Single pass	Single pass	Single pass
Peening		Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Initial/interpass cleaning		Brushing and Grinding	Brushing and Grinding	Brushing and Grinding	Brushing and Grinding	Brushing and Grinding	Brushing and Grinding
Back gouging method		None	None	None	None	None	None
PASS PERFORMED/WITNESSED BY							
Welders name		Chad Northup	Chad Northup	Chad Northup	Chad Northup	Chad Northup	Chad Northup
Recorded/witnessed by		R. Ladner / J. Necaise	R. Ladner / J. Necaise	R. Ladner / J. Necaise	R. Ladner / J. Necaise	R. Ladner / J. Necaise	R. Ladner / J. Necaise
Date		12/17/2008	12/17/2008	12/17/2008	12/17/2008	12/17/2008	12/17/2008
Data entry by		Rennis Branson	Rennis Branson	Rennis Branson	Rennis Branson	Rennis Branson	Rennis Branson

WeldOffice WPS 2008.12.016
Catalog # PQD0000

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B.4 WPS 8-8-GT-LT-1

JACOBS

Jacobs
5995 Rogerdale Road, P. O. Box 53495, Houston, Texas 77052-3495, USA
ASME - Welding Procedure Specification (WPS)
WeldOffice WPS

WPS record number	8-8-GT-LT-1 Revision 1	Qualified to	ASME Section IX and B31.3
Date	10/25/2010	Company name	Jacobs
Supporting PQR(s) Reference docs.	WP10208 - Rev 0, MT10391 - Rev 0, AFRL8A - Rev 0		

Scope	Groove, fillet, no PWHT (As-welded), impact testing
Joint	Joint details for this welding procedure specification in: Production drawings, Engineering specifications

BASE METALS (QW-403)

Type	SA240 Type 304L	P-no. 8	Grp-no. 1
Welded to	SA240 Type 304L	P-no. 8	Grp-no. 1
Backing:	With or without	P-no. 8	Grp-no. 1
Retainers	None		
Notes	Maximum misalignment shall be 1/16" per side.		

THICKNESS RANGE QUALIFIED (in.)

	As-welded Min.	As-welded Max.	With PWHT Min.	With PWHT Max.
Complete pen.	0.0625	1.5000	-	-
Impact tested	0.2180	0.8720	-	-
Partial pen.	-	-	-	-
Fillet welds	no min.	no max.	-	-

DIAMETER RANGE QUALIFIED (in.)

	As-welded Min.	As-welded Max.	With PWHT Min.	With PWHT Max.
Nominal pipe size	no min.	no max.	-	-

FILLER METALS (QW-404)

	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	5.9	ER316L	6	8	Bare Solid Wire	no min.	1.000	-	-
Cons. Insert	-	-	-	-	-	- None -			
Flux	-	-	-	-	-	- None -			

WELDING PROCEDURE

Welding process	GTAW	
Type	Manual	
Minimum preheat/interpass temperature (°F)	50	
Maximum interpass temperature (°F)	350	
Tungsten size (in.)	3/32 or 1/8	
Tungsten type	SFA 5.12 EWTh-2	
Filler metal size (in.)	3/32	1/8
Layer number	1+	1+
Position of groove	All	All
Weld progression	Uphill	Uphill
Current/polarity	DCEN	DCEN
Amperes	60-100	70-100
Volts	7-14	7-14
Travel speed (in./min)	3 -4	3 - 4
Maximum heat input (kJ/in.)	28	28
DC pulsing current	Not used	Not used
Shielding: Gas type	Argon (A5.32 SG-A) (99.997%)	
Flow rate (cfh)	10-40	
Trailing: Gas type		
Flow rate (cfh)		
Backing: Gas type	Argon (A5.32 SG-A) (99.997%)	
Flow rate (cfh)	5-40	5-40
String or weave	Stringer	
Orifice/gas cup size	4-12	
Multi/Single pass per side	Multiple passes	
Weld deposit chemistry	Not Recorded	
Notes		

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Catalog # WPS20014 Page 1 of 3

JACOBS

Jacobs
5995 Rogerdale Road, P. O. Box 53495, Houston, Texas 77052-3495, USA
ASME - Welding Procedure Specification (WPS)
WeldOffice WPS

WPS record number	8-8-GT-LT-1	Revision 1	Qualified to	ASME Section IX and B31.3
Date	10/25/2010		Company name	Jacobs

TECHNIQUE (QW-410)

Peening	Not used
Surface preparation	Grind, steam or solvent clean to remove all contaminants.
Initial/Interpass cleaning	Clean 1" back from weld joint by brushing or grinding
Back gouging method	Chipping, grinding or arc-gouging followed by grinding when required

NOTES

1. No autogenous welding allowed, add filler metal to all passes.
2. Use high frequency starting equipment or equal where possible.
3. Gas backing is required for a minimum of two passes or until at least 1/4" weld depth on full penetration groove welds made from one side with open butt root passes.
4. Use stainless steel brushes and aluminum oxide grinding wheels not previously used on other metals for surface preperation and interpass cleaning.
5. This WPS is qualified in accordance with ASME B31.3 down to -452 deg F.
6. At -320 deg F this WPS is qualified from 0.093" thru 1.000".

Signature 1		Signature 2	
Name	Signature	Name	Signature
Arthur Henderson	Arthur Henderson		
Date		Date	
10/25/2010			

Signature 3		Signature 4	
Name	Signature	Name	Signature
Date		Date	

WeldOffice WPS 2009.11.027
Catalog n° WPS00014

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Page 2 of 2

B.5 PQR WP10208

JACOBS

Jacobs
5995 Rogerdale Road, P. O. Box 53495, Houston, Texas 77052-3495, USA
ASME - Procedure Qualification Record (PQR) - QW-483
WeldOffice WPS

PQR record number	WP10208	Revision 0	WPS record number		Revision
Date	7/29/2010		Company name	Jacobs	
			Welding standard	ASME Section IX	

BASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Grp no.	Size	Sch.	Thick. (in.)	Dia. (in.)
	Plate	SA240 Type 304L	8	1	-	-	0.1875	-
Welded to:	Plate	SA240 Type 304L	8	1	-	-	0.1875	-

and tested:	Without PWHT, With impacts
Notes	

JOINTS (QW-402)

Joint design	Single-V-groove		
Backing:	None		
Retainers	None		
Groove angle (deg.)	60		
Root opening (in.)	1/8		
Root face (in.)	1/16		

WELDING PROCESSES

Welding process	GTAW
Type	Manual

FILLER METALS (QW-404)

SFA specification		5.9
AWS classification		ER316L
Filler metal F-number		6
Weld metal A-number		8
Filler metal nominal composition		316 SS
Filler metal trade name		ESAB Arcaloy
Filler metal size (in.)	1/8	
Deposited thickness (in.)		3/16
Maximum pass thickness (in.)		<1/8
Weld deposit chemistry		Not Reported

POSITION (QW-405)

Position of groove	3G
Weld progression	Uphill

PREHEAT (QW-406)

Preheat temperature (°F)	50
Maximum interpass temperature (°F)	350

GAS (QW-408)

Shielding gas:	Type		Argon (A5.32 SG-A)
	Flow rate (cfh)	35-40	
Trailing gas:	Type		
	Flow rate (cfh)		
Backing gas:	Type		Argon (A5.32 SG-A)
	Flow rate (cfh)	25-30	

ELECTRICAL (QW-409)

Filler metal size (in.)	1/8		
Amperes	88-92	156-161	118-121
Volts	10-12	13-15	12-14
Travel speed (in/min)	2.5-3.0	8-9	5-6
Maximum heat input (kJ/in.)	26.5	18.1	20.4
Tungsten size (in.)		1/8	
Tungsten type		SFA 5.12 EWTh-2	
Current/polarity	DCEN	DCEN	DCEN
DC pulsing current		Not used	

TECHNIQUE (QW-410)

String or weave	Stringer
Orifice/gas cup size	1/2"
Multi/Single pass per side	Multiple passes
Peening	Not used
Initial/interpass cleaning	Brushing and/or Grinding
Back gouging method	None

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JACOBS

Jacobs
5995 Rogerdale Road, P. O. Box 53495, Houston, Texas 77052-3495, USA
ASME - Procedure Qualification Record (PQR) - Test results (as welded)
WeldOffice WPS

PQR record number	WP10208	Revision 0	WPS record number		Revision
date	7/29/2010		Company name	Jacobs	
			Welding standard	ASME Section IX	

TENSILE TESTS (QW-150) Reduced section

Specimen number	Width (in.)	Thickness (in.)	Area (in²)	Ultimate total load (lb)	Ultimate unit stress (psi)	Type of failure and location
T1	0.750	0.154	0.1155	9611	83000	Ductile-Weld
T2	0.752	0.156	0.1173	9857	84000	Ductile-Weld

Comments

GUIDED BEND TESTS (QW-160)

Type of test	Acceptance criteria	Result	Comments
2 transverse face bends per QW-161.2 and QW-462.3(a)	QW-163	Acceptable	see - ASME IX - QW-451.1
2 transverse root bends per QW-161.3 and QW-462.3(a)	QW-163	Acceptable	see - ASME IX - QW-451.1

Comments

TOUGHNESS TESTS (QW-170)

Specimen number	Notch location	Notch type	Specimen size (in.) x (in.)	Test temperature (°F)	Impact values (ft lb)	(% Shear)	(Mils)	Drop weight break
1	Weld Metal	Charpy V	10 x 3.86mm	-320	27	100	44	
2	Weld Metal	Charpy V	10 x 3.86mm	-320	29	100	50	
3	Weld Metal	Charpy V	10 x 3.86mm	-320	23	100	41	
4	HAZ	Charpy V	10 x 3.86mm	-320	54	100	57	
5	HAZ	Charpy V	10 x 3.86mm	-320	50	100	52	
6	HAZ	Charpy V	10 x 3.86mm	-320	50	100	52	
7	304L BM	Charpy V	10 x 3.86mm	-320	52	100	53	
8	304L BM	Charpy V	10 x 3.86mm	-320	51	100	55	
9	304L BM	Charpy V	10 x 3.86mm	-320	53	100	56	

Comments: Acceptable for all temperatures colder than -320 F per ASME Sec VIII Div 1 UHA-51(a)(4)(a).

CERTIFICATION

Welder's name	ID Number	Stamp number		
Stephen Williams	2881	None	Mechanical testing by	Dynamic Laboraties Inc.
			Laboratory test number	WP10-208
			Test file number	None
			Tests conducted by	Brad Berglan

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.

Signature 1		Signature 2	
Name	Signature	Name	Signature
Art Henderson	Arthur Henderson		
Date		Date	
7/29/2010			

Signature 3		Signature 4	
Name	Signature	Name	Signature
Date		Date	

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JACOBS

Jacobs
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ASME - Additional information (PQR)
WeldOffice WPS

PQR record number	WP10208	Revision 0	WPS record number		Revision
Date	7/29/2010		Company name	Jacobs	
			Welding standard	ASME Section IX	

1. All passes were made with the addition of filler metal.
2. High frequency starting equipment was used for all welding.
3. Purge gas was maintained until completion of welding.
4. A contact pyrometer was used to confirm interpass temperatures.

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B.6 PQR MT10391

JACOBS

Jacobs
5995 Rogerdale Road, P. O. Box 53495, Houston, Texas 77052-3495, USA
ASME - Procedure Qualification Record (PQR) - QW-483
WeldOffice WPS

PQR record number	MT10391	Revision 0	WPS record number		Revision
Date	7/29/2010		Company name	Jacobs	
			Welding standard	ASME Section IX	

BASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Grp no.	Size	Sch.	Thick. (in.)	Dia. (in.)
Welded to:	Plate	SA240 Type 304L	8	1	-	-	0.750	-
	Plate	SA240 Type 304L	8	1	-	-	0.750	-

and tested: Without PWHT, With impacts
Notes

JOINTS (QW-402)

Joint design		Double-V groove
Backing:		None
Retainers		None
Groove angle	(deg.)	60
Root opening	(in.)	1/8
Root face	(in.)	1/16

WELDING PROCESSES

Welding process	GTAW
Type	Manual

FILLER METALS (QW-404)

SFA specification		5.9		
AWS classification		ER316L		
Filler metal F-number		6		
Weld metal A-number		8		
Filler metal nominal composition		316L SS		
Filler metal trade name		Arcaloy ER316L		
Filler metal size	(in.)	3/32		
Deposited thickness	(in.)	3/4		
Maximum pass thickness	(in.)	<1/8		
Weld deposit chemistry		Not Recorded		

POSITION (QW-405)

Position of groove	3G
Weld progression	Uphill

PREHEAT (QW-406)

Preheat temperature	(°F)	70
Maximum interpass temperature	(°F)	350

GAS (QW-408)

Shielding gas:	Type		Argon (A5.32 SG-A)	
	Flow rate	(cfh)	20-30	
Trailing gas:	Type			
	Flow rate	(cfh)		
Backing gas:	Type		None	
	Flow rate	(cfh)	-	-

ELECTRICAL (QW-409)

Filler metal size	(in.)	3/32		
Amperes		90-105	100-110	105-115
Volts		7-11	9-11	8-11
Travel speed	(in/min)	1.3	1.4	2.4
Maximum heat input	(kJ/in.)	53.3	51.9	31.6
Tungsten size	(in.)		1/8	
Tungsten type			SFA 5.12 EWTh-2	
Current/polarity		DCEN	DCEN	DCEN
DC pulsing current			Not used	

TECHNIQUE (QW-410)

String or weave	Stringer and Weave
Orifice/gas cup size	4-8
Multi/Single pass per side	Multiple passes
Peening	Not used
Initial/Interpass cleaning	Brushing and/or Grinding
Back gouging method	Grinding

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JACOBS

Jacobs
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ASME - Procedure Qualification Record (PQR) - Test results (as welded)
WeldOffice WPS

PQR record number	MT10391	Revision: 0	WPS record number		Revision:
date	7/29/2010		Company name	Jacobs	
			Welding standard	ASME Section IX	

TENSILE TESTS (QW-150)

Reduced section

Specimen number	Width (in.)	Thickness (in.)	Area (in²)	Ultimate total load (lb)	Ultimate unit stress (psi)	Type of failure and location
T1	0.751	0.724	0.5437	48518	89300	
T2	0.750	0.724	0.5430	48876	90000	

Comments

GUIDED BEND TESTS (QW-160)

Type of test	Acceptance criteria	Result	Comments
4 transverse side bends per QW-161.1 and QW-462.2	QW-160	Acceptable	see - ASME IX - QW-451.1

Comments

TOUGHNESS TESTS (QW-170)

Specimen number	Notch location	Notch type	Specimen size (in.) x (in.)	Test temperature (°F)	Impact values (ft-lb)	(% Shear)	(Mils)	Drop weight break
1	Weld Metal	V-notch	10MM X 10MM	-320	64	100	40	
2	Weld Metal	V-notch	10MM X 10MM	-320	57	100	42	
3	Weld Metal	V-notch	10MM X 10MM	-320	56	100	38	
4	HAZ	V-notch	10MM X 10MM	-320	137	100	55	
5	HAZ	V-notch	10MM X 10MM	-320	155	100	71	
6	HAZ	V-notch	10MM X 10MM	-320	149	100	67	
7	Base Metal	V-notch	10MM X 10MM	-320	164	100	78	
8	Base Metal	V-notch	10MM X 10MM	-320	156	100	61	
9	Base Metal	V-notch	10MM X 10MM	-320	172	100	75	

Comments: Acceptable for all temperatures down to -425F per ASME B31.3 and ASME Sec Div 1 UHA-51(a)(4)(a).

CERTIFICATION

Welder's name	ID Number	Stamp number		
Bobby White	6727	W8	Mechanical testing by	Dynamic Laboratories Inc.
			Laboratory test number	MT10-391
			Test file number	None
			Tests conducted by	Brad Bergian

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.

Signature 1		Signature 2	
Name	Signature	Name	Signature
Art Henderson			
Date		Date	
7/29/2010			

Signature 3		Signature 4	
Name	Signature	Name	Signature
Date		Date	

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Catalog n° PQR00016

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JACOBS

Jacobs
5995 Rogerdale Road, P. O. Box 53495, Houston, Texas 77052-3495, USA
ASME - Additional Information (PQR)
WeldOffice WPS

PQR record number	MT10391	Revision 0	WPS record number		Revision
ate	7/29/2010		Company name	Jacobs	
			Welding standard	ASME Section IX	

1. All passes were made with the addition of filler metal.
2. High frequency starting equipment was used for all welding.
3. Purge gas was maintained until completion of welding.
4. A contact pyrometer was used to confirm interpass temperatures.

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B.7 PQR AFRL8A

Jacobs

5995 Rogerdale Road, P. O. Box 53495, Houston, Texas 77052-3495, USA

ASME - Procedure Qualification Record (PQR) - QW-483

WeldOffice WPS

PQR record number	AFRL8A Revision 0	WPS record number	Revision
date	10/25/2010	Company name	Jacobs
		Welding standard	ASME Section IX

BASE METALS (QW-403)

	Product form	Specification (type or grade)	P no.	Grp-no.	Size	Sch.	Thick. (in.)	Dia. (in.)
	Pipe	SA-312 TP304	8	1	2	XX	0.436	2.375
Welded to:	Pipe	SA-312 TP304	8	1	2	XX	0.436	2.375

and tested:	Without PWHT, With impacts
Notes	PQR originally qualified on 05/22/2003 by Jacobs Technology Inc and furnished by Robert Hand.

JOINTS (QW-402)

Joint design	Single-V-groove		
Backing:	None		
Retainers			
Groove angle (deg.)	60		
Root opening (in.)	1/8		
Root face (in.)	1/16		

WELDING PROCESSES

Welding process	GTAW
Type	Manual

FILLER METALS (QW-404)

SFA specification	5.9
AWS classification	ER316L
Filler metal F-number	6
Weld metal A-number	8
Filler metal nominal composition	S.S.
Filler metal trade name	Harris Welco
Filler metal size (in.)	3/32
Deposited thickness (in.)	0.436
Maximum pass thickness (in.)	1/8
Weld deposit chemistry	Not Recorded

POSITION (QW-405)

Position of groove	6G
Weld progression	Uphill

PREHEAT (QW-406)

Preheat temperature (°F)	55
Maximum interpass temperature (°F)	350

GAS (QW-408)

Shielding gas:	Type	Argon (A5.32 SG-A) (99.997%)
	Flow rate (cfh)	20
Trailing gas:	Type	
	Flow rate (cfh)	
Backing gas:	Type	Argon (A5.32 SG-A) (99.997%)
	Flow rate (cfh)	10

ELECTRICAL (QW-409)

Filler metal size (in.)	3/32
Amperes	85 - 100
Volts	8 - 14
Travel speed (in./min)	3
Maximum heat input (kJ/in.)	28.0
Tungsten size (in.)	3/32
Tungsten type	SFA 5.12 EWTh-2
Current/polarity	DCEN (straight polarity)
DC pulsing current	Not used

TECHNIQUE (QW-410)

String or weave	Stringer
Orifice/gas cup size	#8
Multi/Single pass per side	Multiple passes
Peening	Not used
Initial/Interpass cleaning	Not Recorded
Back gouging method	None

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Jacobs

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ASME - Procedure Qualification Record (PQR) - Test results (as welded)

WeldOffice WPS

PQR record number	AFRL8A	Revision: 0	WPS record number	Revision
Date	10/25/2010		Company name	Jacobs
			Welding standard	ASME Section IX

TENSILE TESTS (QW-150) Reduced section

Specimen number	Width (in.)	Thickness (in.)	Area (in²)	Ultimate total load (lb)	Ultimate unit stress (psi)	Type of failure and location
1	0.863	0.440	0.3797		87120	Ductile-Weld
2	0.980	0.450	0.4410		82819	Ductile-Base Metal

Comments: Testing performed by Krazan & Associates.

GUIDED BEND TESTS (QW-160)

Type of test	Acceptance criteria	Result	Comments
2 transverse face bends per QW-161.2 and QW-462.3(a)	QW-163	Acceptable	see - ASME IX - QW-451.1
2 transverse root bends per QW-161.3 and QW-462.3(a)	QW-163	Acceptable	see - ASME IX - QW-451.1

Comments: Testing performed by Krazan & Associates.

TOUGHNESS TESTS (QW-170)

Specimen number	Notch location	Notch type	Specimen size (in.) x (in.)	Test temperature (°F)	Impact values (ft lb)	(% Shear)	(Mils)	Drop weight break
1	Weld Metal	Charpy V	10MM X 10MM	-452	44	90	0.057	No
2	Weld Metal	Charpy V	10MM X 10MM	-452	35	90	0.053	No
3	Weld Metal	Charpy V	10MM X 10MM	-452	40	90	0.054	No
1	HAZ	Charpy V	10MM X 10MM	-452	73	90	0.073	No
2	HAZ	Charpy V	10MM X 10MM	-452	74	90	0.072	No
3	HAZ	Charpy V	10MM X 10MM	-452	77	90	0.075	No

Comments: Impact testing by Durkee Testing Lab.

CERTIFICATION

Welder's name	ID Number	Stamp number		
Ernie Rogers	ER	R	Mechanical testing by	Krazan
			Laboratory test number	026-03219
			Test file number	None
			Tests conducted by	Krazan

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.

Signature 1		Signature 2	
Name	Signature	Name	Signature
Arthur Henderson	Arthur Henderson		
Date		Date	
10/25/2010			

Signature 3		Signature 4	
Name	Signature	Name	Signature
Date		Date	

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