UOP

A Honeywell Company

UOPR SF-009

FABRICATORS PIPING & STRUCTURE INSPECTION PLAN HONEYWELL UOP RUSSELL PROCESS PLANTS FOR CRYO, REFRIGERATION, AMINE,

PROJECT SPECIFICATION

Job # J-447

PO - 4500757622

REV	DATE	BY	CHK	APV	REV	DATE	BY	CHK	APV
0	3/8/2016	JB							

REVISION	DESCRIPTION
0	Fabricators Skid ITP

A Honeywell Company

UOPR SF-009

PROJECT SPECIFICATION

Job # J-447

80-4500757622

REV	DATE	BY	CHK	APV	REV	DATE	BY	CHK	APV
0	3/8/2016	JB							

FABRICATORS PIPING & STRUCTURE INSPECTION PLAN
HONEYWELL UOP RUSSELL PROCESS PLANTS FOR CRYO, REFRIGERATION, AMINE,

As a minimum, Fabricator shall review and inspect the Control Activities indicated below.

Fabricator shall provide inspectors (UOPR and Client) with Two (2) working days advance notice for inspection points (A1 and A2).

Fabricator shall provide UPOR QC with Two (2) working days written notification for hold points (H). E-mail is the preferred method of written notification.

Inspection Code:

A1 – 100% Actual Inspection
A2 – Random Inspection

R1 – 100% Review of Documentation
R2 – Random Review of Documentation

H – Hold Point – do not proceed until inspection by party requesting the hold is complete.
W—Witness Point – do not proceed until inspection by party requesting the witness point is Complete or (waived.)

AP – Approval Required
NA – Not Applicable

Control Activity	Governing Code or Specification	Required Inspections Initials and Date			
		Fabricator/ vendor	UOPR	Client	A.I/3rd party
Fabrication Inspection and Testing plan					
Review fabrication isometric drawings and PO Clarification SOP.	UOPR SOP-001 P&IDs ENG-14cf ENG-14ca ENG-14cas	R1 1/25	R1		3/21
Review WPS's and PQR's	ENG-14cam ENG-13ap UOPR Quality Control Manual ASME D1.1 Weld Maps ASME Sec. IX	1/25	R1		3/21

A Honeywell Company

UOPR SF-009

PROJECT SPECIFICATION

Job # J.

REV	DATE	BY	CHK	APV	REV	DATE	BY	CHK	APV
0	3/8/2016	JB							

FABRICATORS PIPING & STRUCTURE INSPECTION PLAN
HONEYWELL UOP RUSSELL PROCESS PLANTS FOR CRYO, REFRIGERATION, AMINE,

Control Activity	Governing Code or Specification	Required Inspections Initials and Date			
		Fabricator/ vendor	UOPR	Client	A.I/3rd party
VT/Dimensional check of skid top (Done on Ground).	AWS D1.1 ENG-14de	A1 N/A	H		
Visually examine weld quality and dimensional check of ALL structural components.	AWS D1.1	A1 N/A	A1,H, A2		
Verify trial fit of upper and lower stacked skid structures, ladders, platforms, stairs, handrails and any additional bolt on attachments.		H, A1 N/A	H, A1		
Visually examine piping weld quality.	ENG-13aae ASME B-31.3	A1 3/17	A1,AP		3/27
Conduct dimensional piping and fitting orientation check.	Structural Steel Plan, Elevation and Isometric drawings	H, A1 3/17	H, A1		3/27
Review radiographs and NDE test reports	ASME B-31.3	R1 3/17	R1		3/27
Witness pressure testing of piping. Verify pressure test results. **Chart Required.**	Line List ENG-13aae ASME B-31.3 HUR-1000	N/A	A1, R1		
Review skid documentation / data book.	ENG-13aae	R1 3/17	R1, AP		3/27

VSB2760 / 107798 / 6.0A106STDF / 6 STD A106B SMLS PIPE

VS

VALLOUREC & SUMITOMO TUBOS DO BRASIL

Distrito Industrial, s/n
Jeceaba - MG - 35498-000 - Brasil

INSPECTION CERTIFICATE
EN 10204.3.1

No.: 30010317

Sheet: 1 / 5

Trading Company: Sumitomo Corporation
NSSMC work No.: JYYS07970000
Buyer: Nippon Steel & Sumitomo Metal Corporation
Buyer Order No.: SP17S337301
Customer: SUMITOMO CORPORATION OF AMERICAS
Customer Order No / Item: 209482 / 1
Inspection Company: Vallourec & Sumitomo Tubos do Brasil Ltda.

Destination Country: USA
Work Order: 2384/10
Material Number: 701242

Size (O.D. X W.T.): 6.625 inch X 0.280 inch
Grade: X42R # B # B
Standard: API SPEC 5L, 12.2012, 45TH EDITION # PSL 2

In accordance also to the standards:
ASTM A106M - 14 / ASME SA-106M - 13 / ASTM A 53M - 12 / ASTM A 530M - 12 / ASME SA-53M - 13 / ASME SA-530M - 13
Description of Products: SEAMLESS STEEL PIPE Heat Treatment : AS ROLLED , BEVELED ENDS 30 DEG.

Pipes Ends Protector: POLYETHYLENE CAP WITH HOLE
Wall Thickness: - 12.5 % / + 15.0 %
External Surface Protection: UV-VARNISH
Tolerances: Outside Diameter: - 0.75 % / + 0.75 %
Length: RANDOM: 40.0 FT / 42.0 FT
Acceptance Length: RANDOM, 10 %, 38.0 FT / 40.0 FT
Standard Marking:
PAINT STENCILED: VSB LOGO API SPEC. 5L 0867 API MONOGRAM MONTH/YEAR ASTM/ASME A/SA-106 A/SA-53 6.625 0.280 BR/X42R PSL2 SMLS JYYS07970000 HEAT NUMBER PIPE TALLY NO LENGTH B S TESTED 2670 PSI/NDE WEIGHT NSSMC LOGO
Shipping Marking:
SUMITOMO CORPORATION OF AMERICAS HOUSTON P.O. NO. 209482 MADE IN BRAZIL

Heat No.	Pieces	Length(m)	Weight(kgf)	Length(ft)	Weight(lbf)
107743	234	2933,44	84934	9621	187235
107744	193	2398,23	69346	7866.1	152874
107745	226	2829,12	82030	9280.7	180831
107798	135	1671,81	48609	5485	107157
107799	265	3290,22	94913	10796.5	209232
107800	113	1405,68	40716	4611.4	89751

VSB2760 / 107798 / 6.0A106STDF / 6 STD A106B SMLS PIPE

VALLOUREC & SUMITOMO TUBOS DO BRASIL
Distrito Industrial, s/n
Jeceaba - MG - 35498-000 - Brasil

INSPECTION CERTIFICATE
EN 10204.3.1

No.: 30020217

Heat No.	Pieces	Length(m)	Weight(kgf)	Length(ft)	Weight(lbf)
107803	90	1137,10	32670	3729.5	72022
107862	145	1822,82	52074	5980.7	114795
107863	185	2329,53	66753	7642.9	147151
TOTAL	1586	19817,95	572045	65013.8	1261048

The product is satisfactory in the following tests/inspections:
Dimensional # Visual # Flattening Test # Flux Leakage Electromagn. Test : API 5L, L2(N5)L/O L4(N12,5)L/T #Maximum Residual Magnetism : 30 GAUSS # Hydrostatic Test : 2670.0 PSI 5 s #

CHEMICAL COMPOSITION (%)

Process: Electric Arc Furnace (EAF), heats fully killed

CEQ:C+Mn/6+(Cr+Mo+V)/5 +(Ni+Cu)/15
CE1:Cr + Cu + Mo + Ni + V CE2:Nb + V

Required	Ladle Analysis		C	Mn	P	S	Si	Ni	Cr	Mo	Cu	V	Nb	B	Ti	Ceq	CE1	CE2
		Min.		0.29			0.10											
		Max.	0.20	1.20	0.025	0.015	0.40	0.30	0.30	0.15	0.40	0.06	0.05	0.001	0.04	0.42	1.00	0.06
	Product Analysis	Min.		0.29			0.10											
		Max.	0.20	1.20	0.025	0.015	0.40	0.30	0.30	0.150	0.40	0.06	0.050	0.0010	0.040	0.42	1.00	0.06
Heat No.	Pipe No.																	
107743		Ladle	0.14	1.13	0.011	0.002	0.29	0.03	0.14	0.01	0.05	0.04	0.00	0.000	0.00	0.37	0.27	0.04
	102120	Check1	0.14	1.15	0.011	0.002	0.29	0.03	0.15	0.01	0.05	0.04	0.00	0.001	0.00	0.38	0.28	0.04
	205110	Check1	0.15	1.16	0.011	0.002	0.29	0.03	0.14	0.01	0.05	0.04	0.00	0.001	0.00	0.39	0.27	0.04
	405110	Check2	0.14	1.17	0.011	0.002	0.29	0.03	0.14	0.01	0.05	0.04	0.00	0.000	0.00	0.38	0.27	0.04
	502130	Check2	0.16	1.18	0.012	0.002	0.29	0.03	0.15	0.01	0.05	0.04	0.00	0.001	0.00	0.40	0.28	0.04
107744		Ladle	0.14	1.11	0.010	0.002	0.31	0.02	0.13	0.01	0.04	0.03	0.00	0.000	0.00	0.36	0.23	0.03
	303110	Check2	0.14	1.13	0.010	0.002	0.30	0.02	0.13	0.01	0.04	0.03	0.00	0.000	0.00	0.37	0.23	0.03
	501110	Check1	0.14	1.14	0.011	0.002	0.29	0.02	0.14	0.01	0.04	0.03	0.00	0.000	0.00	0.37	0.24	0.03
107745		Ladle	0.15	1.11	0.009	0.002	0.30	0.02	0.13	0.02	0.03	0.03	0.00	0.000	0.00	0.37	0.23	0.03
	102110	Check2	0.15	1.13	0.010	0.003	0.30	0.02	0.13	0.02	0.03	0.03	0.00	0.000	0.00	0.38	0.23	0.03
	201130	Check1	0.15	1.14	0.010	0.002	0.30	0.02	0.13	0.02	0.04	0.03	0.00	0.000	0.00	0.38	0.24	0.03
	202110	Check1	0.15	1.14	0.010	0.002	0.30	0.02	0.13	0.02	0.03	0.03	0.00	0.000	0.00	0.38	0.23	0.03
	306130	Check2	0.15	1.15	0.009	0.002	0.30	0.02	0.13	0.02	0.03	0.04	0.00	0.000	0.00	0.38	0.24	0.04

VSB2760 / 107798 / 6.0A106STDF / 6 STD A106B SMLS PE

VALLOUREC & SUMITOMO TUBOS DO BRASIL

Distrito Industrial, s/n
Jeceaba - MG - 35498-000 - Brasil

INSPECTION CERTIFICATE
EN 10204.3.1

No.: 30020217

			C	Mn	P	S	Si	Ni	Cr	Mo	Cu	V	Nb	B	Ti	Ceq	CE1	CE2
Required	Ladle Analysis	Min.		0.29			0.10											
		Max.	0.20	1.20	0.025	0.015	0.40	0.30	0.30	0.15	0.40	0.06	0.05	0.001	0.04	0.42	1.00	0.06
	Product Analysis	Min.		0.29			0.10											
		Max.	0.20	1.20	0.025	0.015	0.40	0.30	0.30	0.150	0.40	0.06	0.050	0.0010	0.040	0.42	1.00	0.06
Heat No.	Pipe No.																	
107798		Ladle	0.15	1.12	0.011	0.001	0.30	0.03	0.12	0.02	0.06	0.04	0.00	0.001	0.00	0.38	0.27	0.04
	107120	Check1	0.15	1.12	0.011	0.001	0.29	0.03	0.12	0.02	0.06	0.04	0.00	0.001	0.00	0.38	0.27	0.04
	107130	Check2	0.16	1.12	0.011	0.001	0.29	0.03	0.12	0.02	0.06	0.04	0.00	0.001	0.00	0.39	0.27	0.04
107799		Ladle	0.15	1.13	0.011	0.002	0.29	0.03	0.12	0.01	0.05	0.04	0.00	0.000	0.00	0.38	0.25	0.04
	102140	Check2	0.15	1.12	0.010	0.001	0.29	0.03	0.12	0.01	0.05	0.04	0.00	0.000	0.00	0.38	0.25	0.04
	201110	Check1	0.15	1.12	0.011	0.002	0.29	0.03	0.12	0.01	0.05	0.04	0.00	0.001	0.00	0.38	0.25	0.04
	306110	Check1	0.15	1.13	0.011	0.002	0.28	0.03	0.12	0.01	0.05	0.04	0.00	0.000	0.00	0.38	0.25	0.04
	405110	Check2	0.15	1.12	0.010	0.002	0.29	0.03	0.12	0.01	0.05	0.03	0.00	0.000	0.00	0.38	0.25	0.04
107800		Ladle	0.15	1.12	0.009	0.003	0.30	0.03	0.12	0.01	0.06	0.03	0.00	0.000	0.00	0.37	0.24	0.03
	103110	Check1	0.15	1.12	0.010	0.003	0.29	0.03	0.12	0.01	0.06	0.03	0.00	0.000	0.00	0.37	0.25	0.03
	103120	Check2	0.15	1.12	0.009	0.002	0.30	0.03	0.12	0.01	0.06	0.03	0.00	0.000	0.00	0.37	0.25	0.03
107803		Ladle	0.15	1.11	0.011	0.003	0.30	0.03	0.12	0.01	0.06	0.04	0.00	0.000	0.00	0.38	0.26	0.04
	306210	Check1	0.15	1.11	0.010	0.002	0.30	0.03	0.12	0.01	0.06	0.04	0.00	0.000	0.00	0.38	0.26	0.04
	408210	Check2	0.14	1.11	0.011	0.002	0.30	0.03	0.12	0.01	0.06	0.04	0.00	0.000	0.00	0.37	0.26	0.04
107862		Ladle	0.15	1.12	0.009	0.001	0.30	0.03	0.11	0.02	0.04	0.04	0.00	0.001	0.00	0.38	0.24	0.04
	202110	Check1	0.15	1.10	0.009	0.002	0.30	0.03	0.12	0.02	0.04	0.04	0.00	0.001	0.00	0.37	0.25	0.04
	402110	Check2	0.15	1.10	0.009	0.002	0.30	0.03	0.12	0.02	0.04	0.04	0.00	0.001	0.00	0.37	0.25	0.04
107863		Ladle	0.15	1.11	0.010	0.001	0.30	0.03	0.12	0.02	0.04	0.03	0.00	0.000	0.00	0.37	0.24	0.03
	302110	Check2	0.15	1.12	0.011	0.001	0.30	0.03	0.12	0.02	0.04	0.03	0.00	0.001	0.00	0.38	0.24	0.03
	402110	Check1	0.15	1.08	0.010	0.001	0.30	0.03	0.12	0.02	0.04	0.03	0.00	0.001	0.00	0.37	0.24	0.03

CE: Combined Elements ;

VSB2760 / 107798 / 6.0A106STDF / 6 STD A106B SMLS PIPE

VALLOUREC & SUMITOMO TUBOS DO BRASIL
Distrito Industrial, s/n
Jeceaba - MG - 35498-000 - Brasil

INSPECTION CERTIFICATE
EN 10204.3.1

No.: 30020217

TENSILE TEST

S.Direction: Longitudinal
Type of specimen: STRIP 1" WIDTH
Temperature: Room Temperature
Gage Length: L0=2"
Thickness: 0.280"
YS Method: 0.50 %

				YS (Psi)	TS (Psi)	E %
Required			Min.	42100	70000	25.0
			Max.	71800	95000	
Heat No.	Pipe no.	Position of Sample				
107743	205110	Top		52100	75000	37.0
107743	102120	Bottom		50900	74500	37.0
107744	303110	Top		55000	75900	38.0
107744	305140	Bottom		49700	73100	38.0
107745	306130	Top		56600	77300	38.0
107745	102110	Bottom		50900	74300	38.0
107798	203110	Top		51500	75100	37.0
107798	107130	Bottom		50200	75000	36.0
107799	102140	Top		52400	74300	38.0
107799	405110	Top		52800	73700	38.0
107800	103120	Top		55300	76700	38.0
107803	408210	Bottom		52500	76400	37.0
107862	402110	Top		54800	76600	37.0
107863	103110	Top		53800	75000	36.0
107863	302110	Top		52200	74300	36.0

YS-yield strength; TS-tensile strength; E-Elongation;

VSB2760 / 107798 / 6.0A106STDF / 6 STD A106B SMLS PE

VSB
VALLOUREC & SUMITOMO TUBOS DO BRASIL

Distrito Industrial, s/o
Jeceaba - MG - 35498-000 - Brasil

INSPECTION CERTIFICATE
EN 10204.3.1

No.: 30020217

Sheet: 5 / 5

REMARKS:

THE DATA PRESENTED WAS CONVERTED FROM SI MEASUREMENT SYSTEM USED FOR THE ORIGINAL INSPECTION
NACE MR0103-2012/MR0175/ISO15156-2/2009: SATISFACTORY
MANUFACTURED FROM FULLY KILLED CARBON STEEL
ASTM A106-C AND ASME SA106-C: GUARANTEED

We hereby certify that this product has been manufactured and examined in accordance with all requirements of the standards and specifications and all the results are found to be satisfactory.

This testimonial and certificate respectively is recorded by a computer system and is valid without signature. Alteration or use for others products are regarded as falsification of documents and will be subject to criminal jurisdiction

QUALITY CONTROL DEPARTMENT

FAX: +55 31 2141 5365

Email: carlos.horta@vstubos.com

Carlos Eduardo Lima Horta
Technical Responsible
Date : 09.11.2015

Ruan Felipe Vieira leal
PI

PAN6804 / SJ609 / 6.0TEESTDF / 6" STD WELD TEE S/ 34 WPB

INSPECTION CERTIFICATE

PANTECH STEEL INDUSTRIES SDN. BHD. (509731-A)
LOT 13258 & 13259, Jalan Haji Abd. Manan,
Off Jalan Meru, 42200 Kapar, Selangor, Malaysia.
Tel: 603-3393 1633 Fax: 603-3393 1733 E-mail: info@pantechsteel.com

LLOYD'S REGISTER-LRQA
ISO 9001
Cert. No.: KLR 0403926

PED 97/23/EC Annex 1 Clause 4.3
Cert. No.: 0038/PED/MUM/0810070/1

WROUGHT CARBON STEEL BUTTWELDING FITTINGS

INSPECTION DOCUMENT: EN10204:2004 Type 3.1

Purchaser :

Certificate No : PSI 110366
Date : 20-Jun-16

Order No.	Invoice No.	Starting Material	Specification for Fittings- Seamless	Specification for Inspection
		Seamless Pipe	ASTM A234-14 WPB/ASME SA234-15 WPB NACE MR0175/NACE MR0103/ISO15156*	ASME B16.9-12 / ASTM A960-14a

Heat No.	Part Code	Product & Size	Quantity (pcs)	Dimensional & Visual Inspection	Heat Treatment	Magnetic Particle Testing
SJ-609	FTS6-PS	6" STD TEE	1053	GOOD	C&S	GOOD

Specification	Chemical Composition (%)												Tensile Test *1			Hardness	
	C x100	Si x100	Mn x100	P x1000	S x1000	Ni x100	Cr x100	Mo x100	Cu x100	V x1000	Pb	CE x100	YS (KSI / MPa)	TS	E (%)	(HB) 1	(HB) 2
Min	-	10	29	-	-	-	-	-	-	-	-	-	240	415	22	-	
Max	30	-	106	50	58	40	40	15	40	80	-	50	-	-	-	197	
Heat No.																	
SJ-609	17	22	37	19	6	1	3	1	2	4	<0.10	25	374	488	31.2	128	129

WE CERTIFY THAT ALL PRODUCTS WERE MANUFACTURED,SAMPLED,TESTED, AND INSPECTED SOLELY BY THE MANUFACTURER LISTED AT THE ADDRESS ABOVE IN ACCORDANCE WITH INDICATED SPECIFICATION AND FOUND TO MEET REQUIREMENTS. MATERIAL IS FREE FROM MERCURY AND RADIOACTIVE CONTAMINATION.
TENSILE REQUIREMENT: CONFORMS TO ASTM A370 STANDARD, LONGITUDINAL DIRECTION, GAUGE LENGTH 2" (50mm)
* HARDNESS ACCORDING TO NACE MR0103-12/ NACE MR0175/ISO15156-15

NOTE:
C: Cold formed at temperature below 620°C
S: Stress relieved in temperature between 595°C - 690°C and cooled in still air.
H : Hot formed in temperature between 845°C - 945°C and cooled in still air.
N: Normalised at 910°C
Q: Heated to 910°C and quench in water.
T: Temper between 590°C - 690°C.

*1: YS = Yield strength TS=Tensile strength E = Elongation

Made in Malaysia

Quality Assurance Manager

PAN6825 / SH602 / 6.0LR90STDF / 6" STD LR 90 ELBC) SA234 WPB)

INSPECTION CERTIFICATE

PANTECH STEEL INDUSTRIES SDN. BHD. (509731-A)
LOT 13258 & 13259, Jalan Haji Abd. Manan,
Off Jalan Meru, 42200 Kapar, Selangor, Malaysia.
Tel: 603-3393 1633 Fax: 603-3393 1733 E-mail: info@pantechsteel.com

LLOYD'S REGISTER-LRQA
ISO 9001
Cert. No.: KLR 0403926

PED 97/23/EC Annex 1 Clause 4.3
Cert. No.: 0038/PED/MUM/0810070/1

WROUGHT CARBON STEEL BUTTWELDING FITTINGS

INSPECTION DOCUMENT: EN10204:2004 Type 3.1

Purchaser :

Certificate No : PSI 106615
Date : 20-Jan-16

Order No.	Invoice No.	Starting Material	Specification for Fittings- Seamless	Specification for Inspection
		Seamless Pipe	ASTM A234-14 WPB/ASME SA234-15 WPB NACE MR0175/NACE MR0103/ISO15156*	ASME B16.9-12 / ASTM A960-14a

Heat No.	Product & Size	Quantity (pcs)	Visual Examination	Dimensional Inspection	Heat Treatment	Magnetic Particle Testing
SH602	6" 90 DEG LR STD ELBOW	71	GOOD	GOOD	H	N.A

Specification	Chemical Composition (%)												Tensile Test *1			Hardness	
	C x100	Si x100	Mn x100	P x1000	S x1000	Ni x100	Cr x100	Mo x100	Cu x100	V x1000	Pb	CE x100	YS (KSI / MPa)	TS	E (%)	(HB) 1	(HB) 2
Min	-	10	29	-	-	-	-	-	-	-	-	-	240	415	22	-	
Max	30	-	106	50	58	40	40	15	40	80	-	50	-	-	-	197	
Heat No.																	
SH602	21	22	39	13	3	1	4	1	4	3	<0.10	29	357	470	29.0	128	131

WE CERTIFY THAT ALL PRODUCTS WERE MANUFACTURED,SAMPLED,TESTED, AND INSPECTED SOLELY BY THE MANUFACTURER LISTED AT THE ADDRESS ABOVE IN ACCORDANCE WITH INDICATED SPECIFICATION AND FOUND TO MEET REQUIREMENTS. MATERIAL IS FREE FROM MERCURY AND RADIOACTIVE CONTAMINATION.

TENSILE REQUIREMENT: CONFORMS TO ASTM A370 STANDARD, LONGITUDINAL DIRECTION, GAUGE LENGTH 2" (50mm)

* HARDNESS ACCORDING TO NACE MR0175/ NACE MR 0103/ ISO15156

NOTE:

C: Cold formed at temperature below 620°C
S: Stress relieved in temperature between 595°C - 690°C and cooled in still air.
H : Hot formed in temperature between 845°C - 945°C and cooled in still air.
N: Normalised at 910°C
Q: Heated to 910°C and quench in water.
T: Temper between 590°C - 690°C.

*1: YS = Yield strength TS=Tensile strength E = Elongation

Made in Malaysia

Quality Assurance Manager

PAN6826 / RL810 / 6.0LR90STDF / 6" STD LR 90 ELBO / SA234 WPB

INSPECTION CERTIFICATE

PANTECH STEEL INDUSTRIES SDN. BHD. (909731-A)
LOT 13258 & 13259, Jalan Haji Abd. Manan,
Off Jalan Meru, 42200 Klang, Selangor, Malaysia.
Tel: 603-3393 1633 Fax: 603-3393 1733 E-mail: info@pantechsteel.com

ISO 9001
Cert. No.: KLR 0403926
PED 97/23/EC Annex 1 Clause 4.3
Cert. No.: 0038/PED/MUM/0810070/1

WROUGHT CARBON STEEL BUTTWELDING FITTINGS

INSPECTION DOCUMENT: EN10204:2004 Type 3.1

Purchaser :

Certificate No : PSI 99208
Date : 9-Apr-15

Order No.	Invoice No.	Starting Material	Specification for Fittings- Seamless	Specification for Inspection
		Seamless Pipe	ASTM A234-13 WPB/ASME SA234-13 WPB, NACE MR0175/NACE MR0103/ISO15156*	ASME B16.9-12 / ASTM A960-10

Heat No.	Product & Size	Quantity (pcs)	Visual Examination	Dimensional Inspection	Heat Treatment	Magnetic Particle Testing
RL 810	6" 90 DEG LR STD ELBOW	737	GOOD	GOOD	H	N.A

Specification / Heat No.	Chemical Composition (%)												Tensile Test *1			Hardness	
	C x100	Si x100	Mn x100	P x1000	S x1000	Ni x100	Cr x100	Mo x100	Cu x100	V x1000	Pb	CE x100	YS (KSI / MPa)	TS (KSI / MPa)	E (%)	(HB) 1	(HB) 2
Min	-	10	29	-	-	-	-	-	-	-	-	-	240	415	22	-	
Max	30	-	106	50	58	40	40	15	40	80	-	50	-	-	-	197	
RL 810	13	21	77	8	4	1	5	1	3	8	<0.10	29	311	453	42.4	130	132

WE CERTIFY THAT ALL PRODUCTS WERE MANUFACTURED,SAMPLED,TESTED, AND INSPECTED SOLELY BY THE MANUFACTURER LISTED AT THE ADDRESS ABOVE IN ACCORDANCE WITH INDICATED SPECIFICATION AND FOUND TO MEET REQUIREMENTS. MATERIAL IS FREE FROM MERCURY AND RADIOACTIVE CONTAMINATION

TENSILE REQUIREMENT: CONFORMS TO ASTM A370 STANDARD, LONGITUDINAL DIRECTION, GAUGE LENGTH 2" (50mm)

* HARDNESS ACCORDING TO NACE MR0175/ NACE MR 0103/ ISO15156

NOTE:

C: Cold formed at temperature below 620°C
S: Stress relieved in temperature between 595°C - 690°C and cooled in still air.
H : Hot formed in temperature between 845°C - 945°C and cooled in still air.
N: Normalised at 910°C
Q: Heated to 910°C and quench in water.
T: Temper between 590°C - 690°C.

*1: YS = Yield strength TS=Tensile strength E = Elongation

Made in Malaysia

PANTECH STEEL INDUSTRIES SDN. BHD. QA / QC MANAGER HOI YS * 909731-A *

Quality Assurance Manager

RWL166/14 / RBCB-0746 / 6.0RFWN#30STDF / 6" 300# RFWN STD A105

TEST CERTIFICATE

Test Report / Inspection Certificate No. : RFPL/N.I.C./14-15/0524/2186 Dated : 10/Feb/2015 BS EN 10204 - 3.1 (2004)

An ISO9001-2008 Certified Organization. (Ref. QM 02 00345)

PED 97/23/EC & AD-2000-MARKBLATT W9 CERT. NO. 01 202 IND/Q-12-0003

Customer :

Invoice No. & Date : 4171/09-Feb-2015 Manufacturer's Mark : RWF/INDIA

ROLLWELL FORGE PVT. LTD.
Survey No. 239/1, B/h. G.E.B. Sub Station,National Highway 8/B,Shapar (Veraval), Rajkot - 360002.
Phone : +91-2827-253671 Fax : +91-2827-253571
Email : info@rollwellforge.com Website : www.rollwellforge.com

Designation of Article	Material	UNS No.	Surface Condition	Melting Process	Steel Mill
CARBON STEEL FORGED FLANGE	ASTM A/ASME SA 105 Ed 2013		FINISH	EAF	BRITISH ALLOYS

Item Sr. No.	Quantity	Description	P.O. No.	Heat No.	Mill Heat No.
1	54	6"-300#-WNRF-A105-FINISH-STD	124/005023	RBCB-0746	633000

CHEMICAL ANALYSIS (%) [illegible]

Elements	C %	Mn %	P %	S %	Si %	Cr %	Mo %	Ni %	Cu %	V %					
Specified	0.35 Max.	0.6-1.35	0.035 Max.	0.04 Max.	0.1-0.35	0.3 Max.	0.12 Max.	0.4 Max.	0.4 Max.	0.08 Max.					CE
Ladle Analysis	0.19	0.67	0.021	0.007	0.18	0	0	0	0	0				-	0.47 Max.
RBCB-0746	0.189	0.685	0.018	0.005	0.221	0.016	0.01	0.006	0.006	0.005					0.30
Heat Treatment : N/A															0.31

MECHANICAL TESTING [illegible]

Test No.	Direction	Tensile Testing					V - Notch Charpy / Impact Test				
		Yield Strength Re		Tensile Strength Rm	Elongation A	Reduction of Area Z	Energie of Impact (Temperature +20°c) SAMPLE SIZE(10X10X55MM)				Hardness BHN
		Rp 1%	Reb/Rp 0.2% MPA	MPA	Lo = 4d %	%	1	2	3	/n	
Specified		-	250 Min.	485 Min.	22 Min.	30 Min.	-	-	-	-	187 Max.
RBCB-0746	T	-	270.60	496.60	32.60	60.60	-	-	-	-	159 , 166

Additional Test As Per Client Requirement

Surface and Dimensional Inspection - Acceptable as per ASME B16.5 Ed. 2013

Marking - Acceptable as per ASME B16.5 Ed. 2013

Ultrasonic Test - N/A.

IGC Test - N/A.

Magnetic Particle Examination - N/A.

NACE MR-0175[Ed.2008] & NACE MR-0103 [Ed.2012] & ISO15156 [Ed.2009] - N/A.

For ROLLWELL FORGE PVT. LTD.

(Lab Incharge) (Q.C. Manager)

We Confirm That Material is Free From Mercury Contamination & Radioactive Contamination.

Remarks : WE CERTIFY THAT THE MATERIAL HAS BEEN TESTED AND COMPLIES WITH THE GIVEN PURCHASE ORDER

F QC 12 (00 / 01.04.12)

PAN6258 / SJ201C / 6.0X4.0CSTDF / 6 X 4" STD CONC EDUCER SA234

INSPECTION CERTIFICATE

PANTECH STEEL INDUSTRIES SDN. BHD. (509731-A)
LOT 13258 & 13259, Jalan Haji Abd. Manan,
Off Jalan Meru, 42200 Kapar, Selangor, Malaysia.
Tel: 603-3393 1633 Fax: 603-3393 1733 E-mail: info@pantechsteel.com

LLOYD'S REGISTER-LRQA
ISO 9001
Cert. No.: KLR 0403926
PED 97/23/EC Annex 1 Clause 4.3
Cert. No.: 0038/PED/MUM/0810070/1

WROUGHT CARBON STEEL BUTTWELDING FITTINGS

INSPECTION DOCUMENT: EN10204:2004 Type 3.1

Purchaser :

Certificate No : PSI 110804
Date : 27-Jun-16

Order No.	Invoice No.	Starting Material	Specification for Fittings- Seamless	Specification for Inspection
67160PS-7	E 000012579	Seamless Pipe	ASTM A234-14 WPB/ASME SA234-15 WPB NACE MR0175/NACE MR0103/ISO15156*	ASME B16.9-12 / ASTM A960-14a

Heat No.	Part Code	Product & Size	Quantity (pcs)	Dimensional & Visual Inspection	Heat Treatment	Magnetic Particle Testing
SJ 201C	FRCS6x4-PS	6" x 4" STD CON RED	330	GOOD	C&S	N.A

Specification	Chemical Composition (%)												Tensile Test *1			Hardness	
	C x100	Si x100	Mn x100	P x1000	S x1000	Ni x100	Cr x100	Mo x100	Cu x100	V x1000	Pb	CE x100	YS (KSI / MPa)	TS	E (%)	(HB) 1	(HB) 2
Min	-	10	29	-	-	-	-	-	-	-	-	-	240	415	22	-	
Max	30	-	106	50	58	40	40	15	40	80	-	50	-	-	-	197	
Heat No.																	
SJ 201C	20	19	42	13	6	0	1	1	2	3	<0.10	28	312	464	32.2	130	133

WE CERTIFY THAT ALL PRODUCTS WERE MANUFACTURED,SAMPLED,TESTED, AND INSPECTED SOLELY BY THE MANUFACTURER LISTED AT THE ADDRESS ABOVE IN ACCORDANCE WITH INDICATED SPECIFICATION AND FOUND TO MEET REQUIREMENTS. MATERIAL IS FREE FROM MERCURY AND RADIOACTIVE CONTAMINATION.
TENSILE REQUIREMENT: CONFORMS TO ASTM A370 STANDARD, LONGITUDINAL DIRECTION, GAUGE LENGTH 2" (50mm)
* HARDNESS ACCORDING TO NACE MR0103-12/ NACE MR0175/ISO15156-15

NOTE:
C: Cold formed at temperature below 620°C
S: Stress relieved in temperature between 595°C - 690°C and cooled in still air.
H : Hot formed in temperature between 845°C - 945°C and cooled in still air.
N: Normalised at 910°C
Q: Heated to 910°C and quench in water.
T: Temper between 590°C - 690°C.

*1: YS = Yield strength TS=Tensile strength E = Elongation

Made in Malaysia

Quality Assurance Manager

PAN6421 / SF713C / 6.0X4.0CSTDF / 6 X 4" STD CONC REDUCER SA234

INSPECTION CERTIFICATE

PANTECH STEEL INDUSTRIES SDN. BHD. (508731-A)
LOT 13258 & 13259, Jalan Haji Abd. Manan,
Off Jalan Meru, 42200 Kapar, Selangor, Malaysia.
Tel: 603-3393 1633 Fax: 603-3393 1733 E-mail: info@pantechsteel.com

LLOYD'S REGISTER LRQA
ISO 9001
Cert. No.: KLR 0403926

PED 97/23/EC Annex 1 Clause 4.3
Cert. No.: 0038/PED/MUM/0810070/1

WROUGHT CARBON STEEL BUTTWELDING FITTINGS

INSPECTION DOCUMENT: EN10204:2004 Type 3.1

Certificate No : PSI 106091
Date : 6-Jan-16

Purchaser :

Order No.	Invoice No.	Starting Material	Specification for Fittings- Seamless	Specification for Inspection
		Seamless Pipe	ASTM A234-14 WPB/ASME SA234-15 WPB NACE MR0175/NACE MR0103/ISO15156*	ASME B16.9-12 / ASTM A960-14a

Heat No.	Product & Size	Quantity (pcs)	Visual Examination	Dimensional Inspection	Heat Treatment	Magnetic Particle Testing
SF 713C	6" x 4" STD CON RED	287	GOOD	GOOD	C&S	N.A

Specification	Chemical Composition (%)												Tensile Test *1			Hardness	
	C x100	Si x100	Mn x100	P x1000	S x1000	Ni x100	Cr x100	Mo x100	Cu x100	V x1000	Pb	CE x100	YS (KSI / MPa)	TS	E (%)	(HB) 1	(HB) 2
Min																	
Max	-	10	29	-	-	-	-	-	-	-	-	-	240	415	22	-	
Heat No.	30	-	106	50	58	40	40	15	40	80	-	50	-	-	-	197	
SF 713C	15	25	83	16	4	2	8	3	3	4	<0.10	32	326	495	36.0	148	151

WE CERTIFY THAT ALL PRODUCTS WERE MANUFACTURED,SAMPLED,TESTED, AND INSPECTED SOLELY BY THE MANUFACTURER LISTED AT THE ADDRESS ABOVE IN ACCORDANCE WITH INDICATED SPECIFICATION AND FOUND TO MEET REQUIREMENTS. MATERIAL IS FREE FROM MERCURY AND RADIOACTIVE CONTAMINATION.

TENSILE REQUIREMENT: CONFORMS TO ASTM A370 STANDARD, LONGITUDINAL DIRECTION, GAUGE LENGTH 2" (50mm)

* HARDNESS ACCORDING TO NACE MR0175/ NACE MR 0103/ ISO15156

NOTE:

C: Cold formed at temperature below 620°C
N: Normalised at 910°C
S: Stress relieved in temperature between 595°C - 690°C and cooled in still ai
Q: Heated to 910°C and quench in water.
H : Hot formed in temperature between 845°C - 945°C and cooled in still air.
T: Temper between 590°C - 690°C.

*1: YS = Yield strength TS=Tensile strength E = Elongation

Made in Malaysia

Quality Assurance Manager

PAN6683 / DS710E / 6.0X3.0ESTDF / 6 X 3" STD ECC REDUCER SA234

INSPECTION CERTIFICATE

PANTECH STEEL INDUSTRIES SDN. BHD. (509731-A)
LOT 13258 & 13259, Jalan Haji Abd. Manan,
Off Jalan Meru, 42200 Kapar, Selangor, Malaysia.
Tel: 603-3393 1633 Fax: 603-3393 1733 E-mail: info@pantechsteel.com

ISO 9001
Cert. No.: KLR 0403926

PED 97/23/EC Annex 1 Clause 4.3
Cert. No.: 0038/PED/MUM/0810070/1

WROUGHT CARBON STEEL BUTTWELDING FITTINGS

INSPECTION DOCUMENT: EN10204:2004 Type 3.1

Purchaser :

Certificate No : PSI 112985
Date : 10-Oct-16

Order No.	Invoice No.	Starting Material	Specification for Fittings- Seamless	Specification for Inspection
		Seamless Pipe	ASTM A234-14 WPB/ASME SA234-15 WPB NACE MR0175/NACE MR0103/ISO15156*	ASME B16.9-12 / ASTM A960-14a

Heat No.	Part Code	Product & Size	Quantity (pcs)	Dimensional & Visual Inspection	Heat Treatment	Magnetic Particle Testing
DS 710E	FRES6x3-PS	6" x 3" STD ECC RED	125	GOOD	C&S	N.A

Specification / Heat No.	Chemical Composition (%)												Tensile Test *1			Hardness	
	C x100	Si x100	Mn x100	P x1000	S x1000	Ni x100	Cr x100	Mo x100	Cu x100	V x1000	Pb	CE x100	YS (KSI / MPa)	TS	E (%)	(HB) 1	(HB) 2
Min													240	415	22	-	
Max	-	10	29	-	-	-	-	-	-	-	-	-					
DS 710E	23	22	54	18	4	4	1	0	1	0	<0.10	33	291	495	33.5	142	138

WE CERTIFY THAT ALL PRODUCTS WERE MANUFACTURED,SAMPLED,TESTED, AND INSPECTED SOLELY BY THE MANUFACTURER LISTED AT THE ADDRESS ABOVE IN ACCORDANCE WITH INDICATED SPECIFICATION AND FOUND TO MEET REQUIREMENTS. MATERIAL IS FREE FROM MERCURY AND RADIOACTIVE CONTAMINATION.

TENSILE REQUIREMENT: CONFORMS TO ASTM A370 STANDARD, LONGITUDINAL DIRECTION, GAUGE LENGTH 2" (50mm)

* HARDNESS ACCORDING TO NACE MR0103-12/ NACE MR0175/ISO15156-15

NOTE:

C: Cold formed at temperature below 620°C
S: Stress relieved in temperature between 595°C - 690°C and cooled in still air.
H : Hot formed in temperature between 845°C - 945°C and cooled in still air.
N: Normalised at 910°C
Q: Heated to 910°C and quench in water.
T: Temper between 590°C - 690°C.

*1: YS = Yield strength TS=Tensile strength E = Elongation

Made in Malaysia

Quality Assurance Manager

INSPECTION CERTIFICATE

PANTECH STEEL INDUSTRIES SDN. BHD. (509731-A)
LOT 13258 & 13259, Jalan Haji Abd. Manan,
Off Jalan Meru, 42200 Klang, Selangor, Malaysia.
Tel: 603-3393 1633 Fax: 603-3393 1733 E-mail: info@pantechsteel.com

ISO 9001
Cert. No.: KLR 0469926
PED 97/23/EC Annex 1 Clause 4.3
Cert. No.: 0038/PED/MUM/0811.0070/1

WROUGHT CARBON STEEL BUTTWELDING FITTINGS

INSPECTION DOCUMENT: EN10204:2004 Type 3.1

Purchaser :

Certificate No : PSI 94043
Date : 10-Sep-14

Order No.	Invoice No.	Starting Material	Specification for Fittings- Seamless	Specification for Inspection
		Seamless Pipe	ASTM A234 -13 WPB / ASME SA234 -13 WPB NACE MR0175/ NACE MR 0103/ ISO15156*	ASME B16.9 - 12 / ASTM A960 - 10

Heat No.	Product & Size	Quantity (pcs)	Visual Examination	Dimensional Inspection	Heat Treatment	Magnetic Particle Testing
RF 403C	4" x 2" XS CON RED	281	GOOD	GOOD	C & S	N.A
PF 613C	4" x 2" XS CON RED	369	GOOD	GOOD	C & S	N.A
P 209	3" S160 TEE	250	GOOD	GOOD	C & S	GOOD

Specification	Chemical Composition (%)												Tensile Test *1			Hardness
	C x100	Si x100	Mn x100	P x1000	S x1000	Ni x100	Cr x100	Mo x100	Cu x100	V x1000	Pb	CE x100	YS (KSI / MPa)	TS	E (%)	(HB) 1	(HB) 2
Min	-	10	29	-	-	-	-	-	-	-	-	-	240	415	22	-	
Max	30	-	106	50	58	40	40	15	40	60	-	50	-	-	-	197	
Heat No.																	
RF 403C	7	22	101	14	2	3	4	0	5	6	< 0.10	26	309	446	23.9	127	128
PF 613C	12	19	78	10	2	1	3	1	2	2	< 0.10	26	300	429	35.6	126	127
P 209	13	19	79	11	5	2	3	2	4	0	< 0.10	28	319	423	44.4	127	126

WE CERTIFY THAT ALL PRODUCTS WERE MANUFACTURED,SAMPLED,TESTED, AND INSPECTED SOLELY BY THE MANUFACTURER LISTED AT THE ADDRESS ABOVE IN ACCORDANCE WITH INDICATED SPECIFICATION AND FOUND TO MEET REQUIREMENTS. MATERIAL IS FREE FROM MERCURY AND RADIOACTIVE CONTAMINATION.
TENSILE REQUIREMENT: CONFORMS TO ASTM A370 STANDARD, LONGITUDINAL DIRECTION, GAUGE LENGTH 2" (50mm)
* HARDNESS ACCORDING TO NACE MR0175/ NACE MR 0103/ ISO15156

NOTE:
C: Cold formed at temperature below 620°C
S: Stress relieved in temperature between 595°C - 690°C and cooled in still air.
H : Hot formed in temperature between 845°C - 945°C and cooled in still air.
N: Normalised at 910°C
Q: Heated to 910°C and quench in water.
T: Temper between 590°C - 690°C.

*1: YS = Yield strength TS=Tensile strength E = Elongation

Made in Malaysia

PANTECH STEEL INDUSTRIES SDN BHD
QA / QC MANAGER
HOI YS
509731-A

Quality Assurance Manager

PAN6676 / PF613C / 4.0X2.0CXHF / 4 X 2" XH CONC REDUCER SA234

INSPECTION CERTIFICATE

PANTECH STEEL INDUSTRIES SDN. BHD. (614751-A)
LOT 13258 & 13259, Jalan Haji Abd. Manan,
Off Jalan Meru, 42200 Klang, Selangor, Malaysia.
Tel: 603-3393 1633 Fax: 603-3383 1733 E-mail: info@pantechsteel.com

ISO 9001
Cert. No.: KLR 0408926
PED 97/23/EC Annex 1 Clause 4.3
Cert. No.: 0038/PED/MUM/0810070/1

WROUGHT CARBON STEEL BUTTWELDING FITTINGS

INSPECTION DOCUMENT: EN10204:2004 Type 3.1

Purchaser :

Certificate No : PSI 94043
Date : 10-Sep-14

Order No.	Invoice No.	Starting Material	Specification for Fittings- Seamless	Specification for Inspection
82214PS-1	E 000011034	Seamless Pipe	ASTM A234 -13 WPB / ASME SA234 -13 WPB NACE MR0175/ NACE MR 0103/ ISO15156*	ASME B16.9 - 12 / ASTM A960 - 10

Heat No.	Product & Size	Quantity (pcs)	Visual Examination	Dimensional Inspection	Heat Treatment	Magnetic Particle Testing
RF 403C	4" x 2" XS CON RED	281	GOOD	GOOD	C & S	N.A
PF 613C	4" x 2" XS CON RED	389	GOOD	GOOD	C & S	N.A
P 209	3" S160 TEE	250	GOOD	GOOD	C & S	GOOD

Specification	Chemical Composition (%)												Tensile Test *1			Hardness	
	C x100	Si x100	Mn x100	P x1000	S x1000	Ni x100	Cr x100	Mo x100	Cu x100	V x1000	Pb	CE x100	YS (KSI / MPa)	TS	E (%)	(HB) 1	(HB) 2
Min	-	10	29	-	-	-	-	-	-	-	-	-	240	415	22	-	
Max	30	-	106	50	58	40	40	15	40	60	-	50	-	-	-	197	
Heat No.																	
RF 403C	7	22	101	14	2	3	4	0	5	6	< 0.10	26	309	446	23.9	127	126
PF 613C	12	19	78	10	2	1	3	1	2	2	< 0.10	26	300	429	36.6	128	127
P 209	13	19	79	11	5	2	3	2	4	0	< 0.10	28	319	423	44.4	127	126

WE CERTIFY THAT ALL PRODUCTS WERE MANUFACTURED,SAMPLED,TESTED, AND INSPECTED SOLELY BY THE MANUFACTURER LISTED AT THE ADDRESS ABOVE,IN ACCORDANCE WITH INDICATED SPECIFICATION AND FOUND TO MEET REQUIREMENTS. MATERIAL IS FREE FROM MERCURY AND RADIOACTIVE CONTAMINATION.
TENSILE REQUIREMENT: CONFORMS TO ASTM A370 STANDARD, LONGITUDINAL DIRECTION, GAUGE LENGTH 2" (50mm)
* HARDNESS ACCORDING TO NACE MR0175/ NACE MR 0103/ ISO15156

NOTE:
C: Cold formed at temperature below 620°C
S: Stress relieved in temperature between 595°C - 650°C and cooled in still air.
H : Hot formed in temperature between 845°C - 945°C and cooled in still air.
N: Normalized at 910°C
Q: Heated to 910°C and quench in water.
T: Temper between 550°C - 650°C.

*1: YS = Yield strength TS=Tensile strength E = Elongation

Made in Malaysia

PANTECH STEEL INDUSTRIES SDN. BHD. QA / QC MANAGER HOI YS 509731-A

Quality Assurance Manager

ISC694/Z / 1602945 / 3.0A106STDa / 3 STD A106B SMLS PIPE

ArcelorMittal South Africa Limited
Tubular Products
273 Genl. Hertzog Rd,
Peacehaven Vereeniging 1939
P O Box 48 Vereeniging 1930
South Africa

Telephone +27 (0)16 450 4220
Fax +27 (0)16 423 4906

MATERIAL TEST CERTIFICATE
SEAMLESS TUBE

Licensed under API Spec 5L and 5CT
5L - 0319
5CT - 0419
ISO 9001: 2008
DE-395997 QM
Test Certificate EN 10204:2004 TYPE 3.1

ArcelorMittal

Customer:		Customer Order/Contract No:	SUS5 153200
Order No:	4000021783	Material No:	1000000695
Certificate Reference No:	040061960020	Cast/Heat No:	1602945
Product:	FULLY KILLED HOT FINISHED CARBON STEEL SEAMLESS TUBES		
Specification:	ISO3183:2012/API 5L:2012 L245/L290/B/X42 PSL1 ASTM A106B.15/A53B.12/ A530.12 ASME SA106B.13/SA53B.13/SA530.13		
Product Marking:	ARCELORMITTAL SA ISO3183/Spec 5L-0319 MONOGRAM 05-16 ASTM/ASME A/SA106B A/SA53B 3.500 0.216 40.000 L245/B L290/X42 PSL1 SMLS TESTED 3000 psi CAST NO: 1602945 PROD/O NO: T0432178310 NDE MADE IN SOUTH AFRICA		

General Information

Quantity	Mass	Dimensions		Total Length	Steel making process	Final Rolling Operation
		Tube OD	Thickness	Length		As Rolled
750	227,795.807(lb)	3.500(")	0.216(")	40.000 (ft)	30.000.000(ft)	Electric Arc	Final hot rolling finished above 1,580°F and cooled in still air

Chemical Composition

R22-(V + Nb + Ti)
R24-(Nb + V)

Element(%)	C	Si	Mn	S	P	Cr	Ni	Mo	Cu	V	Al	Ti	Sn	Ca	N	B	Nb	CE	R22	R24
Minimum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maximum	0.200	-	1.30	0.030	0.030	0.50	0.50	0.150	0.500	-	-	-	-	-	-	-	-	0.41	0.15	0.060
Heat	0.180	0.26	0.90	0.004	0.009	0.02	0.01	0.001	0.005	0.003	0.031	0.001	0.003	0.0013	0.0094	0.0004	0.0010	0.34	0.01	0.004
Product	0.1800	0.2600	0.9000	0.0040	0.0090	0.0200	0.0110	0.0010	0.0050	0.0030	0.0310	0.0012	0.0030	0.0013	0.0094	0.0004	0.0010	0.3359	0.0052	0.0040
Product (ADD)	0.1800	0.2600	0.9000	0.0040	0.0090	0.0200	0.0110	0.0010	0.0050	0.0030	0.0310	0.0012	0.0030	0.0013	0.0094	0.0004	0.0010	0.3359	0.0052	0.0040

Mechanical Properties

Specification Limits	UTS (Rm) MPa	UTS (Rm) psi	Yield (0.5%) MPa	Yield (0.5%) psi	% EL 2 inch
Minimum		60000		42000	30.0
Maximum					
(1) Actual		68167		44091	35.0
(2) Actual		69908		44816	37.0
(3) Actual					
(4) Actual					
(5) Actual					
(6) Actual					
(7) Actual					

	UTS (Rm) MPa	UTS (Rm) psi	Yield (0.5%) MPa	Yield (0.5%) psi	% EL 2 inch
Orientation & type of tensile test	Longitudinal, Strip				
Width of tensile piece (inch)	0.75 Inch				
Orientation of impact test piece					

OTHER TESTS	
Category	Result
Flattening	Passed
Hydrostatic	3000 psi for > Sec
NDI: EMI	PASS - ASTM E570 12.5% NOTCH
NDI: UT	UT not required
HV 22 lbs	140 142 147

Remarks:

Material in accordance with NACE MR0175:2015.ISO15156-3:2015, MR0103:2015. Dimensions to ASME B36.10M-2015. The material conform to the hot yield strength requirements as per ASME, Sect II, Pt D, Table Y-1, 2013. All the material conform to the visual and dimensional requirements and is made to a suitable fine grain practice.

Quality Assurance Manager: PJ Venter *Date of Release: 2016.05.10* *Certified by:*

MUN3195 / 114665 / 3.0RFWN#30S'IDF / 3" 300# RFWT STD A105

004139

MUNISH FORGE PVT. LTD
VILL. GOBINDGARH ADJOINING PHASE –VII FOCAL POINT
LUDHIANA- 141 010 INDIA. TEL:- + 91-161-2673307, 2673407 Fax: + 91-161-2676046
AN ISO 9001 : 2008 CERTIFIED COMPANY
(CERTIFICATE No. 125446-2008-AQ-IND-RvA Rev.02)
CERTIFICATE AS PER DIN EN 10204 3.1 : 2004

FM.NO. 960A
REV: 00
EFF. DT: 22.07.08

INVOICE NO. & DATE		CERTIFICATE NO.	8209/11
CUSTOMER'S NAME		DATE	01.09.2011
PART NO. / NAME	3" – 300 WNRF STD	P.O. NO. & DATE	
MATERIAL SPECIFICATION	ASTM A105/ SA105 2009, NACE MR 0175-2003		
STANDARD	ASME B16.5:2009 (REVISION OF ASME B16.5:2003)	BATCH NO.	114665
QUANTITY	300Pcs		

DESCRIPTION	QTY (PCs)	BATCH NO.	CHEMICAL COMPOSITION											
			C	Mn	P	S	Si	Cu	Ni	Cr	Mo	V	Nb	CE%
SPECIFIED		-	0.35 MAX	0.60 1.05	0.035 MAX	0.040 MAX	0.10 - 0.35	0.40 MAX	0.40 MAX	0.30 MAX	0.12 MAX	0.08 MAX	0.02 MAX	0.47 MAX
MILL TEST REPORT	300	C-14	0.20	0.84	0.034	0.032	0.27							
OBSERVED BY US	300	114665	0.217	0.89	0.021	0.022	0.275	0.131	0.056	0.087	0.010	0.001	0.003	0.39

MECHANICAL TESTING AS PER ASTM A 370 – 09 **MECHANICAL PROPERTIES**

BATCH NO.	DESCRIPTION	YIELD STRENGTH PSI	TENSILE STRENGTH PSI	% ELONGATION	% REDUCTION	HARDNESS BHN
-	SPECIFIED	36000 MIN	70000 MIN	22 MIN	30 MIN	137-187
114665	OBSERVED	54468.19	78512.70	29.00	43.80	137 -138

SPECIAL REMARKS: - WE CERTIFY THAT THE MATERIAL MEETS THE REQUIREMENT OF **ASTM A105/SA105-09 & DIMENSIONAL STD.ASME B16.5:2009 (REVISION OF ASME B16.5:2003)** CARBON STEEL FLANGES ARE FORGED & FULLY MACHINED WITH SERRATED FINISH AS PER STD.**MSS SP-6-2007**
FLANGES ARE PAINTED WITH BLACK PAINT & MARKED AS : **MUNISH 3 WNRF STD 300 A/SA105 B16.5 114665 INDIA**

MADE BY

CHECKED BY (Q.C.M)

D.G.M. (Q.C) WORK INSPECTOR
FOR MUNISH FORGE PVT. LTD.

ISC581 / 18B9678 / 2.0A106XHa / 2 XH A106B SMLS PIPE

ArcelorMittal South Africa Limited
Tubular Products
273 Genl. Hertzog Rd, Peacehaven Vereeniging
1939
P O Box 48 Vereeniging 1930
South Africa
Telephone +27 (0)16 450 4220
Fax +27 (0)16 423 4906

MATERIAL TEST CERTIFICATE
SEAMLESS STEEL TUBE
CERTIFICATE DE RECEPTION - TUBES D'ACIER SANS SOUDURE
ABNAHMEPRÜFZEUGNIS - NAHTLOSE STAHLROHRE

Licensed under API Spec 5L and 5CT
5L - 0319
5CT - 0419

ISO 9001: 2008
DH-3b 5997 QM

Test Certificate EN 10204:2004 TYPE 3.1

ArcelorMittal

Customer: Client Kunde	
Customer Order/Contract No: No de commande client Kundenauftrags-Nr	SUS9 148556
Order No: No. de commande Mittal: Mittal-Auftrags-Nr:	4000019243
Material No: No de matériau: Werkstoff-Nr:	1000038202
Certificate Reference No: No de certificat: Zeugnis-Nr:	040061477626
Cast/Heat No: Coulée No: Schmelzen-Nr:	18B9678
Product: Produit: Produkt:	FULLY KILLED HOT FINISHED CARBON STEEL SEAMLESS TUBES
Page Number: Page: Blatt:	1 of 3
Specification: Spécification Angabe	ISO3183:2012/API 5L:2012 L245/L290/B/X42 PSL1 ASTM A/SA53B A106B/C.13 A530.13 ASME SA106B/C.13/SA530.13
Product Marking: Langage de produit Produktkennzeichnung	ARCELORMITTAL SA ISO3183/Spec 5L-0319 MONOGRAM 09-14 ASTM/ASME A/SA106B/C A53B 2.374 0.218 40.000 L245/B L290/X42 PSL1 SMLS TESTED 3000 psi CAST NO: 18B9678 PROD/O NO: T0841924310 MADE IN SOUTH AFRICA

General Information
Information Générale
Allgemeine Information

Quantity Quantité Menge	Mass Poids Gewicht	Dimensions Tube OD Diamètre Durchschnitt	Dimensions Thickness Epaisseur Stärke	Dimensions Length Longeur Länge	Total Length Longeur Länge	Steel making process Procédé d'eleboration de l'aciers Stahlerschmelzungsverfahren	Final Rolling Operation Fin de laminage / Walzende
513	103,222.701(lb)	2.374(")	0.218(")	40.000 (ft)	20,520.000(ft)	Electric Arc	Final hot rolling finished above 1,580°F and cooled in still air

Chemical Composition
Analyse sur coulée Schmelzenanalyse

R05-(Cr+Ni+Mo+Cu+V) R22-(V+Nb+Ti) R24-(Nb+V)

Element(%)	C	Si	Mn	S	P	Cr	Ni	Mo	Cu	V	Al	Ti	Sn	Ca	N	B	Nb	CE	R05	R22	R24
Minimum																					
Maximum	0.200	-	1.30	0.030	0.030	0.50	0.50	0.150	0.500	-	-	-	-	-	-	-	-	0.41	-	0.15	0.060
Heat	0.160	0.27	0.79	0.007	0.009	0.06	0.17	0.036	0.130	0.001	0.030	0.001	0.009	0.0012	0.0099	0.0001	0.0020	0.33	0.40	0.00	0.003
Product	0.1600	0.2700	0.7900	0.0065	0.0090	0.0600	0.1700	0.0360	0.1300	0.0010	0.0300	0.0010	0.0090	0.0012	0.0099	0.0001	0.0020	0.3311	0.3970	0.0040	0.0030
Product (ADD)	0.1600	0.2700	0.7900	0.0065	0.0090	0.0600	0.1700	0.0360	0.1300	0.0010	0.0300	0.0010	0.0090	0.0012	0.0099	0.0001	0.0020	0.3311	0.3970	0.0040	0.0030

ISC581 / 18B9678 / 2.0A106XHa / 2"XH A106B SMLS PIPE

ArcelorMittal South Africa Limited
Tubular Products
273 Genl. Hertzog Rd, Peacehaven Vereeniging 1939
P O Box 48 Vereeniging 1930
South Africa

Telephone +27 (0)16 450 4220
Fax +27 (0)16 423 4906

MATERIAL TEST CERTIFICATE
SEAMLESS STEEL TUBE
CERTIFICATE DE RECEPTION - TUBES D'ACIER SANS SOUDURE
NAHMEPRÜFZEUGNIS - NAHTLOSE STAHLROHRE

Licensed under API Spec 5L and 5CT
5L - 0319
5CT - 0419

ISO 9001: 2008
DE-385987 QM

Test Certificate
EN 10204:2004 TYPE 3.1

ArcelorMittal

Customer: Client / Kunde	
Order No: No. de commande Mittal: / Mittal-Auftrags-Nr:	4000019243
Certificate Reference No: No de certificat: / Zeugnis-Nr:	040061477626
Product: Produit: / Produkt:	FULLY KILLED HOT FINISHED CARBON STEEL SEAMLESS TUBES
Specification: Spécification / Angabe	ISO3183:2012/API 5L:2012 L245/L290/B/X42 PSL1 ASTM A/SA53B A106B/C.13 A530.13 ASME SA106B/C.13/SA530.13
Product Marking: Larquage de produit / Produktkennzeichnung	ARCELORMITTAL SA ISO3183/Spec 5L-0319 MONOGRAM 09-14 ASTM/ASME A/SA106B/C A53B 3.374 0.218 40.000 L245/B L290/X42 PSL1 SMLS TESTED 3000 psi CAST NO: 18B9678 PROD/O NO: T0841924310 MADE IN SOUTH AFRICA
Customer Order/Contract No: No de commande client / Kundenauftrags-Nr	SUS9 148556
Material No: No de matériau / Werkstoff-Nr:	1000038202
Cast/Heat No: Coulée No: / Schmelzen-Nr:	18B9678
Page Number: Page: / Blatt:	2 of 3

Mechanical Properties
Propriétés Mécaniques
Mechanische Eigenschaften

Specification / Spécification / Angabe	UTS (Rm) Force de tension / Zugfestigkeit	Yield (Re) Limit élastique / Fließgrenze	% EL Allong / Dehnu	% EL Allong / Dehun
Limits / Limite / Grenze	psi	psi	2 inch	5.65 Sqr S0
Minimum	70000	42000	30.0	
Maximum				
Sample (1)	71213	48587	35.0	
Sample (2)	72228	49893	35.0	
Sample (3)				
Sample (4)				
Sample (5)				
Sample (6)				
Sample (7)				
Sample (8)				
Sample (9)				

TECHNOLOGICAL TESTS
ÉPREUVES TECHNOLOGIQUES
TECHNISCHE PRÜFUNGEN

Bending / Essai de pliage / Biegeversuch	Passed
Flattening test / Essai d'aplatissement / Ringfaltversuch	Passed
Hydrostatic / Hydrostatique / Hydrostatisch	3000 psi for 5 Sec
Electromagnetic Insp / Inspection électromagnétique / Elektromagnatische Prüfung	PASS - ASTM E570 - 12.5% NOTCH
Ultrasonic Inspection / Inspection ultrasonic / Ultraschallprüfung	UT not required

TECHNOLOGICAL TESTS
ÉPREUVES TECHNOLOGIQUES
TECHNISCHE PRÜFUNGEN

HV 22 lbs / Dureté / Härte	151	152	157

Width of tensile piece (inch) / Largeur de l'échantillon / Zugstab Breite	0.75 inch
Orientation of tensile piece / Orientation de la prouvette de tension / Richtung der Zugprobe	Longitudinal, Strip

* Elongation to BS EN ISO 2566 table 7: 5.65 square root S0
Élongation au BS EN ISO 2566 tableau 7: 5.65 racine carrée S0
Verlängerung zu BS EN ISO 2566 Tabelle 7: 5.65 quadratwurzel S0

ISC581 / 18B9678 / 2.0A106XHa / 2 XH A106B SMLS PIPE

ArcelorMittal South Africa Limited
Tubular Products
273 Genl. Hertzog Rd, Peacehaven Vereeniging 1939
P O Box 48 Vereeniging 1930
South Africa
Telephone +27 (0)16 450 4220
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MATERIAL TEST CERTIFICATE
SEAMLESS STEEL TUBE
CERTIFICATE DE RECEPTION - TUBES D'ACIER SANS SOUDURE
NAHTLOSE STAHLROHRE

Licensed under API Spec 5L and 5CT
5L - 0319
5CT - 0419
ISO 9001: 2008
DE-39997 QM
Test Certificate EN 10204.2004 TYPE 3.1

ArcelorMittal

Customer: Client / Kunde	
Order No: No. de commande Mittal: / Mittal-Auftrags-Nr:	4000019243
Certificate Reference No: No de certificat: / Zeugnis-Nr:	040061477626
Product: Produit: / Produkt:	FULLY KILLED HOT FINISHED CARBON STEEL SEAMLESS TUBES
Specification: Spécification / Angabe	ISO3183:2012/API 5L:2012 L245/L290/B/X42 PSL1 ASTM A/SA53B A106B/C.13 A530.13 ASME SA106B/C.13/SA530.13
Product Marking: Language de produit / Produktkennzeichnung	ARCELORMITTAL SA ISO3183/Spec 5L-0319 MONOGRAM 09-14 ASTM/ASME A/SA106B/C A53B 2.374 0.218 40.000 L245/B L290/X42 PSL1 SMLS TESTED 3000 psi CAST NO: 18B9678 PROD/O NO: T0841924310 MADE IN SOUTH AFRICA
Customer Order/Contract No: No de commande client / Kundenauftrags-Nr	SUS9 148556
Material No: No de matériau: / Werkstoff-Nr:	1000038202
Cast/Heat No: Coulée No: / Schmelzen-Nr:	18B9678
Page Number: Page: / Blatt:	3 of 3

Remarks:
Remarque: / Bemerkung:

Material in accordance with NACE MR0175:2009/ISO15156-3:2009 and MR0103:2012. Dimensions to ANSI B36.10 - 2010

The material will conform to the hot yield strength requirements as per ASME, Sect II, Part D, Table Y-1 and the general requirements of ASME, Sect II, Part A, Ed 2013

All the material conform to the visual inspection and dimensional tolerance requirements of the specification.

A suitable fine grain practice is followed in manufacturing.

La Société ArcelorMittal South Africa garantit que les produits objet du présent certificat, respectent en leur totalitéles prescriptions de l'Article 15 de l'Arrete Ministériel du 24 mars 1978 modifé.

C<=0,25%,P<=0,05%,S<=0,05%, R<=700N/mm2,E<=0,9xR

A%(Lo=5,65VSo) min.16% en long. R(A-2)>=10500

A%(Lo=5,65VSo) min.16% en transv. RxA)>=10500

The QM System of ArcelorMittal SA meets the requirements of PED 97/23/EC, App. I, Sect. 4.3 as certified by TUV cert 01 202 ZA/Q-02 0004. All materials meet the requirements of PED 97/23/EC, App I, Sect 7.5. Non-harmonized materials require Particular Material Appraisal. The impact strength is guaranteed to exceed 27J at 0°C

Quality Assurance Manager: *PJ Venter*
Chef des services de l'assurance de qualité:
Qualitätssicherungsmanager:

Date of Issue: *2014.10.20*
Certifié par:
Bescheinigt von:

Certified by:
Enils
Freigegeben

We hereby certify that the steel grade and quality level of all products are in conformity with the order and comply fully with specification requirements. No changes, amendments or additions may be made to this document. Any changes which are affected shall invalidate this certificate.
Nous certifions ci que la qualité de l'acier et celle de tous les produits se conforme à la commande et est complétement conforme à la spécification. Il est interdit de modifier ou de corriger ce document ou d'y ajouter quoi que ce soit. Tout changement invalide le présent certificat.
Wir bezeugen, daß die Stahlgüte und das Beschaffenheitsniveau aller Produkte mit dem Auftrag und der Angabe in übereinstimmung sind. Diese Unterlage darf in keiner Weise geändert, abgeändert oder ergänzt werden. Jede derartige Änderung wird die Gültigkeit dieser Bescheinigung aufheben.

SUD174 / 945 / 2.0RFWN#15XHF / 2" 150# RFWN XH A105

SUDHIR FORGINGS (I) LTD.

SUDHIR FORGINGS PVT.LTD
KANGANWAL ROAD,P.O.JUGIANA,
G.T.ROAD,LUDHIANA (INDIA)

Control No. TC/01
Rev. 01

TEST CERTIFICATE
(in accordance with BS EN 10204 3.1 B)

ITEM	2" 150 WNRF XH	CERTIFICATE No.	SF/FLANGE/0157/015 DATED 17-Jul-2015
QUANTITY	400 PCS.	LAB Ref. No.	945
FINISH	BLACK PAINT	CUSTOMER NAME	
MAT. SPECIFICATION	ASME SA105-10 / ASTM A105-10A	INVOICE No.	
P.O. No.		INVOICE DATE	

Chemical Analysis

Heat No.	Supplier Heat No.	Description	C%	Mn%	P%	S%	Si%	Cu%	Ni%	Cr%	Mo%	V%	TOTAL % (Cu+Ni+Cr+Mo+V)	TOTAL % (Cr+Mo)
945	418588	Specified	0.25 max	0.60 - 1.05	0.035 max	0.040 max	0.10 - 0.35	0.40 max	0.40 max	0.30 max	0.12 max	0.08 max	1.00 max	0.32 max
		Observed	0.220	0.940	0.035	0.021	0.170	0.002	0.000	0.000	0.002	0.000	0.004	0.002

Physical / Mechanical Properties

Heat No.	Supplier Heat No.	Description	UTS MPa	YIELD Mpa	Elongation%	R.A.%	Hardness (HBW)
945	418588	Specified	485 min	250 min	22 min	30 min	187 max
		Observed	560.11	319.11	40.00	64.19	170

REMARKS.

- Material is in accordence with NACE STD, MR-0175/ISO-15156
- Flanges satisfy the requrement of latest revision of ANSI /ASME B16.5 ASME SA105-10/ASTM A105-10a MSS SP-25
- The product is free of radiation & The product is free from weld repair
- We certify that the Material Suits the Requirement of P.O./Relevant specifications.
- Flanges have serrated face as per MSS-SP-6 within the limit of 125 - 250 RMS.
- Flanges are painted with black paint & Marked as. SF 2 WNRF XH 150 SA/A105 B16.5 945 INDIA

for

Q.C. Engg.

FOR SUDHIR FORGINGS PVT. LTD

Q.C. Mgr

SUD219 / 886 / 2.0RFWN#30XHF / 2" 300# RFWN XH A105

SUDHIR FORGINGS (P) LTD.

SUDHIR FORGINGS PVT.LTD
KANGANWAL ROAD,P.O.JUGIANA,
G.T.ROAD,LUDHIANA (INDIA)

Control No. TC/01
Rev. 01

TEST CERTIFICATE

(in accordance with BS EN 10204 3.1 B)

ITEM	2" 300 WNRF XH	CERTIFICATE No.	SF/FLANGE/1336/014 DATED 18-Mar-2015
QUANTITY	150 PCS.	LAB Ref. No.	886
FINISH	BLACK PAINT	CUSTOMER NAME	
MAT. SPECIFICATION	ASME SA105-10/ ASTM A105-10A	INVOICE No.	SF/2014-15/080
P.O. No.	205475 DT. 8-Dec-2014	INVOICE DATE	18-Mar-2015

Chemical Analysis

Heat No.	Supplier Heat No.	Description	C%	Mn%	P%	S%	Si%	Cu%	Ni%	Cr%	Mo%	V%	TOTAL % (Cu+Ni+Cr+Mo+V)	TOTAL % (Cr+Mo)
886	GG-083	Specified	0.25 max	0.60 - 1.05	0.035 max	0.040 max	0.10 - 0.35	0.40 max	0.40 max	0.30 max	0.12 max	0.08 max	1.00 max	0.32 max
		Observed	0.210	0.750	0.029	0.018	0.160	0.022	0.022	0.073	0.000	0.000	0.117	0.073

Physical / Mechanical Properties

Heat No.	Supplier Heat No.	Description	UTS MPa	YIELD Mpa	Elongation%	R.A.%	Hardness (HBW)
886	GG-083	Specified	485 min	250 min	22 min	30 min	187 max
		Observed	532.22	353.84	39.40	64.00	149

REMARKS.

- Material is in accordence with NACE STD, MR-0175/ISO-15156
- Flanges satisfy the requrement of latest revision of ANSI /ASME B16.5 ASME SA105-10/ASTM A105-10a MSS SP-25
- The product is free of radiation & The product is free from weld repair
- We certify that the Material Suits the Requirement of P.O./Relevant specifications.
- Flanges have serrated face as per MSS-SP-6 within the limit of 125 - 250 RMS.
- Flanges are painted with black paint & Marked as. SF 2 WNRF XH 300 SA/A105 B16.5 886 INDIA

For

Q.C. Engg.

FOR SUDHIR FORGINGS PVT. LTD

Q.C. Mgr

PAN5651 / S501 / 2.0CAPXHF / 2" XH WELD CAP SA234 WPB

INSPECTION CERTIFICATE

PANTECH STEEL INDUSTRIES SDN. BHD. (509731-A)
LOT 13258 & 13259, Jalan Haji Abd. Manan,
Off Jalan Meru, 42200 Klang, Selangor, Malaysia.
Tel: 603-3393 1633 Fax: 603-3393 1733 E-mail: info@pantechsteel.com

LLOYD'S REGISTER · LRQA
ISO 9001
Cert. No.: KLR 0403926

WROUGHT CARBON STEEL BUTTWELDING FITTINGS

INSPECTION DOCUMENT: EN10204:2004 Type 3.1

Purchaser :

Certificate No : PSI 103119
Date : 19-Aug-15

Order No.	Invoice No.	Starting Material	Specification for Fittings- Seamless	Specification for Inspection
		Plate	ASTM A234-14 WPB/ASME SA234-15 WPB NACE MR0175/NACE MR0103/ISO15156*	ASME B16.9-12 / ASTM A960-14a

Heat No.	Product & Size	Quantity (pcs)	Visual Examination	Dimensional Inspection	Heat Treatment	Magnetic Particle Testing
S 501	2" XS CAP	1000	GOOD	GOOD	C&S	N.A

Specification	Chemical Composition (%)												Tensile Test *1			Hardness	
	C x100	Si x100	Mn x100	P x1000	S x1000	Ni x100	Cr x100	Mo x100	Cu x100	V x1000	Pb	CE x100	YS (KSI / MPa)	TS	E (%)	(HB) 1	(HB) 2
Min	-	10	29	-	-	-	-	-	-	-	-	-	240	415	22	-	
Max	30	-	106	50	58	40	40	15	40	80	-	50	-	-	-	197	
Heat No.																	
S 501	7	15	42	19	9	2	2	0	9	3	<0.10	16	391	445	35.7	128	129

WE CERTIFY THAT ALL PRODUCTS WERE MANUFACTURED,SAMPLED,TESTED, AND INSPECTED SOLELY BY THE MANUFACTURER LISTED AT THE ADDRESS ABOVE IN ACCORDANCE WITH INDICATED SPECIFICATION AND FOUND TO MEET REQUIREMENTS. MATERIAL IS FREE FROM MERCURY AND RADIOACTIVE CONTAMINATION.

TENSILE REQUIREMENT: CONFORMS TO ASTM A370 STANDARD, LONGITUDINAL DIRECTION, GAUGE LENGTH 2" (50mm)

* HARDNESS ACCORDING TO NACE MR0175/ NACE MR 0103/ ISO15156

NOTE:

C: Cold formed at temperature below 620°C
S: Stress relieved in temperature between 595°C - 690°C and cooled in still ai
H : Hot formed in temperature between 845°C - 945°C and cooled in still air.
N: Normalised at 910°C
Q: Heated to 910°C and quench in water.
T: Temper between 590°C - 690°C.

*1: YS = Yield strength TS=Tensile strength E = Elongation

Made in Malaysia

Quality Assurance Manager

INTERNATIONAL WFI NUCLEAR PRODUCTS
Manufacturer of Piping and Pressure Vessel Components
4404 Haygood St - Houston, TX 77022
Phone: 713-695-3633 Fax: 713-695-3528
A Bonney Forge Company

Sold To: LEE SUPPLY COMPANY
821 EAST INDEPENDENCE
STREET
TULSA OK 74101

MTR #: 255,472

PO #: 13-3208-DS

Sales Order #: C001308931 Date: 06/18/2013

This product has not come in direct contact with mercury or any of its compounds, nor with any mercury-containing device employing a single boundary of containment. No welding performed.

We certify that the contents of this report are correct and accurate, and that all test results and operations performed by WFI or its subcontractors are in compliance with the material specification and requirements of the referenced code or standard, and that the material conforms to the dimensional requirements of the order. This document is in accordance with EN10204 3.1.

Certified Material Test Report

Heat Code: 59061

Material: A/SA105 09

Item	Quantity	Description
7	125	36 - 1 1/2 X 3/4 3M THP A/SA105

Chemical Composition

Ladle	C	CR	CU	MN	MO	NB	NI	P
	0.200	0.04	0.040	1.08	0.004	0.014	0.02	0.006
	S	SI	V					
	0.022	0.19	0.003					

Carbon Equivalency: Ladle 0.39

Product	C	CR	CU	MN	MO	NI	P	S
	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.000
	SI	V						
	0.00	0.000						

	Tensile PSI	Yield PSI	Elong %	RA %	Hardness	
Product	76,520	49,604	30.50	62.80	141 BHN	141 BHN

AS FORGED

Marie Dehmer
Quality Assurance Representative

WFI4252 / 59916 INTERNATIONAL 6-1.5SOL3 / 3/4 X 36- 1 1/2" 3000# SC

NUCLEAR PRODUCTS
Manufacturer of Piping and Pressure Vessel Components
4404 Haygood St - Houston, TX 77022
Phone: 713-695-3633 Fax: 713-695-3528
A Bonney Forge Company

Sold To: LEE SUPPLY COMPANY
821 EAST INDEPENDENCE
STREET
TULSA OK 74106

MTR #: 319,511
PO #: 16-4938-DS
Sales Order #: C001610069 Date: 10/21/2016

This product has not come in direct contact with mercury or any of its compounds, nor with any mercury-containing device employing a single boundary of containment. No welding performed.

We certify that the contents of this report are correct and accurate, and that all test results and operations performed by WFI or its subcontractors are in compliance with the material specification and requirements of the referenced code or standard, and that the material conforms to the dimensional requirements of the order. This document is in accordance with EN10204 3.1.

Certified Material Test Report

Heat Code: 59916

Material: A/SA105N 13

Item	Quantity	Description
3	1,000	36 - 1 1/2 X 3/4 3M SWP A/SA105N TAG: RACK MW0215D

Chemical Composition

	C	CR	CU	MN	MO	Nb	NI	P
Ladle	0.2000	0.04	0.04	1.030	0.004	0.013	0.020	0.007
	S	SI	V					
	0.023	0.240	0.003					

Carbon Equivalency: Ladle 0.39

	C	CR	CU	MN	MO	NI	P	S
Product	0.1980	0.04	0.05	1.010	0.006	0.024	0.005	0.017
	SI	V						
	0.215	<0.001						

Carbon Equivalency: Product 0.38

	Tensile PSI	Yield PSI	Elong %	RA %	Hardness	
Product	73,000	48,900	33.00	70.00	140 BHN	143 BHN

MILL/COUNTRY OF ORIGIN: ARCELORMITTAL (CANADA) - HEAT #C116004/BONNEY FORGE (USA) - LOT#59916

PARTS ARE NORMALIZED AT 1650°F FOR A MINIMUM OF 1 HOUR OR FOR 1/2 HOUR PER 1" OF THICKNESS, WHICHEVER IS GREATER, & THEN AIR COOLED. THIS PROCESS IS IN CONFORMANCE TO ASTM A105/A350 NORMALIZING REQUIREMENTS.

Marie Dehmer
Quality Assurance Representative

CAM16746 / 7638 / 76X30XHSML / 3/4 X 3" XHSML S NIPPL E

Capitol Manufacturing
1125 Capitol Avenue
Crowley, LA 70526

Phoenix • Capitol • Camco
CapProducts

ommanding a Higher Standard.sm

Certified Mill Test Report

Printed: 2/1/2017
Customer
LEE SUPPLY CO
PO BOX 1475
TULSA, OK 74101

Certified: 12/28/2016
P.O. 17-0532-DS
Tag

Heat No 2602029
Heat Code 7638
Phoenix Order # 1258995
Material ASTM A106-2014 / ASME SA106-2015 Edition

Part Number
15110706

Description
3/4 X 3" XHSML BK STL NIPL TBE

Chemical Properties

C	Mn	P	S	Si	Cu	Ni	Cr
0.1700	0.7500	0.0160	0.0040	0.1800	0.0070	0.0050	0.0080

C Eq. Long
0.2983

Mo	V	Co	Al	Cb	N	Pb	Sn	Ta	Ti
0.0031	0.0012		0.0290	0.0000					

Additional Chemical Properties

Cr + Cu + Ni
0.0200

Mechanical Properties

ensile (PSI)	Yield (PSI)	Elong. % in 2 in. or 4D	R of A	HBW	HBW2
69,093	51,688	46.8%	0.0%	0	0

Charpy Minimum Impact - ft/lbs

Test 1	Test 2	Test 3	Average	Test Temp.
N/A	N/A	N/A	N/A	N/A

* Hydro test passed. at 2500 psi.

* Bend test passed.

We hereby certify that these parts were manufactured, sampled, tested, and inspected in accordance with the product specifications stated and were found to meet the requirements.
We further certify that this material was inspected using independent inspectors conforming to the requirements of EN 10204 3.1. These products meet the requirements of the latest editions of NACE MR0175, NACE MR0103, and ISO 15156. No weld repair has been performed on these products. This material was not exposed to mercury or any other metal alloy that is liquid at ambient temperatures during processing or while in our possession.

Meets ASME SA 106 Grade B Requirements

INTERNATIONAL
NUCLEAR PRODUCTS
Manufacturer of Piping and Pressure Vessel Components
4404 Haygood St - Houston, TX 77022
Phone: 713-695-3633 Fax: 713-695-3528
A Bonney Forge Company

Sold To: LEE SUPPLY COMPANY
821 EAST INDEPENDENCE
STREET
TULSA OK 74106

MTR #: 323,851

PO #: 17-0784-DS

Sales Order #: C001701548 Date: 02/16/2017

This product has not come in direct contact with mercury or any of its compounds, nor with any mercury-containing device employing a single boundary of containment. No welding performed.

We certify that the contents of this report are correct and accurate, and that all test results and operations performed by WFI or its subcontractors are in compliance with the material specification and requirements of the referenced code or standard, and that the material conforms to the dimensional requirements of the order. This document is in accordance with EN10204 3.1.

Certified Material Test Report

Heat Code: 59172

Material: A/SA105N 09

Item	Quantity	Description
6	100	36 - 3/4 X 1/2 3M SWP A/SA105N

RACK MW0215D

Chemical Composition

	C	CR	CU	MN	MO	NB	NI	P
Ladle	0.2100	0.03	0.05	1.040	0.005	0.016	0.020	0.004
	S	SI	V					
	0.018	0.200	0.003					

Carbon Equivalency: Ladle 0.40

	C	CR	CU	MN	MO	NI	P	S
Product	0.0000	0.00	0.00	0.000	0.000	0.000	0.000	0.000
	SI	V						
	0.000	0.000						

	Tensile PSI	Yield PSI	Elong %	RA %	Hardness	
Product	79,000	50,000	28.00	65.00	163 BHN	165 BHN

MILL/COUNTRY OF ORIGIN: ARCELORMITTAL (CANADA) - HEAT #D87310 / BONNEY FORGE (USA) - LOT #59172

PARTS ARE NORMALIZED AT 1650°F FOR A MINIMUM OF 1 HOUR OR FOR 1/2 HOUR PER 1" OF THICKNESS, WHICHEVER IS GREATER, & THEN AIR COOLED. THIS PROCESS IS IN CONFORMANCE TO ASTM A105/A350 NORMALIZING REQUIREMENTS.

Marie Dehmer
Quality Assurance Representative

INTERNATIONAL
NUCLEAR PRODUCTS
Manufacturer of Piping and Pressure Vessel Components
4404 Haygood St - Houston, TX 77022
Phone: 713-695-3633 Fax: 713-695-3528
A Bonney Forge Company

Sold To: LEE SUPPLY COMPANY
821 EAST INDEPENDENCE
STREET
TULSA OK 74101

MTR #: 282,917
PO #: 14-3971-DS
Sales Order #: C001411631 Date: 09/05/2014

This product has not come in direct contact with mercury or any of its compounds, nor with any mercury-containing device employing a single boundary of containment. No welding performed.

We certify that the contents of this report are correct and accurate, and that all test results and operations performed by WFI or its subcontractors are in compliance with the material specification and requirements of the referenced code or standard, and that the material conforms to the dimensional requirements of the order. This document is in accordance with EN10204 3.1.

Certified Material Test Report

Heat Code: 59444

Material: A/SA105 13

Item	Quantity	Description
9	400	36 - 3/4 X 1/2 3M THP A/SA105 RACK MW0215E

Chemical Composition

Ladle	C	CR	CU	MN	MO	NB	NI	P
	0.200	0.03	0.06	1.02	0.006	0.014	0.02	0.006
	S	SI	V					
	0.021	0.21	0.004					

Carbon Equivalency: Ladle 0.38

	Tensile PSI	Yield PSI	Elong %	RA %	Hardness	
Product	75,760	50,719	33.60	55.82	137 BHN	139 BHN

AS FORGED

Marie Dehmer
Quality Assurance Representative

INTERNATIONAL WFI NUCLEAR PRODUCTS
Manufacturer of Piping and Pressure Vessel Components
4404 Haygood St - Houston, TX 77022
Phone: 713-695-3633 Fax: 713-695-3528
A Bonney Forge Company

Sold To: LEE SUPPLY COMPANY
821 EAST INDEPENDENCE
STREET
TULSA OK 74106

MTR #: 309,356
PO #: 16-0660-DS
Sales Order #: C001601409 Date: 02/15/2016

This product has not come in direct contact with mercury or any of its compounds, nor with any mercury-containing device employing a single boundary of containment. No welding performed.

Certified Material Test Report

Heat Code: 59868

We certify that the contents of this report are correct and accurate, and that all test results and operations performed by WFI or its subcontractors are in compliance with the material specification and requirements of the referenced code or standard, and that the material conforms to the dimensional requirements of the order. This document is in accordance with EN10204 3.1.

Material: A/SA105 13

Item	Quantity	Description
4	50	36 - 3/4 X 1/2 3M SWP A/SA105 RACK MW0215D

Chemical Composition

	C	CR	CU	MN	MO	NB	NI	P
adle	0.2100	0.04	0.07	1.030	0.006	0.012	0.030	0.006
	S	SI	V					
	0.015	0.230	0.003					

Carbon Equivalency: Ladle 0.40

	Tensile PSI	Yield PSI	Elong %	RA %	Hardness	
Product	78,000	52,500	31.00	66.00	156 BHN	163 BHN

COUNTRY OF ORIGIN: CANADA

AS FORGED

Elizabeth Tobias
Quality Assurance Representative

MILL TEST REPORTS

This product has not come in direct contact with mercury or any of its compounds, nor with any mercury containing device employing a single boundary of containment. No welding performed. We certify that the contents of this report are correct and accurate and that all test results and operations performed by WFI or its subcontractors are in compliance with the material specification and requirements of the referenced code or standard and that the material conforms to the dimensional requirements of the order. This document is in accordance with EN10204 3.1.B. Material grade verified on alloy material using a PMI analyzer.

WFI International, Inc.
Nuclear Products, Inc.
4407 Haygood Street
Houston, TX 77022
Phone: 713.695.3633

Manufacturer of Piping and Pressure Vessel Components

Heat Code	Material	Revision	Class	Description
59983	A/SA105	13		36 - 3/4 X 1/2 3M SWP A105

MECHANICAL PROPERTIES

Tensile PSI	Yield PSI	Elong %	RA %	Hardness
78500	53500	32	68	147 BHN 151 BHN

CHEMICAL COMPOSITION

Element	%
C	0.2
Co	0.001
Cr	0.04
Cu	0.03
Mn	1.05
Mo	0.005
Nb	0.011
Ni	0.02
P	0.005
S	0.017
Si	0.28
V	0.001

Heat Treat

As forged

This data has been provided in electronic form.
For help with this or any other MTR, please contact Customer Service at 800-231-0430 or email.

CAP14354 / 73R7 / 5X12.0160SML / 1/2 X 12" S160 SMLS NIPPLE

Capitol Manufacturing
1125 Capitol Avenue
Crowley, LA 70526

Phoenix • Capitol • Camco

CapProducts

Commanding a Higher Standard℠

Certified Mill Test Report

Printed: 3/22/2016
Customer
LEE SUPPLY CO
PO BOX 1475
TULSA, OK 74101

Certified: 09/24/2014
P.O. 16-1410-ds
Tag

Heat No 2F5207
Heat Code 73R7
Phoenix Order # 1191511

Material ASTM A106-2011 / ASME SA106-2010 Edition

Part Number
15136524

Description
1/2 X 12" SCH 160 SMLS NIPL TBE

Chemical Properties

C	Mn	P	S	Si	Cu	Ni	Cr
0.2500	0.7400	0.0070	0.0070	0.2400	0.2100	0.1400	0.0000

C Eq. Long
0.4017

Mo	V	Co	Al	Cb	N	Pb	Sn	Ta	Ti
0.0200	0.0050			0.0000					

Additional Chemical Properties

Cr + Cu + Ni
0.3500

Mechanical Properties

Tensile (PSI)	Yield (PSI)	Elong. % in 2 in. or 4D	R of A	HBW	HBW2
72,000	44,000	40.0%	0.0%	0	0

Charpy Minimum Impact - ft/lbs

Test 1	Test 2	Test 3	Average
N/A	N/A	N/A	N/A

* Eddy Current test passed.

* Bend test passed.

We hereby certify that these parts were manufactured, sampled, tested, and inspected in accordance with the product specifications stated and were found to meet the requirements.
We further certify that this material was inspected using independent inspectors conforming to the requirements of EN 10204 3.1. These products meet the requirements of the latest editions of NACE MR0175, NACE MR0103, and ISO 15156. No weld repair has been performed on these products. This material was not exposed to mercury or any other metal alloy that is liquid at ambient temperatures during processing or while in our possession.

Meets ASME SA 106 Grade B Requirements.

UCS JOB NO. S-4248-13

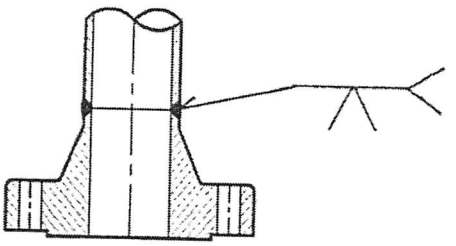
Section 5

Welding Procedures / Procedure Qualification Records

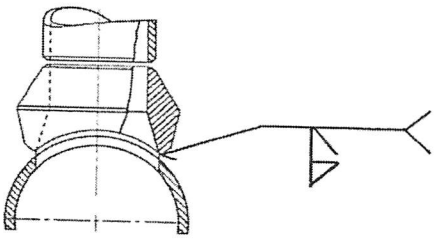
JOB: S-4248-13

UNITED CONTRACTING SERVICES, INC.

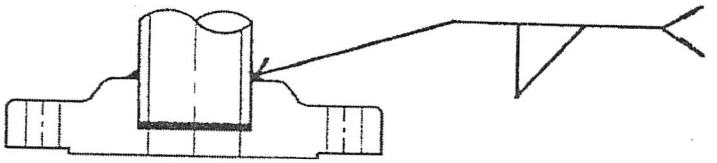
UCS JOB NO.	S-4248
CUSTOMER JOB NO.	J-447
PO NO.	TBD
DATE:	1/25/2017
REVISION:	1



BUTT WELD, TYP.



O-LET WELD, TYP.



FILLET WELD, TYP.

JOINT TYPE: VAIROUS, PIPE				
WPS	PROCESS	MAX DEPOSIT-T	GROOVE-T, min/max	NOTES
5004A	GTAW	0.25"	0.187"-1.0"	P1-Gr.1or2 to P1-Gr.1or2, UNLIMITED PIPE DIA.
	SMAW	0.75"		
5011A	GMAW	0.25"	0.187"-1.50"	P1-Gr.1or2 to P1-Gr.1or2, UNLIMITED PIPE DIA.
	FCAW	1.25"		
5012A	GTAW	1.812"	0.187"-1.812"	P1-Gr.1or2 to P1-Gr.1or2, UNLIMITED PIPE DIA.
GT-1-1.2-50CVN	GTAW	0.625"	0.375"-0.75"	P1-Gr.1or2 to P1-Gr.1or2, BNH, UNLIMITED PIPE DIA.
GM-FC-1-1.2-50CVN	GMAW	0.1375	0.375"-0.75"	P1-Gr.1or2 to P1-Gr.1or2, BNH, UNLIMITED PIPE DIA.
	FCAW	0.50"		
5001A	GTAW	0.864"	0.187"-0.864"	P8-Gr.1 to P8Gr.1, 308L , 309L, 316L
5002A	GMAW	0.137"	0.187"-0.864"	P8-Gr.1 to P8-Gr.1, 308L OR 316L, MIN. PIPE DIA. =0.75"
	FCAW	0.614"		
5007A	GTAW	0.294"	0.062"-0.294"	P8-Gr.1 to P8G-Gr.1, 308L or 316L, UNLIMITED PIPE DIA.

ADDITIONAL NOTES:

Rev. 1 added 5007A for P8 Gr. 1 weld groove thickness down to 0.062"

UCS QUALITY REVIEW: _____ DATE: 1/25/17

CUSTOMER REVIEW: _____ DATE: _____

3RD PARTY/ END USER: _____ DATE: _____

QW-482 SUGGESTED FORMAT FOR WELDING PROCEDURE SPECIFICATION (WPS)

(See QW-200.1, Section IX, ASME Boiler and Pressure Vessel Code)

Juston W Davis CWI 12111641 QC1 EXP. 11/1/2015

05MAR2015

Company Name UNITED CONTRACTING SERVICES By: Tim Morris Approved By: 10-22-12

Welding Procedure Specification No. 5004-A Date 8-14-09 Supporting PQR No.(s) 5004-A

Revision No. 3 Date 10-22-12

Welding Process(es) GAS TUNGSTEN ARC WELDING (GTAW) & SHIELDED METAL ARC WELDING (SMAW) Type(s) GTAW/ SMAW -manual

(Automatic,Manual,Machine,Semi-auto)

Joints (QW-402)

Joint Design Single Vee or Bevel , Double Vee or Bevel

Backing (Yes) Optional (No) GTAW-open root

Backing Material (type) Weld metal for double sided weld

(Refer to both backing and retainers.)

☒ Metal ☐ Nonfusing Metal

☐ Nonmetallic ☐ 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 Mfgr., sketches may be attached to illustrate joint design, weld layers and bead sequence, e.g. for notch toughness procedures, for multiple process, procedures, etc.)

Details

Joint Designs page 3 of WPS

See shop drawings for optional joint designs used with this WPS. This WPS may be used in conjunction with other WPS' as indicated on shop drawings.

*** BASE METALS (QW-403)**

P-No. 1 Group No. 1 or 2 to P-No. 1 Group No. 1 or 2

OR

Specification type and grade Example: SA-106B

To Specification type and grade Example: SA-106B

OR

Chem. Analysis and Mech. Prop.

To Chem. Analysis and Mech. Prop.

Thickness Range:

Base Metal: Groove 3/16" – 1" Fillet Unlimited

Pipe Dia. Range: Groove All Diameters Fillet All Diameters

Other

*** FILLER METALS (QW-404)**	**GTAW Root**	**SMAW Fill**
Spec. No. (SFA)	5.18	5.1
AWS No. (Class)	ER70S-2 or ER70S-6	E7018 or E7018-1
F-No.	6	4
A-No.	1 (verify that ER70S-6 meets A1 chemistry)	1
Size of Filler Metals	1/16", 3/32", 1/8"	3/32", 1/8", 5/32"
Weld Metal Thickness Range:	No autogenous welding allowed	
Groove	.250" (1/4") maximum deposit	.750" (3/4") max. deposit
Fillet	Unlimited	Unlimited
Electrode-Flux (Class)	NONE USED	NA
Flux Trade Name	NONE USED	NA
Consumable Insert	None	NA
Other	Bare (Solid wire)	Max. pass thk. < ½"
	Addition of flux: None	

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

WPS No. 5004-A Rev. 2X 3

POSITIONS (QW-405)
Positions(s) of Groove All positions
Welding Progression: Up Yes Down
Position(s) of Fillet All positions

PREHEAT (QW-406)
Preheat Temp. Min. 3/16" to 1" = 55°F
Interpass Temp. Max. 550°F
Preheat Maintenance None
(Continuous or special heating where applicable should be recorded)

POSTWELD HEAT TREATMENT (QW-407)
Temperature Range As Welded Condition
Time Range N/A

GAS (QW-408)

GTAW	Gas(es)	Percent Composition Mixture	Flow rate
Shielding	Argon	99.995%	20-50 CFH
Trailing	None		
Backing	None		

ELECTRICAL CHARCACTERISTICS (QW-409)
Current AC or DC Below Polarity Below
Amps (Range) Below Volts (Range) Below

(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 EWTh-2 3/32" or 1/8"
(Pure Tungsten, 2% Thoriated, etc.)

Mode of Metal Transfer for GMAW N/A
(Spray arc, short circuiting arc, etc.)

Electrode Wire feed speed range N/A

TECHNIQUE (QW-410)
String or Weave Bead GTAW- weave SMAW- String or weave (3X rod dia. Max)
Orifice or Gas Cup Size GTAW: #4 - #12
Initial and Interpass Cleaning (Brushing, Grinding, etc. All deleterious materials shall be removed 1" both sides of weld joint by grinding or wire brushing. Interpass cleaning with wire brush, chipping hammer or pneumatic scaling gun required.

Method of Back Gouging N/A for GTAW single side open root stringer deposit. Back gouge and/or grind second side for double side weld using the GTAW process if required.
Contact to Tube Work Distance N/A
Multiple or Single Pass (per side) Multiple
Multiple or Single Electrodes Single
Travel Speed (Range) See Below
Peening None
Other Oscillation: None Pulsing current: None

Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp Range	Volt Range	Travel Speed Range	Other Max. J/in.
Root & Hot pass	GTAW	ER70S-2 or ER70S-6	1/16", 3/32" 1/8"	DC/SP DC/SP	40-200 130-300	12-25 18-25	Manual Manual	
Fill & cap	SMAW	E7018 or E7018-1	3/32" 1/8" 5/32" 3/16"	DC/RP DC/RP DC/RP DC/RP	70-100 110-135 130-200 180-250	19-24 19-24 19-25 22-28	Manual Manual Manual Manual	

WELD PROCEDURE SPECIFICATION (WPS) JOINT DESIGNS
(Page 3 of 3)

WPS No.: 5004-A Date: 8-14-09 Rev. No.: 3 Date: 05MAR2015

JOINTS (QW-402

Single-V groove:	**GTAW /SMAW**	**Single bevel groove:**	**GTAW/SMAW**
Backing:	No backing	Backing:	No backing
Root opening:	3/32" – 3/16"	Root opening:	3/32" – 3/16"
Groove angle:	50 deg. Min. included	Groove angle:	45 deg. Min. included
Root face:	1/8" Max	Root face:	1/8" Max
Single-V groove:		**Single bevel groove:**	
Backing:	Backgouged & welded	Backing:	Backgouged & welded
Root opening:	¼" Max.	Root opening:	¼" Max.
Groove angle:	50 deg. Min. included	Groove angle:	45 deg. Min. included
Root face:	3/16" Max.	Root face:	3/16" Max.
Double bevel groove:		**Single J groove:**	3/8" J **GTAW**
Backing:	Backgouged & welded	Backing:	No backing
Root opening:	¼" Max.	Root opening:	3/32" – 3/16"
Groove angle:	50 deg. Min. included	Groove angle:	15 deg. Min. included
Root face:	3/16" Max.	Root face:	1/8" Max
Double V groove:		**Single U groove:**	¾" U **GTAW**
Backing:	Backgouged & welded	Backing:	No backing
Root opening:	¼" Max.	Root opening:	3/32" – 3/16"
Groove angle:	45 deg. Min. included	Groove angle:	15 deg. Min. included
Root face:	3/16" Max.	Root face:	1/8" Max

Single or double fillet weld: GTAW/SMAW

Backing:	Base metal
Root opening:	3/16" Max.
Weld size:	See drawings

1) Alternate weld joint designs may be shown on the drawings or engineering specifications and will take precedence.

2) Initial and interpass cleaning is shown on page 2 of the WPS.

3) Preheat shall be maintained during all thermal cutting, taking and backgouging operations as shown on the WPS.

4) Welds shall be cleaned as required on page 2 of the WPS.

Prepared By:	Tim Morris	Approved By:		Date:	10-22-12

05MAR2015

Juston W Davis
CWI 12111641
QC1 EXP. 11/1/2015

QW-483 SUGGESTED FORMAT FOR PROCEDURE QUALIFICATION RECORD (PQR)

(See QW-200.2, Section IX, ASME Boiler and Pressure Vessel Code)

Record Actual Conditions Used to Weld Test Coupon.

Company Name **UNITED CONTRACTING SERVICES**

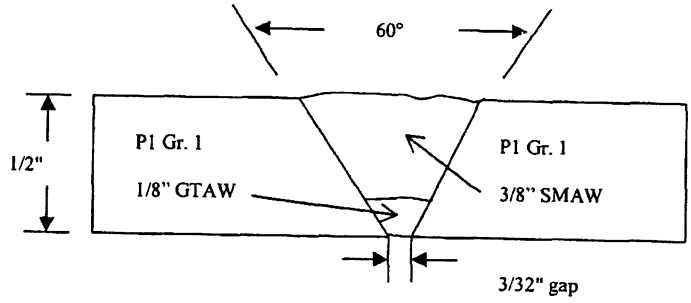
Procedure Qualification Record No. 5004-A Date 8-14-09

WPS No. 5004-A

Welding Processes(es) GAS TUNGSTEN ARC WELDING (GTAW) & SHIELDED METAL ARC WELDING (SMAW)

Types (Manual, Automatic,Semi-auto.) GTAW/ SMAW : 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. SA-106-B

Type or Grade Gr. B

P No. P 1 Gr. 1 to P 1 Gr. 1

Thickness of Test Coupon 1/2 "

Diameter of Test Coupon 8.825"

Other Qualifies T thk. 3/16" – 1" with no PWHT

Qualifies GTAW t thk. 1/4" max.

Qualifies SMAW t thk. 3/4" max.

Max. bead thk. < 1/2"

POSTWELD HEAT TREATMENT (QW-407)

Temperature As Welded

Time N/A

Other

GAS (QW-408)

	Gas(es)	Percent Composition (Mixture)	Flow rate
Shielding	Argon	99.995%	40 CFH
Trailing	None		
Backing	None		

Other

FILLER METALS (QW-404)	**SMAW**	**GTAW**
SFA Specification	5.1	5.18
AWS Classification	E7018	ER70S-2
Filler metal F-No.	4	6
Weld Metal Analysis A-No.	1	1
Size of Filler Metal	1/8"	1/8"
Other	GTAW :Solid wire	
	Consumable inserts: None	
	Addition of flux for GTAW: None	
Weld Metal Thickness	3/8" *	1/8"
Max. pass thk. <1/2"		With filler* addition

ELECTRICAL CHARACTERISTICS (QW-409)

Current GTAW: DC SMAW: DC

Polarity GTAW: SP SMAW: RP

Amps GTAW: 130 SMAW: 98

Volts GTAW: 19 SMAW: 19

Tungsten Electrode Size 1/8" dia. EWTh-2

Pulsing Amps None

J/in. Qualified (CVN's) N/A

Other

POSITION (QW-405)

Position of Groove 6G

Weld Progression (Uphill, Downhill) Uphill

Other

PREHEAT (QW-406)

Preheat Temp. (min.) 70°F

Interpass Temp. (max.) 550°F

Other

TECHNIQUE (QW-410)

Travel Speed Manual

String or Weave Bead GTAW: Weave SMAW: String

Oscillation None

Multipass or Single Pass (per side) Multipass

Single or Multiple Electrodes Single

Other

*Corrected SMAW deposit from 1/2" to 3/8" and added with filler addition to GTAW process. Recertified 10-22-10

QW-483 (Back)

PQR No. 5004-A

Tensile Test (QW-150)

Specimen No.	Width (in)	Thickness (in)	Area (sq. in)	Ultimate Total Load lb	Ultimate Unit Stress Psi	Type of Failure & Location
1	0.756	0.479	0.3621	24,260	66,998	Base- ductile
2	0.748	0.482	0.3605	24,333	67,498	Base- ductile

Guided-Bend Tests (QW-160)

Type and Figure No.	Result
#1 Side bend per QW-462.2	Satisfactory
#2 Side bend per QW-462.2	Satisfactory
#3 Side bend per QW-462.2	Satisfactory
#4 Side bend per QW-462.2	Satisfactory

Toughness Tests (QW-170)

Specimen No.	Notch Location	Notch Type	Test Temp.°F	Impact Values	Lateral Expansion		Drop Weight	
					% Shear	Mils	Break	No Break
			10mmX10mm specimen HAZ (P1 Gr. 1 & Gr. 2)					

Fillet-Weld Tests (QW-180)

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

Macro- Results _____

Other Tests

Type of Test _____

Deposit Analysis _____

Other _____

Welders Name Jorge Pando Clock No. _____ Stamp No. A

Test conducted by: Tulsa Gamma Ray Inc. Laboratory Test No. 102127934

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. Updated to new form 8-13-12

Manufacturer UNITED CONTRACTING SERVICES

Date 8-14-09 By _____

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

Company Name UCONTRACTING SERVICES INC. By: Juston Davis Approved by: Jose R. Estrada
Welding Procedure Specification No. 5011A Date 4/18/12 Supporting PQR No.(s) 5011A
Revision No. 3 Date 11-23-2016
Welding Process(es) GMAW/FCAW Type(s) Semi-Auto/Semi-Auto
(Automatic,Manual,Machine,Semi-auto)

Joints (QW-402) Details

Joint Design Any*
Root Spacing SEE SHEET 3
Backing (Yes) FCAW (No) GMAW
Backing Material (type) PER CUSTOMER REQUIRMENT
(Refer to both backing and retainers.)

☒ Metal ☐ Nonfusing Metal
☐ Nonmetallic ☐ Other

See page 3 of WPS for joint design details.
*1 See shop drawings for optional joint designs used with this WPS.

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 Mfgr., sketches may be attached to illustrate joint design, weld layers and bead sequence, e.g. for notch toughness procedures, for multiple process, procedures, etc.)

This WPS may be used in conjunction with other WPS' as indicated on shop drawings. (Ex. Used for repair or root pass.)

*** BASE METALS (QW-403)**

P-No. 1 Group No. 1 or 2 to P-No. 1 Group No. 1 or 2
OR
Specification type and grade EXAMPLE: SA-516-60
To Specification type and grade EXAMPLE: SA516-70
OR
Chem. Analysis and Mech. Prop. SEE P NO. ABOVE
To Chem. Analysis and Mech. Prop. SEE P NO. ABOVE
Thickness Range:
Base Metal: Groove 3/16"~1.5" Fillet UNLIMITED
Maximum Pass Thickness ≤ ½ in. (Yes) X (No)
Other Not allowed for ASME Services greater than 1.5". Thicknesses between 1.0~1.25" shall have a minimum pre-heat of 175°F and thicknesses from 1.25~1.5" shall have a minimum pre-heat of 200°F.

*** FILLER METALS (QW-404)**	**FCAW**	**GMAW**
Spec. No. (SFA)	5.20/5.36	5.17/5.18
AWS No. (Class)	E71T-M1/E71T1-M21A2	ER70S-3 or ER70S-6
F-No.	6	6
A-No.	1 (VERIFY E71T-M MEETS A1 CHEM.)	1 (VERIFY ER70S-6 MEETS A1 CHEM.)
Size of Filler Metals	0.045", 1/16"	0.035", 0.045"
Filler Metal Product Form	TUBULAR	BARE WIRE
Supplemental Filler Metal	NONE ALLOWED	NONE ALLOWED
Weld Metal Thickness Range: Groove	3/16"~1.375"	0.062"~0.250"
Fillet	UNLIMITED	UNLIMITED
Electrode-Flux (Class)	NO ADDITIONAL FLUX ADDED	NO ADDITIONAL FLUX ADDED
Flux Trade Name	NONE	NONE
Consumable Insert	NONE	NONE
Other	NO ALLOYING ELEMENTS	NO ALLOYING ELEMENTS

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

WPS No. 5011A Rev. 3

POSITIONS (QW-405)
Positions(s) of Groove: ALL
Welding Progression: Up FCAW Down GMAW
Position(s) of Fillet: ALL
Other

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

PREHEAT (QW-406)
Preheat Temp. Min.: 50°F
Interpass Temp. Max.: 500°F MAX.
Preheat Maintenance: NONE AFTER WELDING
(Continuous or special heating where applicable should be recorded)

GAS (QW-408)

	Gas(es)	Percent Composition Mixture	Flow rate
Shielding	AR/CO2	75/25	30~50CHF
Trailing	NONE		
Backing	NONE		
Other			

ELECTRICAL CHARCACTERISTICS (QW-409)

Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp Range	Volt Range	IPM Travel Speed Range	Wire Feed Speed Range	Energy or Power Range	(e.g. Remarks Comment Technique
ROOT	GMAW	ER70S-3 or ER70S-6	.035"	DC/RP	115~145	18~23	MAN.	VAR.	*	
FILL/ CAP	FCAW	E71T-M	.045"	DC/RP	140~240	22~29	MAN.	VAR.	*	
	FCAW	E71T-M	1/16"	DC/RP	220~380	22~32	MAN.	VAR.	*	

Amps and volts, or power or energy range, should be recorded for each electrode size

Pulsing Current: NONE Heat Input Range: *NOT REQUIRED FOR IMPACT EXEMPT APPLICATIONS
Tungsten Electrode size: NONE
Mode of Transfer for GMAW (FCAW): GMAW-GLOB., FCAW-GLOB. or SPRAY
Other

TECHNIQUE (QW-410)
String or Weave Bead: GMAW- STRING or WEAVE, FCAW-STRING (3/4" MAX.)
Orifice or Gas Cup Size: 5/16" or ¾" I.D.
Initial and Interpass Cleaning (Brushing, Grinding, etc.: **All deleterious materials shall be removed 1" both sides of weld joint by grinding or wire brushing. GMAW – WIRE BRUSH EACH PASS REQUIRED. FCAW - Interpass cleaning with wire brush, chipping hammer, or pneu. Scaling gun required.**
Method of Back Gouging: N/A for single side w/ no access to second side; grinding optional if second side accessible. FCAW may be used for dbl. sided welding with sec. side back gouged to bright metal & welded w/FCAW
Oscillation: None
Contact to Tube Work Distance: ½" ~ 1-1/4"
Multiple or Single Pass (per side): MULT.
Multiple or Single Electrodes: SINGLE
Electrode Spacing: NONE
Peening: NONE ALLOWED
Other: NO OCCILATION

PROCEDURE SPECIFICATION (WPS) JOINT DESIGNS
(Page 3 of 3)

WPS No.: 5011A Date: 4-18-12 Rev. No.: 3 Date: 11-23-16

JOINTS (QW-402

Single-V groove:	**GMAW/FCAW**
Backing:	No backing
Root opening:	3/32"~3/16"
Groove angle:	50° Min. included
Root face:	1/8" Max.

Single bevel groove:	**GMAW/FCAW**
Backing:	No backing
Root opening:	3/32"~3/16"
Groove angle:	45° Min. included
Root face:	1/8" Max.

Single-V groove:	**GMAW/FCAW**
Backing:	Backgouged & welded
Root opening:	¼" Max.
Groove angle:	50° Min. included
Root face:	3/16" Max.

Single bevel groove:	**GMAW/FCAW**
Backing:	Backgouged & welded
Root opening:	¼" Max.
Groove angle:	45° Min. included
Root face:	3/16" Max.

Double bevel groove:	**GMAW/FCAW**
Backing:	Backgouged & welded
Root opening:	¼" Max.
Groove angle:	50° Min. included
Root face:	3/16" Max.

Single J groove:	**GMAW/FCAW**
Backing:	No backing
Root opening:	3/32"~3/16"
Groove angle:	15° Min. included
Root face:	1/8" Max.

Double V groove:	**GMAW/FCAW**
Backing:	Backgouged & welded
Root opening:	¼" Max.
Groove angle:	45° Min. included
Root face:	3/16" Max.

Single U groove:	**GMAW/FCAW**
Backing:	No backing
Root opening:	3/32"~3/16"
Groove angle:	15° Min. included
Root face:	1/8" Max.

Single or double fillet weld:	**GMAW/FCAW**
Backing:	Base metal
Root opening:	3/16" Max.
Weld size:	See drawing details

1) Alternate weld joint designs may be shown on the drawings or engineering specifications and will take precedence.

2) Initial and interpass cleaning is shown on page 2 of the WPS.

3) Preheat shall be maintained during all thermal cutting, taking and backgouging operations as shown on the WPS.

4) Welds shall be cleaned as required on page 2 of the WPS.

Prepared By:	Juston Davis	Approved By:	Jose R. Estrada	Date:	11/23/16

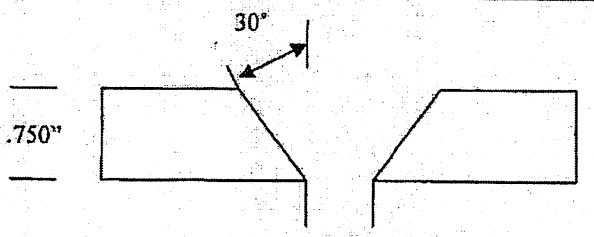
TULSA GAMMA RAY, INC.
1127 S Lewis Ave. Tulsa, OK 74104
PH 918-585-3228 FX 918-598-5584

QW-483 SUGGESTED FORMAT FOR PROCEDURE QUALIFICATION RECORD (PQR)

(See QW-200.0 Section IX, ASME Boiler and Pressure Vessel Code)
Record Actual Conditions Used to Weld Test Coupon.

Company UNITED CONTRACTING SERVICES
PQR No. 5011 Date 4-18-12
WPS No. 5011-A Welding Process(es) GMAW/FCAW
Types (Manual, Automatic, Semi-Auto) SEMI-AUTO

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. SA516
Type or Grade 70
P-No. 1 Gr. 1 to P-No. 1 Gr. 1
Thickness of Test Coupon 0.750"
Diameter of Test Coupon N.A.
Maximum Pass Thickness 0.250"
Other OPEN ROOT, NO BACKING

FILLER METALS (QW-404)

SFA Specification	5.18	5.20
AWS Classification	ER70S-6	E71T-1M
Filler Metal F-No.	6	6
Weld Metal Analysis A-No.	1	1
Size of Filler Metal	0.035"	0.045"
Filler Metal Product Form	SOLID	TUBULAR
Supplemental Filler Metal	NONE	NONE
Electrode Flux Classification	N/A	N/A
Flux Type	N/A	N/A
Flux Trade Name	N/A	N/A
Weld Metal Thickness	0.125"	0.437"

Other

POSITION (QW-405)
Position of Groove 1G
Weld Progression N.A.
Other N/A

PREHEAT (QW-406)
Preheat Temp. AMBIENT (70°F)
Interpass Temp. 475°F MAX
Other

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

GAS (QW-408)

	Gas(es)	Mixture (Percent Composition)	Flow Rate
Shielding	ARGON/CO2	75/25	35 CFH
Trailing	N/A	N/A	N/A
Backing	N/A	N/A	N/A

ELECTRICAL CHARACTERISTICS (QW-409)
Current DCEP /DCEP
Polarity REVERSE /REVERSE
Amps. 130 / 150 Volts 21/23
Tungsten Electrode Size N/A
Mode of Transfer for GMAW (FCAW) SEE BELOW
Other GMAW: GLOBULAR FCAW: GLOBULAR

TECHNIQUE (QW-410)
Travel Speed 12 IPM
String or Weave Bead STRINGER
Oscillation NONE
Multipass or Single Pass (per side) MULTIPASS
Single or Multiple Electrodes SINGLE
Other

UCS HE.
QC Approved
By
Date 4/18/12

TULSA GAMMA RAY, INC.
1127 S Lewis Ave. Tulsa, OK 74104
PH 918-585-3228 FX 918-598-5584

PQR No. 5011-A

Tensile Test (QW-150)

Specimen No.	Width	Thickness	Area	Ultimate Total Load lb.	Ultimate Unit Stress psi	Type of Failure & Location
1 (	0.755"	0.714"	0.5391	44,191	81,972	DUCTILE BASE METAL
2	0.755"	0.722"	0.5451	44,190	74,249	DUCTILE BASE METAL

Guided-Bend Tests (QW-160)

Type and Figure No.			Result
SIDE	FIG. 462.3(a)	102131246	PASS NO RELEVANT INDICATIONS GREATER THAN 1/8"
SIDE	FIG. 462.3(a)	102131246	PASS NO RELEVANT INDICATIONS GREATER THAN 1/8"
SIDE	FIG. 462.3(a)	102131246	PASS NO RELEVANT INDICATIONS GREATER THAN 1/8"
SIDE	FIG. 462.3(a)	102131246	PASS NO RELEVANT INDICATIONS GREATER THAN 1/8"

Toughness Tests (QW-170) N/A

Specimen No.	Notch Location	Specimen Size	Test Temp.	Impact Values			Drop Weight Break (Y/N)
				Ft. lbs	Lateral Expansion	% Shear	
1	WM 1/16"ROOT	10mm x 10mm	-20°F	23	19	55	N
2	WM 1/16"ROOT	10mm x 10mm	-20°F	19	17	50	N
3	WM 1/16"ROOT	10mm x 10mm	-20°F	13	13	45	N
4	WM 1/16" CAP	10mm x 10mm	-20°F	32	28	45	N
5	WM 1/16" CAP	10mm x 10mm	-20°F	23	22	50	N
6	WM 1/16" CAP	10mm x 10mm	-20°F	34	27	50	N
7	HAZ	10mm x 10mm	-20°F	18	18	40	N
8	HAZ	10mm x 10mm	-20°F	15	21	45	N
9	HAZ	10mm x 10mm	-20°F	16	19	45	N

Comments:

Fillet-Weld Test (QW-180) N/A

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

Macro-Results

Other Tests

Type of Test

Deposit Analysis

Other

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

Tests Conducted By Tulsa Gamma Ray, Inc. Laboratory Test No. 102131246

We certify that the statements in this record are correct and that the test welds were prepared, welded, and attested in accordance with the requirements of Section IX of the ASME Code.

Manufacturer UNITED CONTRACTING SERVICES

Date 4/18/12 By

UNITED CONTRACTING SERVICES

Tulsa, Ok.

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

Company Name UNITED CONTRACTING SERVICES Approved by / Date 8-21-13
WPS No: 5012-A Date 6-1-12 Supporting PQR No. (s) 5012
Revision No. 2 Date of Rev. 8-21-13 **Added "with filler Addition" comment**

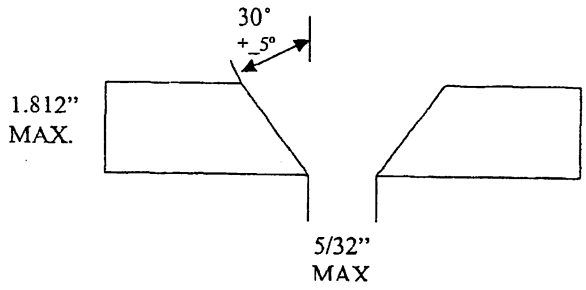
Welding Process(es) GTAW Type MANUAL
(Automatic, Manual, Machine, or Semi-Auto)

JOINTS (QW-402)
Joint Design Any
Backing With or without
Backing Material (Type) Per customer requirement
Refer to both backing and retainers

☐ Metal ☐ Nonfusing Metal
☐ Nonmetallic ☐ Other
No nonmetallic or non-fusing metal retainers used.

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 Mfgr. / sketches may be attached to illustrate joint design, weld layers and bead sequence, e.g., for notch toughness procedures, for multiple process procedures, etc.)

Details



V,J or U bevel grooves, fillets or other joints detailed on engineering drawings, production routing or repair procedures.

BASE METALS (QW-403)
No. 1 Group No. 1 or 2 to P-No. 1 Group No. 1 or 2
OR
Specification type and grade or UNS Number
to Specification type and grade or UNS Number
OR
Chem. Analysis and Mech. Prop
To Chem. Analysis and Mech. Prop
Thickness Range:
Base Metal: Groove 0.1875" TO 1.812" MAX Fillet UNLIMITED
Diameter Groove UNLIMITED Fillet UNLIMITED
Maximum Pass Thickness ≤ ½ in.(13mm)
Other No pass greater than ½"

*FILLER METALS (QW-404)

Spec. No. (SFA)	5.18
AWS No. (Class)	ER70S-6/ER70S-2
F-No.	6
A-No.	1(Verify Chemistry)
Size of Filler Metals	3/32", 1/8"
Filler Metal Product Form	SOLID
Supplemental Filler Metal	NONE
Weld Metal Thickness Range:	
Groove	1.812"
Fillet	ANY
Electrode-Flux (Class)	N.A.
Flux Trade Name	N.A.
Consumable Insert	N.A.
Other	With Filler Addition

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

UNITED CONTRACTING SERVICES

Tulsa, Ok.

			WPS No.	5012-A	Rev. 2

POSITIONS (QW-405)		POSTWELD HEAT TREATMENT (QW-407)	
Position(s) of Groove	ALL	Temp Range	N.A.
Welding Progression:	☐ DOWN ☒ Up	Time Range	N.A.
Position(s) of Fillet	ALL	Other	
Other			

PREHEAT (QW-406)			GAS (QW-408)	Percent Composition	
Preheat Temp. Min.	50°		Gas(es)	Mixture	Flow Rate
Interpass Temp. Max.	550°	Shielding	Argon	100	20-35 CFH
Preheat Maintenance		Trailing	N.A.	N.A.	N.A.
Other		Backing	N.A.	N.A.	N.A.
(Continuous or special heating where applicable should be recorded)		Other			

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass(es)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar	Current Amp. Range	Volt Range	Travel Speed (Range)	Other ; Remarks And Comments
ALL	GTAW	ER70S-6 OR ER70S-2	3/32" OR 1/8"	DCEN	75-150	10-13	3-7 ipm	
ALL	GTAW	ER70S-6 OR ER70S-2	3/32" OR 1/8"	DCEN	75-150	10-13	3-8 ipm	

Amps and volts range should be recorded for each electrode size, position, and thickness, etc.

Pulsing Current N/A Heat Input (max.) N/A

Tungsten Electrode Size and Type: 3/32" or 1/8" EWTh-2
(Pure Tungsten, 2% Thoriated, etc.)

Mode of Metal Transfer for GMAW (FCAW): N/A
(Spray Arc, Short Circuiting Arc, etc.)

Electrode Wire Feed Speed Range: N/A

Other:

TECHNIQUE (QW-410)

String or Weave Bead: STRING or WEAVE

Orifice, Nozzle or Gas Cup Size: #4 TO #12

Initial and Interpass Cleaning (brushing, Grinding, etc.) BRUSHING AND GRINDING AS NEEDED

Method of Back Gouging CARBON ARC GOUGHING

Oscillation: NONE

Contact Tube to Work Distance: N/A

Multiple or Single (per side): MULTIPASS

Multiple or Single Electrodes: SINGLE

Electrode Spacing: N/A

Peening: NONE ALLOWED

Other:

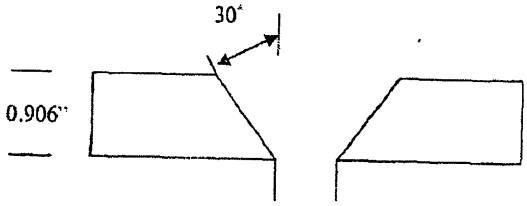
TULSA GAMMA RAY, INC.
1127 S Lewis Ave. Tulsa, OK 74104
PH 918-585-3228 FX 918-598-5584

QW-483 SUGGESTED FORMAT FOR PROCEDURE QUALIFICATION RECORD (PQR)

(See QW-200.0 Section IX, ASME Boiler and Pressure Vessel Code)
Record Actual Conditions Used to Weld Test Coupon.

Company UNITED CONTRACTING SERVICES
PQR No. 5012 Date 6-1-12 Corrected Deposited Filler Metal Thickness & Typos Date: 8-21-13
WPS No. 5012-A 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. SA106
Type or Grade B
P-No. 1 Gr. 1 to P-No. 1 Gr. 1
Thickness of Test Coupon 0.906"
Diameter of Test Coupon N.A.
Maximum Pass Thickness 0.250"
Other OPEN ROOT, NO BACKING

FILLER METALS (QW-404)
SFA Specification 5.18
AWS Classification ER70S-6
Filler Metal F-No. 6
Weld Metal Analysis A-No. 1
Size of Filler Metal 3/32"
Filler Metal Product Form SOLID
Supplemental Filler Metal NONE
Electrode Flux Classification N/A
Flux Type N/A
Flux Trade Name N/A
Weld Metal Thickness 0.906"
Other With filler addition

POSITION (QW-405)
Position of Groove 1G
Weld Progression N.A.
Other N/A

PREHEAT (QW-406)
Preheat Temp AMBIENT (90°F)
Interpass Temp. 475°F MAX
Other

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

GAS (QW-408)

	Gas(es)	Percent Composition Mixture	Flow Rate
Shielding	ARGON	100%	35 CFH
Trailing	N/A	N/A	N/A
Backing	N/A	N/A	N/A

ELECTRICAL CHARACTERISTICS (QW-409)
Current DCEN
Polarity STRAIGHT
Amps. 130 Volts 19
Tungsten Electrode Size 1/8" EWTh-2
Mode of Transfer for GMAW (FCAW) N/A
Other N/A

TECHNIQUE (QW-410)
Travel Speed 10 IPM
String or Weave Bead STRINGER
Oscillation NONE
Multipass or Single Pass (per side) MULTIPASS
Single or Multiple Electrodes SINGLE
Other

TULSA GAMMA RAY, INC.
1127 S Lewis Ave. Tulsa, OK 74104
PH 918-585-3228 FX 918-598-5584

QW-483 (BACK)

PQR No. 5012

Tensile Test (QW-150)

Specimen No.	Width	Thickness	Area	Ultimate Total Load lb.	Ultimate Unit Stress psi	Type of Failure & Location
1	0.748	0.893	0.6679	53,726	80,440	DUCTILE BASE METAL
2	0.753	0.905	0.6814	51,064	74,940	DUCTILE BASE METAL

Guided-Bend Tests (QW-160)

Type and Figure No.	Result
SIDE FIG. 462.2	PASS NO RELEVANT INDICATIONS GREATER THAN 1/8"
SIDE FIG. 462.2	PASS NO RELEVANT INDICATIONS GREATER THAN 1/8"
SIDE FIG. 462.2	PASS NO RELEVANT INDICATIONS GREATER THAN 1/8"
SIDE FIG. 462.2	PASS NO RELEVANT INDICATIONS GREATER THAN 1/8"

Hardness Test- Brinell Hardness

Location	Readings 1	2	3
HAZ	162	176	226
WELD	200	210	198
HAZ	196	176	185

Comments:

Fillet-Weld Test (QW-180) N/A

Result-Satisfactory Yes ____ No ____ Penetration into Parent Metal: Yes ____ No ____

Macro-Results

Other Tests N/A

Type of Test

Deposit Analysis

Other

Welder's Name JORGE PANDO Clock No. ____ Stamp No. A

Tests Conducted By Tulsa Gamma Ray, Inc. Laboratory Test No. 102131720

We certify that the statements in this record are correct and that the test welds were prepared, welded, and attested in accordance with the requirements of Section IX of the ASME Code.

Manufacturer UNITED CONTRACTING SERVICES

Date 8-21-13 By

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

Juston W Davis CWI 12111641 QC1 EXP. 11/1/2015

Company Name **UNITED CONTRACTING SERVICES** By: Tim Morris Approved By:
Welding Procedure Specification No. **GT-1-1.2 -50CVN** Date 11-18-14 Supporting PQR No.(s) 14-14534
Revision No. 0 Date N/A
Welding Process(es) **GAS TUNGSTEN ARC WELDING (GTAW)** Type(s) Manual
(Automatic,Manual,Machine,Semi-auto)

Joints (QW-402) Details

Joint Design: Single Vee or Bevel , Double Vee or Bevel, Fillet
Root Spacing: 3/32" to 3/16"
Backing (Yes): Optional (No): GTAW- open rrot
Backing Material (type): Weld metal or base metal
(Refer to both backing and retainers.)

☒ Metal ☐ Nonfusing Metal
☐ Nonmetallic ☐ Other

See page 3 of WPS for joint design details.
*1 See shop drawings for optional joint designs used with this WPS.

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 Mfgr., sketches may be attached to illustrate joint design, weld layers and bead sequence, e.g. for notch toughness procedures, for multiple process, procedures, etc.)

This WPS may be used in conjunction with other WPS' as indicated on shop drawings. (Ex. Used for repair or root pass.)

*** BASE METALS (QW-403)**

P-No. 1 Group No. 1 or 2 to P-No. 1 Group No. 1 or 2
OR
Specification type and grade: Ex: SA-106-B
To Specification type and grade: Ex: SA-105
OR
Chem. Analysis and Mech. Prop.:
To Chem. Analysis and Mech. Prop.:
Thickness Range:
Base Metal: Groove 3/8" to 3/4" Fillet Unlimited
Maximum Pass Thickness ≤ ½ in. (Yes) X (No)
Other

*** FILLER METALS (QW-404)**	**GTAW**	
Spec. No. (SFA)	5.18	
AWS No. (Class)	**ER70S-6**	
F-No.	6	
A-No.	1 *	*ER70S-6 weld cert. must meet
Size of Filler Metals	1/16", 3/32", 1/8"	1.60% max. Mn and 1.0% max. Si
Filler Metal Product Form	Solid (bare) wire	to meet A1 chemistry.
Supplemental Filler Metal	None	
Weld Metal Thickness Range: Groove	5/8" maximum deposit.**	
Fillet	Unlimited	
Electrode-Flux (Class)	None used for aid in penetration	
Flux Trade Name	N/A	
Consumable Insert	None	
Other	** Due to the mismatch on the coupon, the mechanical testing and CVN's were taken from 5/16" thk. machined material.	

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

WPS No. GT-1-1.2 -50 CVN Rev. 0

POSITIONS (QW-405)

Positions(s) of Groove 1G & 2G
Welding Progression: Up N/A Down N/A
Position(s) of Fillet 1F & 2F
Other

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range None (As welded condition)
Time Range N/A
Other N/A

PREHEAT (QW-406)

Preheat Temp. Min. 60° F
Interpass Temp. Max. 450° F
Preheat Maintenance None after completion of weldment.
(Continuous or special heating where applicable should be recorded)

GAS (QW-408)

	Gas(es)	Percent Composition Mixture	Flow rate
Shielding	Argon	99.995%	25-40 CFH
Trailing	None		
Backing	None		
Other			

ELECTRICAL CHARCACTERISTICS (QW-409)

Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp Range	Volt Range	IPM Travel Speed Range	Wire Feed Speed Range	Energy or Power Range	(e.g. Remarks Comment Technique
	GTAW	ER70S-6	1/16"	DC/SP	70-120	14-21	2.8-6	N/A	*	
	GTAW	ER70S-6	3/32"	DC/SP	80-150	14-21	2.8-7	N/A		
	GTAW	ER70S-6	1/8"	DC/SP	120-150	15-21	2.8-8	N/A		

Amps and volts, or power or energy range, should be recorded for each electrode size

Pulsing Current None Heat Input Range. 67,500 J/in. maximum qualified
Tungsten Electrode size 3/32" or 1/8" EWTh-2
Mode of Transfer for GMAW (FCAW) N/A
Other * Power range is not recorded.

TECHNIQUE (QW-410)

String or Weave Bead String or weave bead
Orifice or Gas Cup Size #6 - #10
Initial and Interpass Cleaning (Brushing, Grinding, etc. **All deleterious materials shall be removed 1" both sides of weld joint by grinding or wire brushing or descaling. Light flash rust after grinding or descaling is acceptable. Interpass cleaning with wire brush, grinding or chatter gun.**
Method of Back Gouging Double side weld- Air carbon arc and/or grind second side to sound metal. NA for fillet welds or open root.
Oscillation None
Contact to Tube Work Distance N/A
Multiple or Single Pass (per side) Multiple
Multiple or Single Electrodes Single
Electrode Spacing Manual
Peening None
Other

PROCEDURE SPECIFICATION (WPS) JOINT DESIGNS
(Page 3 of 3)

WPS No.: GT-1-1.2 -50CVN Date: 11-18-14 Rev. No.: 0 Date: N/A

JOINTS (QW-402

Single-V groove:	**GTAW**	**Single bevel groove:**	**GTAW**
Backing:	No backing	Backing:	No backing
Root opening:	3/32" – 1/4"	Root opening:	3/32" – 1/4"
Groove angle:	50 deg. Min. included	Groove angle:	45 deg. Min. included
Root face:	1/8" Max	Root face:	1/8" Max
Single-V groove:	**GTAW**	**Single bevel groove:**	**GTAW**
Backing:	Backgouged & welded	Backing:	Backgouged & welded
Root opening:	1/4" Max.	Root opening:	1/4" Max.
Groove angle:	50 deg. Min. included	Groove angle:	45 deg. Min. included
Root face:	3/16" Max.	Root face:	3/16" Max.
Double bevel groove:	**GTAW**	**Single J groove:**	**GTAW**
Backing:	Backgouged & welded	Backing:	No backing
Root opening:	1/4" Max.	Root opening:	3/32" – 3/16"
Groove angle:	50 deg. Min. included	Groove angle:	15 deg. Min. included
Root face:	3/16" Max.	Root face:	1/8" Max
Double V groove:	**GTAW**	**Single U groove:**	**¾" U GTAW**
Backing:	Backgouged & welded	Backing:	No backing
Root opening:	1/4" Max.	Root opening:	3/32" – 3/16"
Groove angle:	45 deg. Min. included	Groove angle:	15 deg. Min. included
Root face:	3/16" Max.	Root face:	1/8" Max

Single or double fillet weld: GTAW

Backing:	Base metal
Root opening:	3/16" Max.
Weld size:	See drawings

1) Alternate weld joint designs may be shown on the drawings or engineering specifications WS 1.00-10 and will take precedence.

2) Initial and interpass cleaning is shown on page 2 of the WPS.

3) Preheat shall be maintained during all thermal cutting, taking and backgouging operations as shown on the WPS.

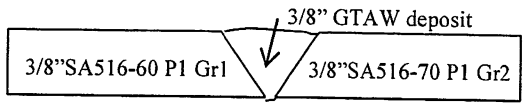
4) Welds shall be cleaned as required on page 2 of the WPS.

Prepared By:	Tim Morris	Approved By:	Juston W Davis CWI 12111641 QC1 EXP. 11/1/2015	Date:	

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

Company Name **UNITED CONTRACTING SERVICES**
Procedure Qualification Record No. 14-14534 Date 11-18-14
WPS No. **GT-1-1.2 -50 CVN**
Welding Processes(es) **GAS TUNGSTEN ARC WELDING (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. SA-516-60 to SA-516-70
Type or Grade Dual certified plate
P No. 1 Gr. No. 1 to P No 1 Gr. No 2
Thickness of Test Coupon 3/8"
Diameter of Test Coupon N/A (plate test)
Max. pass thk. < 1/2"
Other SA-516-60/70 Nucor Ht# 4500920

POSTWELD HEAT TREATMENT (QW-407)
Temperature None (As welded)
Time N/A
Other N/A

GAS (QW-408)

	Gas(es)	Percent Composition (Mixture)	Flow rate
Shielding	Argon	99.995%	40 CFH
Trailing	None		
Backing	None		

FILLER METALS (QW-404)	**GTAW**
SFA Specification	5.18
AWS Classification	ER70S-6
Filler metal F-No.	6
Weld Metal Analysis A-No.	1
Size of Filler Metal	3/32"
Filler metal product form	Bare (solid) wire
Supplemental Filler Metal	N/A
Electrode Flux Classification	N/A
Flux Type	N/A
Flux trade name	None
Weld Metal Thickness	3/8"
Consumable inserts	None

Other GTAW: Oxford Alloys 3/32" HT# SA02684
Meets A1 chemistry

ELECTRICAL CHARACTERISTICS (QW-409)
Current DC
Polarity Straight
Amps 150
Volts 21
Tungsten Electrode Size 1/8" EWTh-2
Pulsing Amps None
J/in. Qualified (CVN's) 67,500 J/in
Mode of metal transfer
GMAW/FCAW N/A
Other

POSITION (QW-405)
Position of Groove 1G .
Weld Progression (Uphill, Downhill) N/A
Other

PREHEAT (QW-406)
Preheat Temp. (min.) 60°F (ambient temp.)
Interpass Temp. (max.) 400°F
Other

TECHNIQUE (QW-410)
Travel Speed 2.8 IPM
String or Weave Bead Weave
Oscillation None
Multipass or Single Pass (per side) Multipass
Single or Multiple Electrodes Single
Other

QW-483 (Back)

PQR No. 14-1453

Tensile Test (QW-150)

Specimen No.	Width (in)	Thickness (in)	Area (sq. in)	Ultimate Total Load lb	Ultimate Unit Stress Psi	Type of Failure & Location
1	0.751	0.328	0.246	19,840	80,650	Base-ductile
2	0.746	0.304	0.277	18,230	80,308	Base-ductile

Guided-Bend Tests (QW-160)

Type and Figure No. QW-462.2a	Result
#1 Side bend	Satisfactory
#2 Side bend	Satisfactory
#3 Side bend	Satisfactory
#4 Side bend	Satisfactory

Toughness Tests (QW-170) (N/A)

Specimen No.	Notch Location	Notch Type	Test Temp.°F	Impact Values			Drop Weight	
				Values ft/lb	% Shear	Mils (in.)	Break	No Break
1,2,3	Weld	"V"	-50 *	45,45,10	N/A	N/A	N/A	N/A
1,2,3	HAZ (SA516-60)	"V"	-50 *	57,46,64	N/A	N/A	N/A	N/A
1,2,3	HAZ (SA516-70)	"V"	-50 *	64,54,34	N/A	N/A	N/A	N/A
					N/A	N/A	N/A	N/A
					N/A	N/A	N/A	N/A
					N/A	N/A	N/A	N/A
Specimen Size 10mm X 7mm *(Actual test temperature due to sub-sized specimen was -58°F)								

Fillet-Weld Tests (QW-180)

Result- Satisfactory: Yes N/A No N/A Penetration into Parent Metal: Yes N/A No N/A

Macro- Results N/A

Other Tests

Type of Test BHN: SA-516-70 (141,139,141) , HAZ (156,156,159) Weld (162,153,159) SA-516-60 (132,130,137) HAZ (153,156, 159)

Other N/A

Welders Name Jorge Pando Sr. Clock No. N/A Stamp No. A

Test conducted by: Sun Materials Testing / Element Laboratory Test No. 14-14534-1/-2

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.

Organization UNITED CONTRACTING SERVICES

Date 11-18-14 By: Tim Morris Certified by

Juston W Davis
CWI 12111641
QC1 EXP. 11/1/2015

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

Juston W Davis
CWI 12111841
QC1 EXP. 11/1/2015

Company Name **UNITED CONTRACTING SERVICES** By: Tim Morris Approved By:
Welding Procedure Specification No. GM-FC-1-1.2 -50 CVN Date 11-9-14 Supporting PQR No.(s) 14-14510
Revision No. 0 Date N/A
Welding Process(es) **GAS METAL ARC WELDING (GMAW) &** Type(s) Semi-automatic
FLUX CORED ARC WELDING (FCAW) (Automatic,Manual,Machine,Semi-auto)

Joints (QW-402)

Joint Design Single V or Bevel , Double V or Bevel, Fillet
Root Spacing 3/32" to 3/16"
Backing (Yes) Optional (No) GMAW- open root
Backing Material (type) Weld metal or base metal
(Refer to both backing and retainers.)

☒ Metal ☐ Nonfusing Metal
☐ Nonmetallic ☐ 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 Mfgr., sketches may be attached to illustrate joint design, weld layers and bead sequence, e.g. for notch toughness procedures, for multiple process, procedures, etc.)

Details

See page 3 of WPS for joint design details.
*1 See shop drawings for optional joint designs used with this WPS.

This WPS may be used in conjunction with other WPS' as indicated on shop drawings. (Ex. Used for repair or root pass.)

*** BASE METALS (QW-403)**

P-No. 1 Group No. 1 or 2 to P-No. 1 Group No. 1 or 2
OR
Specification type and grade Ex: SA-106-B Normalized
To Specification type and grade Ex: SA-516-60/70 Normalized
OR
Chem. Analysis and Mech. Prop. Base material must be in the normalized condition.
To Chem. Analysis and Mech. Prop.
Thickness Range:
Base Metal: Groove 3/8" to 3/4" * Fillet Unlimited
Maximum Pass Thickness ≤ ½ in. (Yes) X (No)
Other *Maximum fill on a 3/4" thk. base metal is 0.6375" due to GMAW short circuiting arc process.

*** FILLER METALS (QW-404)**	**FCAW**	**GMAW**
Spec. No. (SFA)	5.20	5.18
AWS No. (Class)	E71T-12MJ	ER70S-6
F-No.	6	6
A-No.	E71T-12MJ (Kobe DWA-55ESR) *	ER70S-6 *
Size of Filler Metals	.045"	.035"
Filler Metal Product Form	Flux cored wire wire	Solid (bare) wire
Supplemental Filler Metal	None	None
Weld Metal Thickness Range: Groove	1/2" maximum	0.1375" maximim
Fillet	Unlimited	Unlimited
Electrode-Flux (Class)	N/A	N/A
Flux Trade Name	N/A	N/A
Consumable Insert	N/A	N/A
Other	Alloy elements: None	Alloy elements: None
	*Cert. must meet < 1.60 Mn & < .90 Si for A1	*Cert. must meet < 1.60 Mn & < .90 Si for A1

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

WPS No. GM-FC-1-1.2 -50 CVN Rev. 0

POSITIONS (QW-405)

Positions(s) of Groove: All positions
Welding Progression: Up x Down
Position(s) of Fillet: All positions
Other

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range: As Welded Condition
Time Range: N/A
Other

PREHEAT (QW-406)

Preheat Temp. Min.: 60° F
Interpass Temp. Max.: 450° F
Preheat Maintenance: None after completion of weldment.
(Continuous or special heating where applicable should be recorded)

GAS (QW-408)

	Gas(es)	Percent Composition Mixture	Flow rate
Shielding	Argon/CO2	75/25%	25-40 CFH
Trailing	None		
Backing	None		
Other			

ELECTRICAL CHARCACTERISTICS (QW-409)

Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp Range	Volt Range	IPM Travel Speed Range	Wire Feed Speed Range	Energy or Power Range	(e.g. Remarks Comment Technique
Root	GMAW	ER70S-6	.035"	DC/RP	70-100	14-16	4 - 6	N/A	*	
Fill & Cap	FCAW	E71T-12MJ	.045"	DC/RP	175-190	23-25	11-14	N/A		

Amps and volts, or power or energy range, should be recorded for each electrode size

Pulsing Current: None Heat Input Range. GMAW: 24,000 J/in. max. FCAW: 25,909 J/in max.
Tungsten Electrode size: N/A
Mode of Transfer for GMAW (FCAW): GMAW; Short circuiting arc FCAW: Globular
Other: * Power range is not recorded.

TECHNIQUE (QW-410)

String or Weave Bead: GMAW- string or weave bead FCAW- String bead
Orifice or Gas Cup Size: 5/16" or ¾" I.D.
Initial and Interpass Cleaning (Brushing, Grinding, etc.: **All deleterious materials shall be removed 1" both sides of weld joint by grinding or wire brushing or descaling. Light flash rust after grinding or descaling is acceptable. Interpass cleaning with wire brush, grinding or chatter gun.**
Method of Back Gouging: NA for single side GMAW welding w/out access to back side of joint. Grinding optional if back side is accessible. FCAW may be used for double sided weld with second side backgouged, ground to bright metal and welded with FCAW.
Oscillation: None
Contact to Tube Work Distance: ½" to 1 ¼"
Multiple or Single Pass (per side): Multiple
Multiple or Single Electrodes: Single
Electrode Spacing: Manual
Peening: None
Other

PROCEDURE SPECIFICATION (WPS) JOINT DESIGNS

WPS No.: GM-FC-1-1.2 -50CVN Date: 11-9-14 Rev. No.: 0 Date: N/A

JOINTS (QW-402

Single-V groove:	**GMAW/FCAW**
Backing:	No backing
Root opening:	3/32" – 1/4"
Groove angle:	50 deg. Min. included
Root face:	1/8" Max

Single bevel groove:	**GMAW/FCAW**
Backing:	No backing
Root opening:	3/32" – 1/4"
Groove angle:	45 deg. Min. included
Root face:	1/8" Max

Single-V groove:	**GMAW/FCAW**
Backing:	Backgouged & welded
Root opening:	1/4" Max.
Groove angle:	50 deg. Min. included
Root face:	3/16" Max.

Single bevel groove:	**GMAW/FCAW**
Backing:	Backgouged & welded
Root opening:	1/4" Max.
Groove angle:	45 deg. Min. included
Root face:	3/16" Max.

Double bevel groove:	**GMAW/FCAW**
Backing:	Backgouged & welded
Root opening:	1/4" Max.
Groove angle:	50 deg. Min. included
Root face:	3/16" Max.

Single J groove:	**GMAW/FCAW**
Backing:	No backing
Root opening:	3/32" – 3/16"
Groove angle:	15 deg. Min. included
Root face:	1/8" Max

Double V groove:	**GMAW/FCAW**
Backing:	Backgouged & welded
Root opening:	1/4" Max.
Groove angle:	45 deg. Min. included
Root face:	3/16" Max.

Single U groove:	**¾" U GMAW/FCAW**
Backing:	No backing
Root opening:	3/32" – 3/16"
Groove angle:	15 deg. Min. included
Root face:	1/8" Max

Single or double fillet weld:	**GMAW/FCAW**
Backing:	Base metal
Root opening:	3/16" Max.
Weld size:	See drawings

1) Alternate weld joint designs may be shown on the drawings or engineering specifications WS 1.00-10 and will take precedence.

2) Initial and interpass cleaning is shown on page 2 of the WPS.

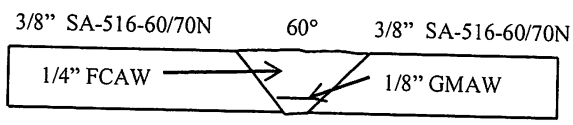
3) Preheat shall be maintained during all thermal cutting, taking and backgouging operations as shown on the WPS.

4) Welds shall be cleaned as required on page 2 of the WPS.

Prepared By:	Tim Morris	Approved By:	Juston W Davis CWI 12111641 QC1 EXP. 11/1/2015	Date:	11-9-14

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

Company Name **UNITED CONTRACTING SERVICES**
Procedure Qualification Record No. 14-14510 Date 11-9-14
WPS No. **GM-FC-1-1.2 -50 CVN**
Welding Processes(es) **GAS METAL ARC WELDING (GMAW) & FLUX CORED ARC WELDING (FCAW)**
Types (Manual, Automatic,Semi-auto.) Semi-automatic



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. SA-516 to SA516
Type or Grade Dual certified to Gr.60 & Gr. 70 normalized.
P No. 1 Gr. No. 1/2 to P No 1 Gr. No 1/2
Thickness of Test Coupon 3/8"
Diameter of Test Coupon N/A plate test
Max. pass thk. < 1/2"
Other NUCOR SA-516-60/70 HT# 4500920

Qualifies T thk. 3/8" – 3/4 " with CVN's
Qualifies t thk. GMAW: Sec, IX CVN's 0.1375" max.
Qualifies t thk. FCAW: Sec, IX CVN's 1/2" max.

POSTWELD HEAT TREATMENT (QW-407)
Temperature As welded condition
Time N/A
Other

GAS (QW-408)

	Gas(es)	(Mixture)	Flow rate
	Percent Composition		
Shielding	Ar/CO2	75/55%	30 CFH *
Trailing	None		
Backing	None		
		*FCAW	40 CFH

FILLER METALS (QW-404)	FCAW	GMAW
SFA Specification	5.20	5.18
AWS Classification	E71T-12MJ	ER70S-6
Filler metal F-No.	6	6
Weld Metal Analysis A-No.	E71T-12MJ	ER70S-6
Size of Filler Metal	.045"	.035"
Filler metal product form	Flux cored	Bare (solid) wire
Supplemental Filler Metal	None	None
Electrode Flux Classification	N/A	N/A
Flux Type	N/A	N/A
Flux trade name	N/A	N/A
Weld Metal Thickness	1/4"	1/8"
Consumable inserts	N/A	N/A

Other GMAW: Exocor" HT# X7910 Ally elements: None
FCAW Kobelco DW-A55ESR HT# AW4569

ELECTRICAL CHARACTERISTICS (QW-409)
Current GMAW – DC FCAW – DC
Polarity GMAW –Reverse FCAW- Reverse
Amps GMAW- 100 FCAW- 190
Volts GMAW- 16 FCAW-25
Tungsten Electrode Size N/A
Pulsing Amps None
J/in. Qualified (CVN's) GMAW: 24,000 J/in
FCAW: 25,909 J/in
Mode of metal transfer
GMAW/FCAW GMAW: Short circuiting arc
Other FCAW: Globular

POSITION (QW-405)
Position of Groove 3G
Weld Progression (Uphill, Downhill) Up-hill
Other

PREHEAT (QW-406)
Preheat Temp. (min.) 70°F (ambient temp.)
Interpass Temp. (max.) 450°F
Other

TECHNIQUE (QW-410)
Travel Speed GMAW- 4 IPM FCAW- 11 IPM
String or Weave Bead GMAW –Weave FCAW- String
Oscillation None
Multipass or Single Pass (per side) Multipass
Single or Multiple Electrodes Single
Other

QW-483 (Back)

PQR No. 14-14510

Tensile Test (QW-150)

Specimen No.	Width (in)	Thickness (in)	Area (sq. in)	Ultimate Total Load lb	Ultimate Unit Stress Psi	Type of Failure & Location
1	0.752	0.330	0.248	19,020	76,694	Weld -ductile
2	0.753	0.347	0.261	20,490	78,508	Weld -ductile

Guided-Bend Tests (QW-160)

Type and Figure No. QW-462.2a	Result
#1 Side bend	Satisfactory
#2 Side bend	Satisfactory
#3 Side bend	Satisfactory
#4 Side bend	Satisfactory

Toughness Tests (QW-170) (N/A)

Specimen No.	Notch Location	Notch Type	Test Temp.°F	Impact Values			Drop Weight	
				Values ft/lb	% Shear	Mils (in.)	Break	No Break
1,2,3	Weld 1/16" root surface	"V"	-50	62,61,41	N/A	N/A	N/A	N/A
1,2,3	HAZ	"V"	-50	39,74,61	N/A	N/A	N/A	N/A
					N/A	N/A	N/A	N/A
					N/A	N/A	N/A	N/A
					N/A	N/A	N/A	N/A
					N/A	N/A	N/A	N/A
Specimen Size 10mmX10mm								

Fillet-Weld Tests (QW-180)

Result- Satisfactory: Yes N/A No N/A Penetration into Parent Metal: Yes N/A No N/A

Macro- Results N/A

Other Tests

Type of Test BHN: Base- 150,179,141 Weld- 150,159,141 HAZ- 169,162,147

Deposit Analysis N/A

Other N/A

Welders Name Marco Morenos Clock No. N/A Stamp No. M2

Test conducted by: Sun Materials Testing / Element Laboratory Test No. 14-14510-1/-2

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 and NACE standards.

Organization **UNITED CONTRACTING SERVICES**

Date 11-9-14 By: Tim Morris Certified by

Juston W Davis
CWI 12111641
QC1 EXP. 11/1/2015

MATERIALS TESTING

Division of Sun Heat Treating Inc.

Client: **United Contracting Service**
2716 East Apache St
Tulsa, Oklahoma 74110

Report No: 14-14510-1
Date: November 5, 2014
Auth By: Tim Morris

Subject: Weld Procedure Qualification per ASME Section IX.

Identification:	Procedure No:	GM-FC-1.1-1.2-50CVN (GMAW/FCAW)
	Base Material:	SA516-60/70 to SA516-60/70
	Heat No:	812A36440
	Electrode:	Filler 1: ER-70S-6CF Plus/Heat X7910
		Filler 2: DW-A55ESR/Heat AW456A E71T-12MJ
	Welder:	Mr. Marco Morenos/Stamp M2
	Position:	3G Uphill

TENSILE TEST (QW-150)

	Tensile 1	Tensile 2
Width (in)	0.752	0.753
Thickness (in)	0.330	0.347
Area (sqin)	0.248	0.261
Ultimate load (lbs)	19,020	20,490
Ultimate stress (psi)	**76,694**	**78,508**
Failure Type	Ductile	Ductile
Failure Location	Weld	Weld

TRANSVERSE GUIDED BEND TEST (QW-160)

Specimen Type	Accept/Reject QW-163	Specimen Type	Accept/Reject QW-163
No 1 Side Bend	**Acceptable**	No 2 Side Bend	**Acceptable**
No 3 Side Bend	**Acceptable**	No 4 Side Bend	**Acceptable**

BRINELL HARDNESS SURVEY OF WELD CROSS SECTION

Location	Reading 1	Reading 2	Reading 3	Average Rb/BHN
Weld Zone	80/150	83/159	77/141	80Rb/150BHN
Heat Affected Zone	86/169	84/162	79/147	83Rb/159BHN
Base Material	80/150	79/179	77/141	79Rb/147BHN

SUN HEAT TREATING INC.
Materials Testing Division
Paul R. Secrest
Paul R. Secrest/President

Juston W Davis.
CWI 12111641
QC1 EXP. 11/1/2015

MATERIALS TESTING

Division of Sun Heat Treating Inc.

Client: **United Contracting Service**
2716 East Apache St
Tulsa, Oklahoma 74110

Report No: 14-14510-2
Date: November 5, 2014
Auth By: Tim Morris

Subject: Charpy Impact Testing per ASME Section VIII, Div 2, UG-84 (2013).

Identification:		
	Procedure No:	GM-FC-1.1-1.2-50CVN (GMAW/FCAW)
	Base Material:	SA516-60/70 to SA516-60/70
	Heat No:	812A36440
	Electrode:	Filler 1: ER-70S-6CF Plus/Heat X7910
		Filler 2: DW-A55ESR/Heat AW456A E71T-12MJ
	Welder:	Mr. Marco Morenos/Stamp M2
	Position:	3G Uphill

Results:

CHARPY IMPACT TEST AT -50°F.

Weld Zone:	**62**	**61**	**41**	ft-lbs
Heat Affected Zone:	**39**	**74**	**61**	ft-lbs

End of Data

TEST PARAMETERS

Type of Machine: Tinius Olsen 74
Serial No: 123871/Next Calibration 09-15
Impact Velocity: 17 ft/sec
Specimen Type: "V" notch

Available Impact: 264 ft-lbs
Method of Test: ASTM A370/E23
Specimen Location: Per UG 84
Specimen Size: 10mm x 8.7mm

Temperature Measurement: Kiethly RTD/MOC 868
Serial No: 1481976/Next Calibration 12-14

SUN HEAT TREATING INC.
Materials Testing Division
Paul R. Secrest
Paul R. Secrest/President

Juston W Davis
CWI 12111641
QC1 EXP. 11/1/2015

UCS QC Approved By RK Date 3-9-13

QW-482 SUGGESTED FORMAT FOR WELDING PROCEDURE SPECIFICATION (WPS)

(See QW-200.1, Section IX, ASME Boiler and Pressure Vessel Code)

Company Name UNITED CONTRACTING SERVICES INC. By: Tim Morris Approved by: Robert Kent

Welding Procedure Specification No. 5001-A Date 3-30-09 Supporting PQR No.(s) 5001-A

Revision No. 3 Date 3-9-13

Welding Process(es) GAS TUNGSTEN ARC WELDING (GTAW) Type(s) GTAW -manual

(Automatic,Manual,Machine,Semi-auto)

Joints (QW-402) Details

Joint Design Single V or Bevel , Double V or Bevel *1

Backing (Yes) Optional (No) GTAW-open root

Backing Material (type) Weld or base metal for double side weld

Retainers: None (Refer to both backing and retainers.)

☒ Metal ☐ Nonfusing Metal

☐ Nonmetallic ☐ Other

Joint Designs page 3 of WPS

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 Mfgr., sketches may be attached to illustrate joint design, weld layers and bead sequence, e.g. for notch toughness procedures, for multiple process, procedures, etc.)

*1 See shop drawings for optional joint designs used with this WPS. This WPS may be used in conjunction with other WPS' as indicated on shop drawings.

*** BASE METALS (QW-403)**

P-No. 8 Group No. 1 to P-No. 8 Group No. 1

OR

Specification type and grade Example: SA-240 Type 308L / 308 or 316L / 316

To Specification type and grade

OR

Chem. Analysis and Mech. Prop.

To Chem. Analysis and Mech. Prop.

Thickness Range:

Base Metal: Groove 3/16" – 0.864" Fillet Unlimited

Pipe Dia. Range: Groove All Diameters Fillet All Diameters

Other

*** FILLER METALS (QW-404)**	**GTAW**	
Spec. No. (SFA)	5.9	
AWS No. (Class)	ER308L, ER309L, ER316L *	
F-No.	6	
A-No.	8	
Size of Filler Metals	1/16", 3/32", 1/8"	
Weld Metal Thickness Range:		
Groove	0.864" maximum deposit	
Fillet	Unlimited	*ER308L with 304 or 304L base metals
Electrode-Flux (Class)	N/A	*ER316L with 316 or 316L base metal
Flux Trade Name	N/A	*ER309L with 310 to 304 or 304L base metals
Consumable Insert	None	
Other	Solid (bare) wire	
	Addition of flux: None	

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

WPS No. **5001-A** Rev. 3

POSITIONS (QW-405)

Positions(s) of Groove: All positions

Welding Progression: Up Yes Down

Position(s) of Fillet: All positions

PREHEAT (QW-406)

Preheat Temp. Min.: 50° F

Interpass Temp. Max.: 350°F

Preheat Maintenance: None

(Continuous or special heating where applicable should be recorded)

POSTWELD HEAT TREATMENT (QW-407)

Temperature Range: As Welded

Time Range: N/A

GAS (QW-408)

GTAW	Gas(es)	Percent Composition Mixture	Flow rate
Shielding	Argon	99.995%	20-40 CFH
Trailing	None		
Backing	Argon	99.995%	**

** Prior to welding, purge with 6 – 8 volume changes of Argon @ 20 – 40 CFH. During welding, continue to purge @ 10-20 CFH to minimize back pressure until weld is completed or a minimum of 1/4" weld is deposited. O2 < .5% in purge area.

ELECTRICAL CHARCACTERISTICS (QW-409)

Current AC or DC: Below Polarity: Below

Amps (Range): Below Volts (Range): Below

(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: EWTh-2 3/32" or 1/8"

(Pure Tungsten, 2% Thoriated, etc.)

Mode of Metal Transfer for GMAW: N/A

(Spray arc, short circuiting arc, etc.)

Electrode Wire feed speed range: N/A

TECHNIQUE (QW-410)

String or Weave Bead: GTAW- string or weave

Orifice or Gas Cup Size: GTAW: #4 - #12

Initial and Interpass Cleaning (Brushing, Grinding, etc.: All deleterious materials shall be removed 2" both sides of weld joint by grinding or stainless steel wire brushing. Interpass cleaning with wire brush, chipping hammer or pneumatic scaling gun required.

Method of Back Gouging: N/A for GTAW single side open root stringer deposit. Back gouge and/or grind second side for double side weld using the GTAW process.

Contact to Tube Work Distance: N/A

Multiple or Single Pass (per side): Multiple

Multiple or Single Electrodes: Single

Travel Speed (Range): See Below

Peening: None

Other: Pulsing amps: None

Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp Range	Volt Range	Travel Speed Range	Other Max. J/in.
Root	GTAW	See page 1 for AWS filler designation. Filler must match correct base metal.	1/16", 3/32"	DC/SP	80-200	12-25	Manual	
Hot pass			1/8"	DC/SP	120-250	18-25	Manual	
Fill								

WELD PROCEDURE SPECIFICATION (WPS) JOINT DESIGNS

WPS No.: 5001-A Date: 3-30-09 Rev. No.: 3 Date: 3-9-13

JOINTS (QW-402

Single-V groove: GTAW

Backing:	No backing
Root opening:	3/32" – 3/16"
Groove angle:	50 deg. Min. included
Root face:	1/8" Max

Single bevel groove: GTAW

Backing:	No backing
Root opening:	3/32" – 3/16"
Groove angle:	45 deg. Min. included
Root face:	1/8" Max

Single-V groove: GTAW

Backing:	Backgouged & welded
Root opening:	¼" Max.
Groove angle:	50 deg. Min. included
Root face:	3/16" Max.

Single bevel groove: GTAW

Backing:	Backgouged & welded
Root opening:	¼" Max.
Groove angle:	45 deg. Min. included
Root face:	3/16" Max.

Double bevel groove: GTAW

Backing:	Backgouged & welded
Root opening:	¼" Max.
Groove angle:	50 deg. Min. included
Root face:	3/16" Max.

Single J groove: 3/8" J GTAW

Backing:	No backing
Root opening:	3/32" – 3/16"
Groove angle:	15 deg. Min. included
Root face:	1/8" Max

Double V groove: GTAW

Backing:	Backgouged & welded
Root opening:	¼" Max.
Groove angle:	45 deg. Min. included
Root face:	3/16" Max.

Single U groove: ¾" U GTAW

Backing:	No backing
Root opening:	3/32" – 3/16"
Groove angle:	15 deg. Min. included
Root face:	1/8" Max

Single or double fillet weld: GTAW

Backing:	Base metal
Root opening:	3/16" Max.
Weld size:	See drawings

1) Alternate weld joint designs may be shown on the drawings or engineering specifications and will take precedence.

2) Initial and interpass cleaning is shown on page 2 of the WPS.

3) Preheat shall be maintained during all thermal cutting, taking and backgouging operations as shown on the WPS.

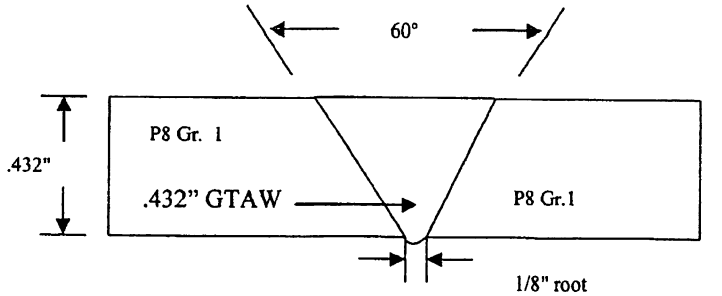
4) Welds shall be cleaned as required on page 2 of the WPS.

Prepared By:	Tim Morris	Approved By:	Robert Keil	Date:	3-9-13

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

Company Name UNITED CONTRACTING SERVICES INC.
Procedure Qualification Record No. 5001-A Date 3-30-09
WPS No. 5001-A
Welding Processes(es) GAS TUNGSTEN ARC WELDING (GTAW)
Types (Manual, Automatic,Semi-auto.) Manual – Both processes

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. SA-312 to SA-312
Type or Grade 304 to 304
P No. P 8 Gr. 1 to P 8 Gr. 1
Thickness of Test Coupon .432"
Diameter of Test Coupon 6.625"
Other Qualifies T thk. 3/16" – 0.864"
Qualifies GTAW t thk. 0.864" max.
Max. bead thk. < 1/2"

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

GAS (QW-408)

	Gas(es)	Percent Composition (Mixture)	Flow rate
Shielding	Argon	99.995%	40 CFH
Trailing	None		
Backing	Argon	99.995%	35 CFH

Other

FILLER METALS (QW-404)

	GTAW
SFA Specification	5.9
AWS Classification	ER308L
Filler metal F-No.	6
Weld Metal Analysis A-No.	8
Size of Filler Metal	1/8"
Other	
Solid bare wire	
No flux addition	
Weld Metal Thickness	0.432"
Consumable inserts- None	

ELECTRICAL CHARACTERISTICS (QW-409)
Current GTAW & SMAW: DC
Polarity GTAW- Straight
Amps GTAW- 110
Volts GTAW- 19
Tungsten Electrode Size EWTh-2 1/8" dia.
Pulsing Amps None
J/in. Qualified (CVN's)
Other

POSITION (QW-405)
Position of Groove 6G
Weld Progression (Uphill, Downhill) Vertical up
Other

PREHEAT (QW-406)
Preheat Temp. (min.) 55°F ambient temp.
Interpass Temp. (max.) 350°F
Other

TECHNIQUE (QW-410)
Travel Speed 10 IPM
String or Weave Bead GTAW – Slight Weave
Oscillation None
Multipass or Single Pass (per side) Multipass
Single or Multiple Electrodes Single
Other

QW-483 (Back)

PQR No. 5001-A

Tensile Test (QW-150)

Specimen No.	Width (in)	Thickness (in)	Area (sq. in)	Ultimate Total Load lb	Ultimate Unit Stress Psi	Type of Failure & Location
1	0.752	0.409	0.3076	24,315	79,047	P8 base -ductile
2	0.756	0.412	0.3115	24,075	77,287	P8 base-ductile

Guided-Bend Tests (QW-160)

Type and Figure No.	Result
#1 Side bend per QW-462.2	Satisfactory
#2 Side bend per QW-462.2	Satisfactory
#3 Side bend per QW-462.2	Satisfactory
#4 Side bend per QW-462.2	Satisfactory

Toughness Tests (QW-170)

Specimen No.	Notch Location	Notch Type	Test Temp.°F	Impact Values	Lateral Expansion		Drop Weight	
					% Shear	Mils	Break	No Break
			10mmX10mm specimen					

Fillet-Weld Tests (QW-180)

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

Macro- Results _____

Other Tests

Type of Test _____

Deposit Analysis _____

Other _____

Welders Name Marco Moreno Clock No. _____ Stamp No. M2

Test conducted by: Tulsa Gamma Ray, Inc Laboratory Test No. 102127500

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. Updated on new form 9-6-12

Manufacturer UNITED CONTRACTING SERVICES INC.

Date 3-30-09 By Tim Morris Approved by: Robert Kane

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

Company Name **UNITED CONTRACTING SERVICES INC.** By: Tim Morris Approved by:
Welding Procedure Specification No. **5002-A** Date 3-20-09 Supporting PQR No.(s) 5002-A
Revision No. 1 Date 9-15-12
Welding Process(es) GAS METAL ARC WELDING (GMAW) & FLUX CORED ARC WELDING (FCAW) Type(s) Semi-automatic
(Automatic,Manual,Machine,Semi-auto)

Joints (QW-402) Details

Joint Design Single V or Single Bevel , Fillet *1
Backing (Yes) FCAW (No) GMAW
Backing Material (type) Weld metal or base metal
(Refer to both backing and retainers.)

Joint Designs page 3 of WPS

GMAW- Open root stringer
☒ Metal (FCAW) ☐ Nonfusing Metal
☐ Nonmetallic ☐ 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 Mfgr., sketches may be attached to illustrate joint design, weld layers and bead sequence, e.g. for notch toughness procedures, for multiple process, procedures, etc.)

*1 See shop drawings for optional joint designs used with this WPS. This WPS may be used in conjunction with other WPS' as indicated on shop drawings.

*** BASE METALS (QW-403)**

P-No. 8 Group No. 1 to P-No. 8 Group No. 1
OR
Specification type and grade Example: SA-240 Type 308L / 308 or 316L / 316
To Specification type and grade
OR
Chem. Analysis and Mech. Prop. See P-No. above.
To Chem. Analysis and Mech. Prop. See P-No. above.
Thickness Range:
Base Metal: Groove 3/16" – 0.864" Fillet Unlimited
Pipe Dia. Range: Groove 3/4 " Min. Fillet Unlimited
Other

*** FILLER METALS (QW-404)**	FCAW	GMAW
Spec. No. (SFA)	5.22	5.9
AWS No. (Class)	E308LT1-4 or E316LT1-4 *	ER308L or ER316L *
F-No.	6	6
A-No.	8	8
Size of Filler Metals	.045", 1/16"	.035", .045"
Weld Metal Thickness Range:	*ER308L with 304 or 304L base metals *ER316L with 316 or 316L base metal	*ER308L with 304 or 304L base metals *ER316L with 316 or 316L base metal
Groove	0.614" max. deposit	0.137" max. deposit
Fillet	Unlimited	Unlimited
Electrode-Flux (Class)	NA	N/A
Flux Trade Name	NA	N/A
Consumable Insert	NA	N/A
Other	Max. passthk. <3/8"	Max pass thk.: 1/8"
	Product form: Flux cored wire Supplemental filler metal: None Alloy elements: None	Product form: Bare wire Supplemental filler metal: None Alloy elements: None

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

UCB QC Approved By: Date 9-17-12

QW-482 (Back)
WPS No. 5002-A Rev. 1

POSITIONS (QW-405)
Positions(s) of Groove: All positions
Welding Progression: Up Yes Down N/A
Position(s) of Fillet: All positions

PREHEAT (QW-406)
Preheat Temp. Min.: 50°F
Interpass Temp. Max.: 350°F max.
Preheat Maintenance: None after welding
(Continuous or special heating where applicable should be recorded)

POSTWELD HEAT TREATMENT (QW-407)
Temperature Range: As Welded condition
Time Range:

10 HOURS MAX. HOLD TIME

GAS (QW-408) Percent Composition

Shielding Gas(es)	Mixture	Flow rate
FCAW	Argon/CO2	75%/25%	30-50 CFH
GMAW	Argon	99.995%	25-45 CFH
Backing	Argon	99.995%	**
Trailing None			

ELECTRICAL CHARCACTERISTICS (QW-409)
Current AC or DC: DC Polarity: Reverse
Amps (Range): Below Volts (Range): Below

(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.)

** Prior to welding, purge with 6 – 8 volume changes of Argon @ 20 – 40 CFH. During welding, continue to purge @ 10-20 CFH to minimize back pressure until weld is completed or a minimum of 1/4" weld is deposited. O2 < .5% in purge area.

Tungsten Electrode Size and Type: NA
(Pure Tungsten, 2% Thoriated, etc.)

Mode of Metal Transfer for GMAW: FCAW: globular transfer GMAW: Short arc
(Spray arc, short circuiting arc, etc.)

Electrode Wire feed speed range: Not recorded

TECHNIQUE (QW-410)
String or Weave Bead: GMAW- string or weave bead FCAW- String bead (3/4" max.)
Orifice or Gas Cup Size: 5/16" or ¾" I.D.
Initial and Interpass Cleaning (Brushing, Grinding, etc.: All deleterious materials shall be removed 1" both sides of weld joint by grinding or wire brushing. Interpass cleaning with wire brush, chipping hammer or pneumatic scaling gun required for FCAW. GMAW root pass shall be wire brushed prior to welding with FCAW. Use stainless steel brushes for cleaning.
Method of Back Gouging: NA for single side welding w/out access to back side of joint. Grinding optional if back side is accessable. FCAW may be used for double sided weld with second side backgouged, ground to bright metal and welded with FCAW.
Contact to Tube Work Distance: ½" to 1 ¼"
Multiple or Single Pass (per side): Multiple
Multiple or Single Electrodes: Single
Travel Speed (Range): Manual
Peening: None
Other: . Oscillation: None

Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp Range	Volt Range	Travel Speed Range	Other (e.g. Remarks Comments Technique)
Root .137" max.	GMAW	ER308L or ER316L	.035"	DC/RP	80-160	18-23	Manual	
Balance (fill & cap)	FCAW	E308LT1-4 or	.045"	DC/RP	140-200	22-29	Manual	
(Fillet) .614" max.	FCAW	E316LT1-4	1/16"	DC/RP	210-250	22-32	Manual	

UCS QC Approved By Date 9-12-12

WELD PROCEDURE SPECIFICATION (WPS) JOINT DESIGNS

WPS No.: 5002-A Date: 3-20-09 Rev. No.: 1 **Date:** 9-15-12

JOINTS (QW-402

Single-V groove:	**GMAW/FCAW**	**Single bevel groove:**	**GMAW/FCAW**
Backing:	No backing	Backing:	No backing
Root opening:	3/32" – 3/16"	Root opening:	3/32" – 3/16"
Groove angle:	50 deg. Min. included	Groove angle:	45 deg. Min. included
Root face:	1/8" Max	Root face:	1/8" Max
Single-V groove:	**GMAW/FCAW**	**Single bevel groove:**	**GMAW/FCAW**
Backing:	Backgouged& welded	Backing:	Backgouged& welded
Root opening:	¼" Max.	Root opening:	¼" Max.
Groove angle:	50 deg. Min. included	Groove angle:	45 deg. Min. included
Root face:	3/16" Max.	Root face:	3/16" Max.
Double bevel groove:	**GMAW/FCAW**	**Single J groove:**	3/8" JGMAW/FCAW
Backing:	Backgouged& welded	Backing:	No backing
Root opening:	¼" Max.	Root opening:	3/32" – 3/16"
Groove angle:	50 deg. Min. included	Groove angle:	15 deg. Min. included
Root face:	3/16" Max.	Root face:	1/8" Max
Double V groove:	**GMAW/FCAW**	**Single U groove:**	¾" UGMAW/FCAW
Backing:	Backgouged& welded	Backing:	No backing
Root opening:	¼" Max.	Root opening:	3/32" – 3/16"
Groove angle:	45 deg. Min. included	Groove angle:	15 deg. Min. included
Root face:	3/16" Max.	Root face:	1/8" Max

Single or double fillet weld: GMAW/FCAW

Backing:	Base metal
Root opening:	3/16" Max.
Weld size:	See drawings

1) Alternate weld joint designs may be shown on the drawings or engineering specifications and will take precedence.

2) Initial and interpass cleaning is shown on page 2 of the WPS.

3) Preheat shall be maintained during all thermal cutting, taking and backgouging operations as shown on the WPS.

4) Welds shall be cleaned as required on page 2 of the WPS.

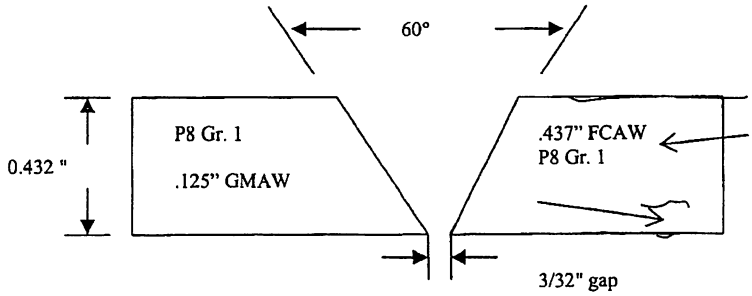
Prepared By:	Tim Morris	Approved By:		Date:	9-17-12

UCS QC Approved By Date 9-17-12

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

Company Name **UNITED CONTRACTING SERVICES INC.**
Procedure Qualification Record No. 5002-A Date 3-20-09
WPS No. **5002-A**
Welding Processes(es) GAS METAL ARC WELDING (GMAW) & FLUX CORED ARC WELDING (FCAW)
Types (Manual, Automatic,Semi-auto.) Semi-automatic both processes

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. SA-312 to SA-312
Type or Grade 304 to 304
P No. P8 Gr.1 to P8 Gr.1
Thickness of Test Coupon 0.432"
Diameter of Test Coupon 6.625'
Other
Qualifies T thk. 3/16" – 0.864"
Qualifies t thk. GMAW: Sec, IX 0.137" max.
Qualifies t thk.FCAW: Sec, IX 0.614" max.
Max. pass thk: GMAW-1/8" FCAW- 3/8"

POSTWELD HEAT TREATMENT (QW-407)
Temperature As Welded
Time
Other

GAS (QW-408)

GMAW & FCAW process		Percent Composition	
FCAW	Gas(es)	(Mixture)	Flow rate
Shielding	Ar/CO2	75%/25%	40 CFH
Trailing	None		
Backing	Argon	99.995%	35 CFH
GMAW	Argon	99.995%	30 CFH

FILLER METALS (QW-404)

	GMAW	FCAW
SFA Specification	5.9	5.22
AWS Classification	ER308L	E308LT1-4
Filler metal F-No.	6	6
Weld Metal Analysis A-No.	8	8
Size of Filler Metal	.035"	.045"
Other	Supplemental filler: None	
	FCAW – flux cored wire GMAW-Bare	
Weld Metal Thickness	1/8"	0.307"
Alloy elements: None		

ELECTRICAL CHARACTERISTICS (QW-409)
Current GMAW – DC FCAW – DC
Polarity GMAW –Reverse FCAW- Reverse
Amps GMAW- 80FCAW- 140
Volts GMAW- 20FCAW-23
Tungsten Electrode Size N/A
Pulsing Amps None
J/in. Qualified (CVN's)
Other Mode of transfer: FCAW- Globular transfer
GMAW- Short Arc

POSITION (QW-405)
Position of Groove 6 G
Weld Progression (Uphill, Downhill) Uphill
Other

PREHEAT (QW-406)
Preheat Temp. (min.) 70°F Ambient temp.
Interpass Temp. (max.) 550°F
Other

TECHNIQUE (QW-410)
Travel Speed GMAW- 12 IPM FCAW- 12 IPM
String or Weave Bead GMAW –String FCAW- String
Oscillation None
Multipass or Single Pass (per side) Multiple
Single or Multiple Electrodes Single
Other

UCS QC Approved By RR Date 9-17-12

QW-483 (Back)

PQR No. 5002-A

Tensile Test (QW-150)

Specimen No.	Width (in)	Thickness (in)	Area (sq. in)	Ultimate Total Load lb	Ultimate Unit Stress Psi	Type of Failure & Location
Tensile A	0.759	0.411	0.3119	24,335	78,021	Base-ductile
Tensile B	0.752	0.416	0.3128	23,826	76,170	Base-ductile

Guided-Bend Tests (QW-160)

Type and Figure No. QW-462.2a	Result
#1 Top & Bottom Transverse Side Bends	Satisfactory
#2 Top & Bottom Transverse Side Bend	Satisfactory
#3 Top & Bottom Transverse Side Bend	Satisfactory
#4 Top & Bottom Transverse Side Bend	Satisfactory

Toughness Tests (QW-170) Specimen size: 10mm X 10mm

Specimen No.	Notch Location	Notch Type	Test Temp.°F	Impact Values	Lateral Expansion		Drop Weight	
					% Shear	Mils	Break	No Break
		"V"						
		"V"						
			10mmX10mm specimen					

Other Tests

Type of Test _____

Welders Name EloyGrajeda Clock No. _____ Stamp No. EG

Test conducted by: Tulsa Gamma Ray, Inc Laboratory Test No. 102127501

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. Updated on new form 9-15-12

Manufacturer UNITED CONTRACTING SERVICES INC.

Date 3-20-09 By Tim Morris Approved by: _____

UCS QC Approved BY Date 9-12-12

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

Company Name **UNITED CONTRACTING SERVICES INC.** By: Tim Morris Approved by:
Welding Procedure Specification No. **5007-A** Date 3-30-09 Supporting PQR No.s 5007-A
Revision No. 3 Date 9-7-12
Welding Process(es) GAS TUNGSTEN ARC WELDING (GTAW) Type(s) GTAW -manual
(Automatic,Manual,Machine,Semi-auto)

Joints (QW-402) Details

Joint Design Single V or Bevel , Double V or Bevel *1
Backing (Yes) Optional (No) GTAW-open root
Backing Material (type) Weld or base metal for double side weld
Retainers: None (Refer to both backing and retainers.)

☒ Metal ☐ Nonfusing Metal
☐ Nonmetallic ☐ Other

Joint Designs page 3 of WPS

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 Mfgr., sketches may be attached to illustrate joint design, weld layers and bead sequence, e.g. for notch toughness procedures, for multiple process, procedures, etc.)

*1 See shop drawings for optional joint designs used with this WPS. This WPS may be used in conjunction with other WPS' as indicated on shop drawings.

*** BASE METALS (QW-403)**

P-No. 8 Group No. 1 to P-No. 8 Group No. 1
OR
Specification type and grade Example: SA-240 Type 308L / 308 or 316L /316
To Specification type and grade
OR
Chem. Analysis and Mech. Prop.
To Chem. Analysis and Mech. Prop.
Thickness Range:
Base Metal: Groove 1/16" – 0.294" Fillet Unlimited
Pipe Dia. Range: Groove All Diameters Fillet All Diameters
Other

*** FILLER METALS (QW-404)**	**GTAW**	
Spec. No. (SFA)	5.9	
AWS No. (Class)	ER308L *	ER316L*
F-No.	6	
A-No.	8	
Size of Filler Metals	1/16", 3/32", 1/8"	
Weld Metal Thickness Range: Groove	0.294" maximum deposit	
Fillet	Unlimited	
Electrode-Flux (Class)	N/A	*ER308L with 304 or 304L base metals
Flux Trade Name	N/A	*ER316L with 316 or 316L base metal
Consumable Insert	None	
Other	Solid wire	
	Addition of flux: None	

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

UCS QC Approved By KR Date 9-17-12

WPS No. 5007-A Rev. 3

POSITIONS (QW-405)
Positions(s) of Groove: All positions
Welding Progression: Up Yes Down
Position(s) of Fillet: All positions

PREHEAT (QW-406)
Preheat Temp. Min.: 50° F
Interpass Temp. Max.: 350°F
Preheat Maintenance: None
(Continuous or special heating where applicable should be recorded)

POSTWELD HEAT TREATMENT (QW-407)
Temperature Range: As Welded
Time Range: N/A

GAS (QW-408)

GTAW	Gas(es)	Percent Composition Mixture	Flow rate
Shielding	Argon	99.995%	20-40 CFH
Trailing	None		
Backing	Argon	99.995%	**

** Prior to welding, purge with 6 – 8 volume changes of Argon @ 20 – 40 CFH. During welding, continue to purge @ 10-20 CFH to minimize back pressure until weld is completed or a minimum of 1/4" weld is deposited. O2 < .5% in purge area.

ELECTRICAL CHARCACTERISTICS (QW-409)
Current AC or DC: Below Polarity: Below
Amps (Range): Below Volts (Range): Below

(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: EWTh-2 3/32" or 1/8"
(Pure Tungsten, 2% Thoriated, etc.)

Mode of Metal Transfer for GMAW: N/A
(Spray arc, short circuiting arc, etc.)

Electrode Wire feed speed range: N/A

TECHNIQUE (QW-410)
String or Weave Bead: GTAW- string or weave
Orifice or Gas Cup Size: GTAW: #4 - #12
Initial and Interpass Cleaning (Brushing, Grinding, etc.: All deleterious materials shall be removed 2" both sides of weld joint by grinding or stainless steel wire brushing. Interpass cleaning with wire brush, chipping hammer or pneumatic scaling gun required.
Method of Back Gouging: N/A for GTAW single side open root stringer deposit. Back gouge and/or grind second side for double side weld using the GTAW process. Use stainless steel brushes for cleaning.
Contact to Tube Work Distance: N/A
Multiple or Single Pass (per side): Multiple
Multiple or Single Electrodes: Single
Travel Speed (Range): See Below
Peening: None
Other: Pulsing amps: None

Weld Layer(s)	Process	Filler Metal Class	Filler Metal Dia.	Current Type Polar.	Current Amp Range	Volt Range	Travel Speed Range	Other Max. J/in.
Root	GTAW	ER308L	1/16", 3/32"	DC/SP	80-200	12-25	Manual	
Hot pass				DC/SP	120-250	18-25	Manual	
Fill			1/8"					

UCS QC Approved
Date 9-17-12

WELD PROCEDURE SPECIFICATION (WPS) JOINT DESIGNS

WPS No.: 5007-A Date: 3-30-09 Rev. No.: 3 Date: 9-7-12

JOINTS (QW-402

Single-V groove: GTAW

Backing:	No backing
Root opening:	3/32" – 3/16"
Groove angle:	50 deg. Min. included
Root face:	1/8" Max

Single bevel groove: GTAW

Backing:	No backing
Root opening:	3/32" – 3/16"
Groove angle:	45 deg. Min. included
Root face:	1/8" Max

Single-V groove: GTAW

Backing:	Backgouged & welded
Root opening:	¼" Max.
Groove angle:	50 deg. Min. included
Root face:	3/16" Max.

Single bevel groove: GTAW

Backing:	Backgouged & welded
Root opening:	¼" Max.
Groove angle:	45 deg. Min. included
Root face:	3/16" Max.

Double bevel groove: GTAW

Backing:	Backgouged & welded
Root opening:	¼" Max.
Groove angle:	50 deg. Min. included
Root face:	3/16" Max.

Single J groove: 3/8" J GTAW

Backing:	No backing
Root opening:	3/32" – 3/16"
Groove angle:	15 deg. Min. included
Root face:	1/8" Max

Double V groove: GTAW

Backing:	Backgouged & welded
Root opening:	¼" Max.
Groove angle:	45 deg. Min. included
Root face:	3/16" Max.

Single U groove: ¾" U GTAW

Backing:	No backing
Root opening:	3/32" – 3/16"
Groove angle:	15 deg. Min. included
Root face:	1/8" Max

Single or double fillet weld: GTAW

Backing:	Base metal
Root opening:	3/16" Max.
Weld size:	See drawings

1) Alternate weld joint designs may be shown on the drawings or engineering specifications and will take precedence.

2) Initial and interpass cleaning is shown on page 2 of the WPS.

3) Preheat shall be maintained during all thermal cutting, taking and backgouging operations as shown on the WPS.

4) Welds shall be cleaned as required on page 2 of the WPS.

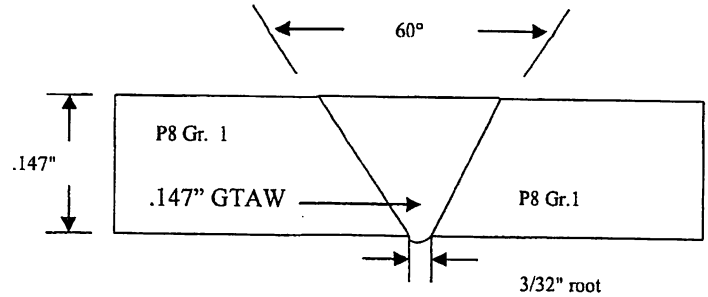
Prepared By:	Tim Morris	Approved By:		Date:	9-17-12

UCS QC Approved By Date 9-17-12

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

Company Name **UNITED CONTRACTING SERVICES INC.**
Procedure Qualification Record No. 5007-A Date 10-1-10
WPS No. 5007-A
Welding Processes(es) GAS TUNGSTEN ARC WELDING (GTAW)
Types (Manual, Automatic,Semi-auto.) Manual – Both processes

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. SA-312 to SA-312
Type or Grade 304 to 304
P No. P 8 Gr. 1 to P 8 Gr. 1
Thickness of Test Coupon .147"
Diameter of Test Coupon 0.840"
Other Qualifies T thk. 1/16" – 0.294"
Qualifies GTAW t thk. 0.294" max.
Max. bead thk. < 1/2"

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

GAS (QW-408)

	Gas(es)	Percent Composition (Mixture)	Flow rate
Shielding	Argon	99.995%	30 CFH
Trailing	None		
Backing	Argon	99.995%	25 CFH
Other			

FILLER METALS (QW-404)

	GTAW
SFA Specification	5.9
AWS Classification	ER308L
Filler metal F-No.	6
Weld Metal Analysis A-No.	8
Size of Filler Metal	1/8"
Other	
Solid bare wire	
No flux addition	
Weld Metal Thickness	0.147"
Consumable inserts- None	

ELECTRICAL CHARACTERISTICS (QW-409)
Current GTAW & SMAW: DC
Polarity GTAW- Straight
Amps GTAW- 112
Volts GTAW- 19
Tungsten Electrode Size EWTh-2 1/8" dia.
Pulsing Amps None
J/in. Qualified (CVN's)
Other

POSITION (QW-405)
Position of Groove 6G
Weld Progression (Uphill, Downhill) Vertical up
Other

PREHEAT (QW-406)
Preheat Temp. (min.) 60°F ambient temp.
Interpass Temp. (max.) 350°F
Other

TECHNIQUE (QW-410)
Travel Speed 10 IPM
String or Weave Bead GTAW – Slight Weave
Oscillation None
Multipass or Single Pass (per side) Multipass
Single or Multiple Electrodes Single
Other

UCS QC Approved By
Date 9-17-12

QW-483 (Back)

PQR No. 5007-A

Tensile Test (QW-150)

Specimen No.	Width (in)	Thickness (in)	Area (sq. in)	Ultimate Total Load lb	Ultimate Unit Stress Psi	Type of Failure & Location
1	0.834	0.144	0.1214	9,685	79,778	P8 base -ductile
2	0.846	0.145	0.1227	9,523	77,612	P8 base-ductile

Guided-Bend Tests (QW-160)

Type and Figure No.	Result
#1 Side bend per QW-462.2	Satisfactory
#2 Side bend per QW-462.2	Satisfactory
#3 Side bend per QW-462.2	Satisfactory
#4 Side bend per QW-462.2	Satisfactory

Toughness Tests (QW-170)

Specimen No.	Notch Location	Notch Type	Test Temp.°F	Impact Values	Lateral Expansion		Drop Weight	
					% Shear	Mils	Break	No Break
			10mmX10mm specimen					

Fillet-Weld Tests (QW-180)

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

Macro- Results _____

Other Tests

Type of Test _____

Deposit Analysis _____

Other _____

Welders Name Jorge Pando Clock No. _____ Stamp No. M2

Test conducted by: Tulsa Gamma Ray, Inc Laboratory Test No. 102129134

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. Updated on new form 9-7-12

Manufacturer UNITED CONTRACTING SERVICES INC.

Date 10-1-10 By Tim Morris Approved by: _____

UCS QC Approved By _____ Date 9-17-12

United Contracting Services INC. 2716 E Apache ST Tulsa OK, 74110 PH 918.551-7659 FX 918.561-6027

QW-484A SUGGESTED FORMAT A FOR WELDER PERFORMANCE QUALIFICATIONS (WPQ)

(See QW-301, Section IX, ASME Boiler and Pressure Vessel Code)

Welder's Name Jorge Pando JR Identification No. JP

TEST DESCRIPTION

Identification of WPS followed 5011-A ☐ Test Coupon ☒ Production Weld

Specification of base metal(s) SA106B Thickness 0.322''

TESTING VARIBLES & QUALIFICATION LIMITS

Welding Variables (QW-350)	Actual values	Range Qualified
Welding Process(es)	GMAW/FCAW	GMAW/FCAW
Type (i.e.: manual, semi-auto) used	SEMI-AUTO	SEMI-AUTO
Backing (metal, weld metal, double-welded, etc.)	NO BACKING	WITH or WITHOUT
☐ Plate ☒ Pipe (enter diameter if pipe or tube)	8.625"	2 5/8" AND GREATER
Base metal P or S-Number to P- or S Number	P1	P1 thru P11 & P4X
Filler metal or electrode specification(s) (SFA) (info only)	5.18/5.20	
Filler metal or electrode classification(s) (info only)	ER70S-6/E71T-1M	
Filler metal F-Numbers	F6	F6
Consumable Insert (GTAW or PAW)	NONE	NONE
Filler type (solid/metal or flux cored/powdered) (GTAW or PAW)	SOLID	SOLID
Deposit thickness for each process	-------	-----
Process 1: GMAW 3 layers minimum ☐ yes ☒ no	0.125''	0.250" MAX
Process 2: FCAW 3 layers minimum ☒ yes ☐ no	0.200''	.644'' MAX
Position qualified (2G, 6G, 3F, etc.)	6G	ALL
Vertical progression (uphill or downhill)	3G	3G/1G
Type of fuel gas (OFW)	N/A	N/A
Inert gas backing (GTAW, PAW, GMAW)	N/A	N/A
Transfer mode (spray/globular or pulse to short circuit-GMAW)	GLOBULAR	GLOBULAR
GTAW current type/polarity (AC, DCEP, DCEN)	DCEP	DCEP

RESULTS

Visual Examination of Completed Weld (QW-302.4) ACCEPTABLE

☐ Bend Test ☐ Transverse Root and Face [QW-462.3(a)] ☐ Longitudinal Root and Face [QW-462.3(b)] ☐ Side (QW-462.2)

☐ Pipe bend specimen, corrosion-resistant overlay[QW-462.5(c)] ☐ Plate bend specimen, corrosion resistant overlay[QW-462.5(d)]

☐ Macro test fusion [QW-462.5 (b)] ☐ Macro test for fusion [QW-462.5(e)]

Type	Result	Type	Result	Type	Result

Alternative radiographic examination results (QW-191) ACCEPTABLE

Fillet weld – fracture test (QW-180) N/A Length and percent of defects N/A

Macro examination (QW-184) N/A Fillet size (in.) ____ x ____ Concavity/convexity (in.) N/A

Other Tests N/A

Film or Specimens evaluated by Tyler Warrington Company American piping inspectors, Inc

Mechanical tests conducted by ____ Laboratory Tests 53834

Welding supervised by UNITED CONTRACTING SERVICES

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 or Contractor UNITED CONTRACTING SERVICES

Date 7/06/12

Certified by Robert Kirk

UCS QC Approved By Date 8/1/14

United Contracting Services INC.
2716 E Apache ST Tulsa OK, 74110
PH 918.551-7659 FX 918.561-6027

QW-484A SUGGESTED FORMAT A FOR WELDER PERFORMANCE QUALIFICATIONS (WPQ)

(See QW-301, Section IX, ASME Boiler and Pressure Vessel Code)

Welder's Name JORGE PANDO JR Identification No. JP

TEST DESCRIPTION

Identification of WPS followed HCS1-1 ☐ Test Coupon ☒ Production Weld
Specification of base metal(s) SA106B Thickness 0.216

TESTING VARIBLES & QUALIFICATION LIMITS

Welding Variables (QW-350)	Actual values	Range Qualified
Welding Process(es)	GTAW	GTAW
Type (i.e.: manual, semi-auto) used	Manual	Manual
Backing (metal, weld metal, double-welded, etc.)	NO BACKING	WITH or WITHOUT
☐ Plate ☒ Pipe (enter diameter if pipe or tube)	3.500	1'' AND GREATER
Base metal P or S-Number to P- or S Number	P1	P1 thru P11 & P4X
Filler metal or electrode specification(s) (SFA) (info only)	5.18	
Filler metal or electrode classification(s) (info only)	ER70S-6	
Filler metal F-Numbers	F6	F6
Consumable Insert (GTAW or PAW)	NONE	NONE
Filler type (solid/metal or flux cored/powdered) (GTAW or PAW)	SOLID	SOLID
Deposit thickness for each process	-------	-----
Process 1: GTAW 3 layers minimum ☒ yes ☐ no	0.216"	0.432" MAX
Process 2: ------ 3 layers minimum ☐ yes ☒ no	N/A	N/A
Position qualified (2G, 6G, 3F, etc.)	5G	F,V,O
Vertical progression (uphill or downhill)	UPHILL	UPHILL
Type of fuel gas (OFW)	N/A	N/A
Inert gas backing (GTAW, PAW, GMAW)	N/A	N/A
Transfer mode (spray/globular or pulse to short circuit-GMAW)	N/A	N/A
GTAW current type/polarity (AC, DCEP, DCEN)	DCEN	DCEN

RESULTS

Visual Examination of Completed Weld (QW-302.4) ACCEPTABLE

☐ Bend Test ☐ Transverse Root and Face [QW-462.3(a)] ☐ Longitudinal Root and Face [QW-462.3(b)] ☐ Side (QW-462.2)
☐ Pipe bend specimen, corrosion-resistant overlay[QW-462.5(c)] ☐ Plate bend specimen, corrosion resistant overlay[QW-462.5(d)]
☐ Macro test fusion [QW-462.5 (b)] ☐ Macro test for fusion [QW-462.5(e)]

Type	Result	Type	Result	Type	Result

Alternative radiographic examination results (QW-191) ACCEPTABLE
Fillet weld – fracture test (QW-180) N/A Length and percent of defects N/A
Macro examination (QW-184) N/A Fillet size (in.) ____ x ____ Concavity/convexity (in.) N/A
Other Tests N/A
Film or Specimens evaluated by JUDY TROUT Company American Piping Inspectors Inc
Mechanical tests conducted by ____ Laboratory Tests 43850
Welding supervised by UNITED CONTRACTING SERVICES

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 or Contractor UNITED CONTRACTING SERVICES

Date 6/06/12

Certified by Robert Kirk

UCS QC Approved By Date 8/1/14

United Contracting Services INC.
2716 E Apache ST Tulsa OK, 74110
PH 918.551-7659 FX 918.561-6027

QW-484A SUGGESTED FORMAT A FOR WELDER PERFORMANCE QUALIFICATIONS (WPQ)

(See QW-301, Section IX, ASME Boiler and Pressure Vessel Code)

Welder's Name SAUL MEDINA Identification No. SM

TEST DESCRIPTION

Identification of WPS followed 5001-A ☒ Test Coupon ☐ Production Weld
Specification of base metal(s) SA312-304 Thickness 0.462"

TESTING CONDITIONS & QUALIFICATIONS

Welding Variables (QW-350)	Actual values	Range Qualified
Welding Process(es)	GTAW	GTAW
Type (i.e.: manual, semi-auto) used	MANUAL	MANUAL
Backing (metal, weld metal, double-welded, etc.)	NONE	WITH or WITHOUT
☐ Plate ☒ Pipe (enter diameter if pipe or tube)	3.5"	2 7/8" & GREATER
Base metal P or S-Number to P- or S Number	P8	P8
Filler metal or electrode specification(s) (SFA) (info only)	5.9	
Filler metal or electrode classification(s) (info only)	ER308L	
Filler metal F-Numbers	6	
Consumable Insert (GTAW or PAW)	NONE	NONE
Filler type (solid/metal or flux cored/powdered) (GTAW or PAW)	SOLID(BARE)	SOLID(BARE)
Deposit thickness for each process		
Process 1: GTAW 3 layers minimum ☒ yes ☐ no	0.462"	0.864 MAX
Process 2: N.A. 3 layers minimum ☐ yes ☐ no	N.A.	N.A.
Position qualified (2G, 6G, 3F, etc.)	6G	ALL
Vertical progression (uphill or downhill)	UPHILL	UPHILL
Type of fuel gas (OFW)	N.A.	N.A.
Inert gas backing (GTAW, PAW, GMAW)	ARGON	ARGON
Transfer mode (spray/globular or pulse to short circuit-GMAW)	N.A.	N.A.
GTAW current type/polarity (AC, DCEP, DCEN)	DCEN	DCEN

RESULTS

Visual Examination of Completed Weld (QW-302.4) ACCEPTABLE

☒ Bend Test ☒ Transverse Root and Face [QW-462.3(a)] ☐ Longitudinal Root and Face [QW-462.3(b)] ☐ Side (QW-462.2)
☐ Pipe bend specimen, corrosion-resistant overlay[QW-462.5(c)] ☐ Plate bend specimen, corrosion resistant overlay[QW-462.5(d)]
☐ Macro test fusion [QW-462.5 (b)] ☐ Macro test for fusion [QW-462.5(e)]

Type	Result	Type	Result	Type	Result
FACE	ACCEPTABLE	FACE	ACCEPTABLE		
ROOT	ACCEPTABLE	ROOT	ACCEPTABLE		

Alternative radiographic examination results (QW-191) N/A
Fillet weld – fracture test (QW-180) N/A Length and percent of defects N/A
Macro examination (QW-184) N/A Fillet size (in.) ____ x ____ Concavity/convexity (in.) N/A
Other Tests N/A
Film or Specimens evaluated by John Phillips Company Tulsa Gamma Ray, Inc.
Mechanical tests conducted by John Phillips Laboratory Tests 102129135
Welding supervised by UNITED CONTRACTING SERVICES

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.

Organization UNITED CONTRACTING SERVICES

Date 11/10/10 By [signature]

UCS QC Approved By Date 7-29-13

TULSA GAMMA RAY INC.
1127 South Lewis Ave. Tulsa OK 74104
PH 918.585.3228 FX 918.584.5598

QW-484A SUGGESTED FORMAT A FOR WELDER PERFORMANCE QUALIFICATIONS (WPQ)

(See QW-301, Section IX, ASME Boiler and Pressure Vessel Code)

Welder's Name: Saul Medina — Identification No.: SM

TEST DESCRIPTION

Identification of WPS followed: 5011A-HT (PQR) — ☒ Test Coupon ☐ Production Weld
Specification of base metal(s): SA-516-60/70 — Thickness: 0.75"

TESTING VARIBLES & QUALIFICATION LIMITS

Welding Variables (QW-350)	Actual values	Range Qualified
Welding Process(es)	GMAW/FCAW	GMAW/FCAW
Type (i.e.: manual, semi-auto) used	SEMI-AUTO	SEMI-AUTO
Backing (metal, weld metal, double-welded, etc.)	NO BACKING	WITH or WITHOUT
☒ Plate ☐ Pipe (enter diameter if pipe or tube)	N/A	2 7/8" AND GREATER
Base metal P or S-Number to P- or S Number	P1	P1 thru P11 & P4X
Filler metal or electrode specification(s) (SFA) (info only)	5.20 / 5.18	
Filler metal or electrode classification(s) (info only)	ER70S-6 / E71T-1M	
Filler metal F-Numbers	F6	F6
Consumable Insert (GTAW or PAW)	NONE	NONE
Filler type (solid/metal or flux cored/powdered) (GTAW or PAW)	SOLID/TUBULAR	SOLID/TUBULAR
Deposit thickness for each process	-------	-----
Process 1: GMAW 3 layers minimum ☐ yes ☒ no	0.125"	0.1625" MAX
Process 2: FCAW 3 layers minimum ☒ yes ☐ no	0.625"	MAX to be Welded
Position qualified (2G, 6G, 3F, etc.)	6G	ALL
Vertical progression (uphill or downhill)	UPHILL	UPHILL
Type of fuel gas (OFW)	N/A	N/A
Inert gas backing (GTAW, PAW, GMAW)	N/A	N/A
Transfer mode (spray/globular or pulse to short circuit-GMAW)	GLOB.	GLOB.
GTAW current type/polarity (AC, DCEP, DCEN)	DCEP	DCEP

RESULTS

Visual Examination of Completed Weld (QW-302.4): ACCEPTABLE

☒ Bend Test ☐ Transverse Root and Face [QW-462.3(a)] ☐ Longitudinal Root and Face [QW-462.3(b)] ☒ Side (QW-462.2)
☐ Pipe bend specimen, corrosion-resistant overlay[QW-462.5(c)] ☐ Plate bend specimen, corrosion resistant overlay[QW-462.5(d)]
☐ Macro test fusion [QW-462.5 (b)] ☐ Macro test for fusion [QW-462.5(e)]

Type	Result	Type	Result	Type	Result
SIDE	ACCEPTABLE	SIDE	ACCEPTABLE		
SIDE	ACCEPTABLE	SIDE	ACCEPTABLE		

Alternative radiographic examination results (QW-191): N/A
Fillet weld – fracture test (QW-180): N/A — Length and percent of defects: N/A
Macro examination (QW-184): N/A — Fillet size (in.): ____ x ____ — Concavity/convexity (in.): N/A
Other Tests: N/A
Film or Specimens evaluated by: JOHN PHILLIPS — Company: API, Inc.
Mechanical tests conducted by: JOHN PHILLIPS — Laboratory Tests: M150928-1B
Welding supervised by: UNITED CONTRACTING SERVICES

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 or Contractor: UNITED CONTRACTING SERVICES

Date: 09/30/2015

Certified by: Juston Davis

United Contracting Services INC. 2716 E Apache ST Tulsa OK, 74110
PH 918.551-7659 FX 918.561-6027

QW-484A SUGGESTED FORMAT A FOR WELDER PERFORMANCE QUALIFICATIONS (WPQ)

(See QW-301, Section IX, ASME Boiler and Pressure Vessel Code)

Welder's Name JOSE A. GALVAN Identification No. JG

TEST DESCRIPTION

Identification of WPS followed 5011-A ☒ Test Coupon ☐ Production Weld
Specification of base metal(s) SA-106 Gr. B Thickness 0.5"

TESTING VARIBLES & QUALIFICATION LIMITS

Welding Variables (QW-350)	Actual values	Range Qualified
Welding Process(es)	GMAW/FCAW	GMAW/FCAW
Type (i.e.: manual, semi-auto) used	MANUAL	MANUAL
Backing (metal, weld metal, double-welded, etc.)	NO BACKING	WITH or WITHOUT
☐ Plate ☒ Pipe (enter diameter if pipe or tube)	8"	2-7/8" and Greater
Base metal P or S-Number to P- or S Number	P1	P1-P11F & P4X
Filler metal or electrode specification(s) (SFA) (info only)	5.18/5.17	
Filler metal or electrode classification(s) (info only)	ER70S-6/E71-T-1M	
Filler metal F-Numbers	F6	F6
Consumable Insert (GTAW or PAW)	NONE	NONE
Filler type (solid/metal or flux cored/powdered) (GTAW or PAW)	SOLID	SOLID
Deposit thickness for each process	--------	-----
Process 1: GMAW 3 layers minimum ☐ yes ☒ no	0.062"	0.125" MAX
Process 2: FCAW 3 layers minimum ☒ yes ☐ no	0.438"	Max to be Welded
Position qualified (2G, 6G, 3F, etc.)	3G	1,2,3G
Vertical progression (uphill or downhill)	GM-DOWN/FC-UP	GM-DOWN/FC-UP
Type of fuel gas (OFW)	N/A	N/A
Inert gas backing (GTAW, PAW, GMAW)	N/A	N/A
Transfer mode (spray/globular or pulse to short circuit-GMAW)	GLOB./SPRAY	GLOB./SPRAY
GTAW current type/polarity (AC, DCEP, DCEN)	DCEP	DCEP

RESULTS

Visual Examination of Completed Weld (QW-302.4) ACCEPTABLE

☐ Bend Test ☐ Transverse Root and Face [QW-462.3(a)] ☐ Longitudinal Root and Face [QW-462.3(b)] ☐ Side (QW-462.2)
☐ Pipe bend specimen, corrosion-resistant overlay[QW-462.5(c)] ☐ Plate bend specimen, corrosion resistant overlay[QW-462.5(d)]
☐ Macro test fusion [QW-462.5 (b)] ☐ Macro test for fusion [QW-462.5(e)]

Type	Result	Type	Result	Type	Result

Alternative radiographic examination results (QW-191) ACCEPTABLE
Fillet weld – fracture test (QW-180) N/A Length and percent of defects N/A
Macro examination (QW-184) N/A Fillet size (in.) ____ x ____ Concavity/convexity (in.) N/A
Other Tests N/A
Film or Specimens evaluated by JACK LLOYD Company AMERICAN PIPING INSP.
Mechanical tests conducted by ____ Laboratory Tests 149189
Welding supervised by UNITED CONTRACTING SERVICES

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 or Contractor UNITED CONTRACTING SERVICES

Date 09/25/2015

Certified by JUSTON W. DAVIS

UCS QC Approved By Date 9/25/15

United Contracting Services INC. 2716 E Apache ST Tulsa OK, 74110
PH 918.551-7659 FX 918.561-6027

QW-484A SUGGESTED FORMAT A FOR WELDER PERFORMANCE QUALIFICATIONS (WPQ)

(See QW-301, Section IX, ASME Boiler and Pressure Vessel Code)

Welder's Name ERNESTO MERCADO Identification No. EM

TEST DESCRIPTION

Identification of WPS followed 5012A ☐ Test Coupon ☒ Production Weld
Specification of base metal(s) SA106B Thickness 0.322"

TESTING VARIBLES & QUALIFICATION LIMITS

Welding Variables (QW-350)	Actual values	Range Qualified
Welding Process(es)	GTAW	GTAW
Type (i.e.: manual, semi-auto) used	MANUAL	MANUAL
Backing (metal, weld metal, double-welded, etc.)	NO BACKING	WITH or WITHOUT
☐ Plate ☒ Pipe (enter diameter if pipe or tube)	8"	2 7/8" AND GREATER
Base metal P or S-Number to P- or S Number	P1	P1 thru P15F,P34 & P4X
Filler metal or electrode specification(s) (SFA) (info only)	5.18	
Filler metal or electrode classification(s) (info only)	ER70S6	
Filler metal F-Numbers	F6	F6
Consumable Insert (GTAW or PAW)	NONE	NONE
Filler type (solid/metal or flux cored/powdered) (GTAW or PAW)	SOLID	SOLID
Deposit thickness for each process	-------	-----
Process 1: GTAW 3 layers minimum ☒ yes ☐ no	0.322"	0.644" MAX
Process 2: ____ 3 layers minimum ☐ yes ☐ no	----	----
Position qualified (2G, 6G, 3F, etc.)	6G	ALL POSITIONS
Vertical progression (uphill or downhill)	UPHILL	UPHILL
Type of fuel gas (OFW)	N/A	N/A
Inert gas backing (GTAW, PAW, GMAW)	N/A	N/A
Transfer mode (spray/globular or pulse to short circuit-GMAW)	N/A	N/A
GTAW current type/polarity (AC, DCEP, DCEN)	DCEN	DCEN

RESULTS

Visual Examination of Completed Weld (QW-302.4) ACCEPTABLE

☐ Bend Test ☐ Transverse Root and Face [QW-462.3(a)] ☐ Longitudinal Root and Face [QW-462.3(b)] ☒ Side (QW-462.2)
☐ Pipe bend specimen, corrosion-resistant overlay[QW-462.5(c)] ☐ Plate bend specimen, corrosion resistant overlay[QW-462.5(d)]
☐ Macro test fusion [QW-462.5 (b)] ☐ Macro test for fusion [QW-462.5(e)]

Type	Result	Type	Result	Type	Result

Alternative radiographic examination results (QW-191) ACCEPTABLE
Fillet weld – fracture test (QW-180) N/A
Macro examination (QW-184) N/A Fillet size (in.) ____ x ____ Length and percent of defects N/A
Other Tests N/A Concavity/convexity (in.) N/A
Film or Specimens evaluated by JACK LLOYD Company API, INC.
Mechanical tests conducted by
Welding supervised by UNITED CONTRACTING SERVICES Laboratory Tests 148769

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.

Date 09/10/2015 Manufacturer or Contractor UNITED CONTRACTING SERVICES

Certified by JUSTON DAVIS

UCS QC Approved By Date 9/10/15

United Contracting Services INC.
2716 E Apache ST Tulsa OK, 74110
PH 918.551-7659 FX 918.561-6027

QW-484A SUGGESTED FORMAT A FOR WELDER PERFORMANCE QUALIFICATIONS (WPQ)

(See QW-301, Section IX, ASME Boiler and Pressure Vessel Code)

Welder's Name: Santos Gutierrez — Identification No.: SG

TEST DESCRIPTION

Identification of WPS followed: 5011-A — ☒ Test Coupon ☐ Production Weld

Specification of base metal(s): SA-106 Gr. B — Thickness: 0.432"

TESTING VARIBLES & QUALIFICATION LIMITS

Welding Variables (QW-350)	Actual values	Range Qualified
Welding Process(es)	GMAW/FCAW	GMAW/FCAW
Type (i.e.: manual, semi-auto) used	SEMI-AUTO	SEMI-AUTO
Backing (metal, weld metal, double-welded, etc.)	NO BACKING	WITH or WITHOUT
☐ Plate ☒ Pipe (enter diameter if pipe or tube)	6" OD	2 7/8" AND GREATER
Base metal P or S-Number to P- or S Number	P1	P1 thru P15F,P34 & P4X
Filler metal or electrode specification(s) (SFA) (info only)	5.18/5.17	
Filler metal or electrode classification(s) (info only)	ER70S-6/E71-T	
Filler metal F-Numbers	F6	F6
Consumable Insert (GTAW or PAW)	NONE	NONE
Filler type (solid/metal or flux cored/powdered) (GTAW or PAW)	SOLID/CORED	SOLID/CORED
Deposit thickness for each process	0.432 Total	0.864 MAX
Process 1: GMAW 3 layers minimum ☐ yes ☒ no	0.0625"	0.187" MAX
Process 2: FCAW 3 layers minimum ☒ yes ☐ no	0.3695"	0.739 MAX
Position qualified (2G, 6G, 3F, etc.)	1G-R	1G, 1F, 1G-R
Vertical progression (uphill or downhill)	FLAT	FLAT
Type of fuel gas (OFW)	N/A	N/A
Inert gas backing (GTAW, PAW, GMAW)	N/A	N/A
Transfer mode (spray/globular or pulse to short circuit-GMAW)	GLOBULAR	GLOBULAR
GTAW current type/polarity (AC, DCEP, DCEN)	DCEP	DCEP

RESULTS

Visual Examination of Completed Weld (QW-302.4): ACCEPTABLE

☐ Bend Test ☐ Transverse Root and Face [QW-462.3(a)] ☐ Longitudinal Root and Face [QW-462.3(b)] ☐ Side (QW-462.2)

☐ Pipe bend specimen, corrosion-resistant overlay[QW-462.5(c)] ☐ Plate bend specimen, corrosion resistant overlay[QW-462.5(d)]

☐ Macro test fusion [QW-462.5 (b)] ☐ Macro test for fusion [QW-462.5(e)]

Type	Result	Type	Result	Type	Result

Alternative radiographic examination results (QW-191): ACCEPTABLE

Fillet weld – fracture test (QW-180): N/A — Length and percent of defects: N/A

Macro examination (QW-184): N/A — Fillet size (in.): ____ x ____ — Concavity/convexity (in.): N/A

Other Tests: N/A

Film or Specimens evaluated by: Chris Brookhart — Company: IRIS NDT

Mechanical tests conducted by: ____ — Laboratory Tests: IRISNDT# 0522

Welding supervised by: UNITED CONTRACTING SERVICES

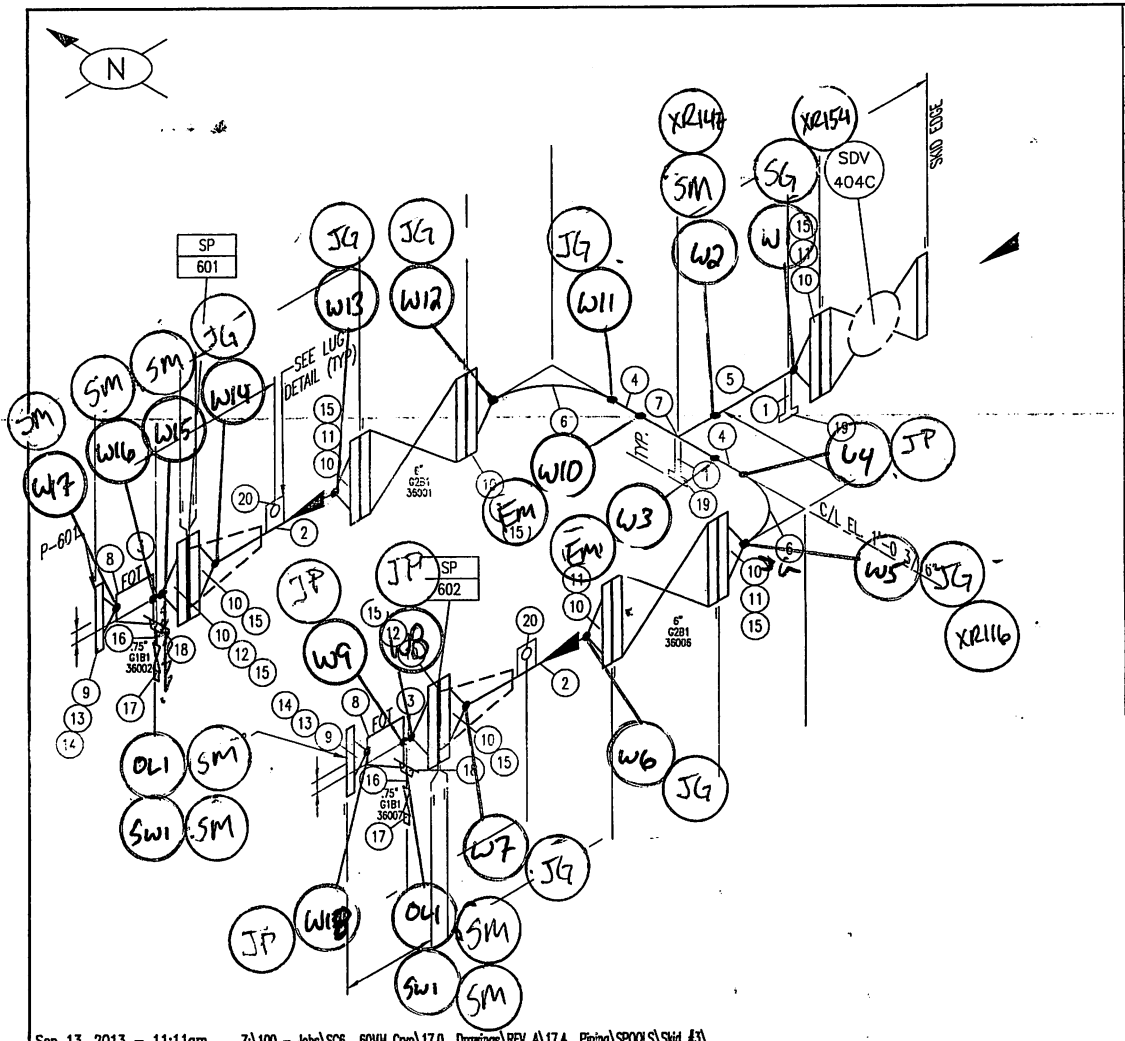
We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of Section IX of the ASME Code.

Manufacturer or Contractor: UNITED CONTRACTING SERVICES

Date: 03FEB2017

Certified by: Juston Davis

UCS QC Approved By Date 2/3/17



BILL OF MATERIAL

MARK	QTY	SIZE	DESCRIPTION	LENGTH
1	2		PIPE, STD SMLS, A-106-B 1602945	
~~2~~	~~2~~		PIPE, STD SMLS, A-106-B 107798	
~~3~~	~~2~~		PIPE, STD SMLS, A-106-B 107798	
~~4~~	~~2~~		PIPE, STD SMLS, A-106-B 107798	
~~5~~	~~10~~		PIPE, STD SMLS, A-106-B 107798	
~~6~~	~~2~~		ELL, 90 LR STD, A-234-WPB RL810 | SH602	
~~7~~	~~10~~		TEE, STR. STD, A-234-WPB SJ609	
8	2		REDUCER, ECC STD, A-234-WPB DS710E	
9	2		FLG, RFWN 300LB STD, A-105 114665	
10	9		FLG, RFWN 300LB STD, A-105 RBCB-0746	
~~11~~	~~5~~		~~(12) STUD BOLTS, A-193-B7 w/ TWO HEAVY HEX NUTS, A-194-2H~~	
~~12~~	~~2~~		~~(12) STUD BOLTS, A-193-B7 w/ TWO HEAVY HEX NUTS, A-194-2H~~	
~~13~~	2		(8) STUD BOLTS, A-193-B7 w/ TWO HEAVY HEX NUTS, A-194-2H	
~~14~~	2		~~GASKET, 1/8" THK, 300LB RF, SPIRALWOUND, 304SS WINDING, FLEXITE SUPER FILLER, CS GUIDE RING~~	
~~15~~	0		~~GASKET, 1/8" THK, 300LB RF, SPIRALWOUND, 304SS WINDING, FLEXITE SUPER FILLER, CS GUIDE RING~~	
16	2		NIPPLE, XH SMLS, A-106-B POE-TOE 7638	
~~17~~	~~2~~		~~PLUG, SOLID STEEL, ROUND HEAD, A-105~~	
18	2		SOL, 3000LB FS, A-105 59916*	
~~19~~	~~2~~		~~BASE PLATE, 1/2" THK. x 6" x 6" (SA-36 MATERIAL)~~	
~~20~~	~~2~~		~~PLATE, 1/2" THK. x 2" x 3" w/ 1-1/8" HOLE A-36~~	

J-447
12/19/16
IFC

*** = JOB #

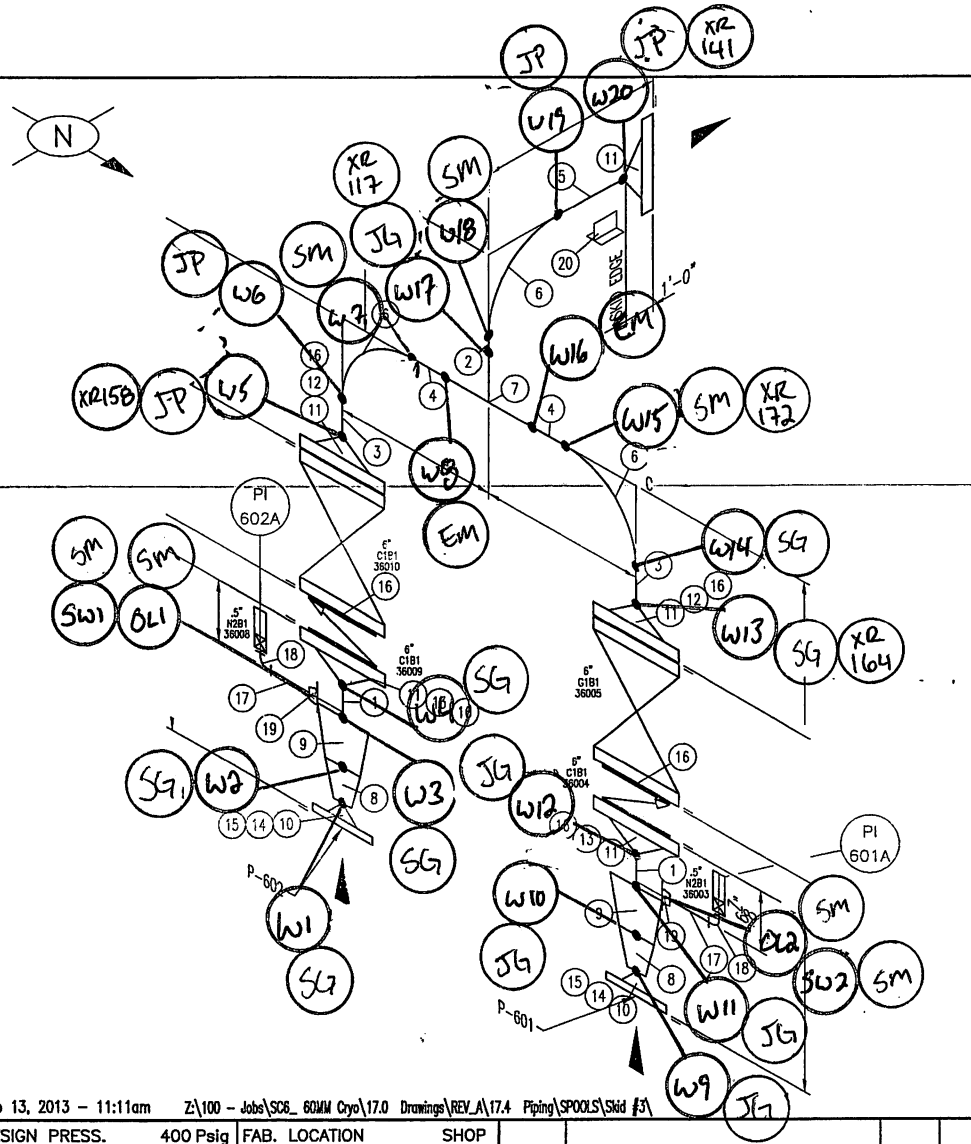
Sep 13, 2013 – 11:11am Z:\100 – Jobs\SC6_ 60MM Cryo\17.0 Drawings\REV_A\17.4 Piping\SPOOLS\Skid #3\

DESIGN PRESS.	400 Psig	FAB. LOCATION	SHOP					
DESIGN TEMP.	200 °F	SPOOL LOCATION	SKID #3					
OPER. PRESS.	190 Psia							
OPER. TEMP.	19 °F	CORR. ALLOW.	.0625"					
STRESS RELIEVE	NO	INSULATION	1"C	0	ISSUE FOR CONSTRUCTION	05/16/11	PLO	LH
RADIOGRAPHY	15% NORMAL	PAINT	TRCo SYSTEM #3	NO.	REVISION	DATE	BY	APR

FABRICATION NOTES:
ALL VALVES ARE RAISED FACE UNLESS NOTED.
ALL FITTING MAKE-UP & CUT LENGTHS FOR BW PIPE DO NOT INCLUDE WELD GAPS.
SHOP TO MAKE ADJUSTMENTS FOR WELD GAPS.
ALL PIPE SEAMLESS UNLESS NOTED OTHERWISE.
ALL COUPLING TO BE SADDLED ON.

Thomas Russell Co.
7050 S. Yale, Suite 210
Tulsa, Oklahoma 74136
PH.: 918-481-5682

LINE No.	213-B1-CS-6" 1"C
ASSEMBLY DRAWING	SC6-403
P&ID DRAWING	***-235/236
DRAWN BY	DV
DATE DRAWN	03/17/11
JOB No.	SC6
SPOOL I.D. No.	SK3-001
REV.	0



BILL OF MATERIAL

MARK	QTY	SIZE	DESCRIPTION	LENGTH
1	[illegible]		PIPE, STD SMLS, A-106-B 107798	
[illegible]	[illegible]		PIPE, STD SMLS, A-106-B 107798	
[illegible]	[illegible]		PIPE, STD SMLS, A-106-B 107798	
[illegible]	[illegible]		PIPE, STD SMLS, A-106-B 107798	
[illegible]	[illegible]		PIPE, STD SMLS, A-106-B 107798	
[illegible]	[illegible]		ELL, 90 LR STD, A-234-WPB RL810 / SH602	
[illegible]	[illegible]		TEE, STR. STD, A-234-WPB SJ609	
8	2		REDUCER, CONC STD-XH, A-234-WPB RF403C / PF613C	
9	2		REDUCER, CONC STD, A-234-WPB - SJ201C / SF713C	
10	2		FLG, RFWN 300LB XH, A-105 866	
11	5		FLG, RFWN 300LB STD, A-105 RBCB-0746	
~~12~~	~~2~~		~~(12) STUD BOLTS, A-193-B7 w/ TWO HEAVY HEX NUTS, A-194-2H~~	
~~13~~	~~2~~		~~(12) STUD BOLTS, A-193-B7 w/ TWO HEAVY HEX NUTS, A-194-2H~~	
~~14~~	~~2~~		~~(8) STUD BOLTS, A-193-B7 w/ TWO HEAVY HEX NUTS, A-194-2H~~	
~~15~~	~~2~~		~~GASKET, 1/8" THK, 300LB RF, SPIRALWOUND, 304SS WINDING, FLEXITE SUPER FILLER, CS GUIDE RING~~	
~~16~~	~~0~~		~~GASKET, 1/8" THK, 300LB RF, SPIRALWOUND, 304SS WINDING, FLEXITE SUPER FILLER, CS GUIDE RING~~	
17	2		NIPPLE, S/160 SMLS, A-106-B POE-TOE 73R7	
~~18~~	~~2~~		~~ELL, 90 THRD, 3000LB FS, A-105~~	
19	2		SOL, 3000LB FS, A-105 59983 / 59172	
~~20~~	~~1~~		~~PIPE SHOE, 0" LG x 3" HI FROM W6x16~~	

J-447
12/19/16
IFC

*** = JOB #

Sep 13, 2013 – 11:11am Z:\100 – Jobs\SC6_ 60MM Cryo\17.0 Drawings\REV_A\17.4 Piping\SPOOLS\Skid #3\

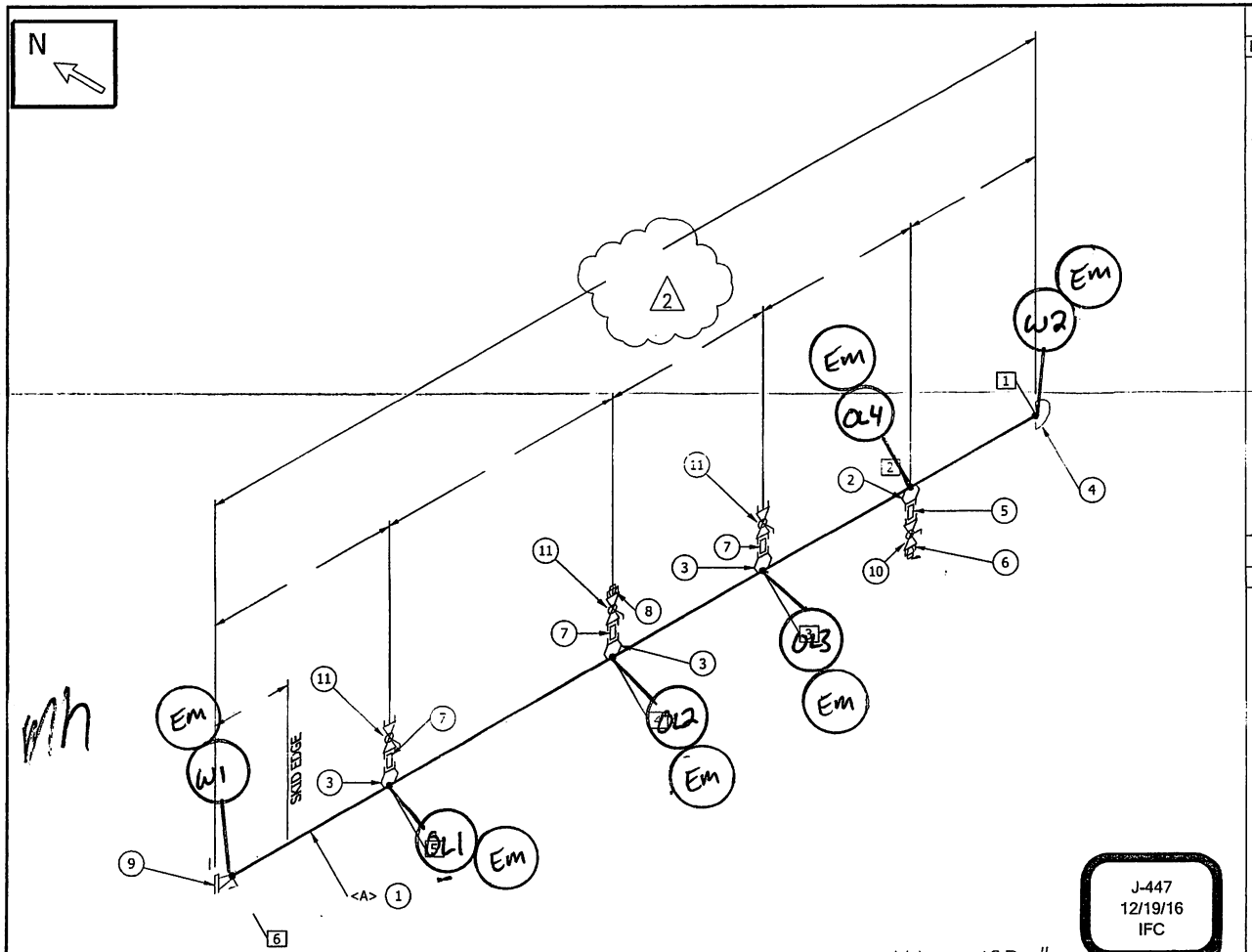
DESIGN PRESS.	400 Psig	FAB. LOCATION	SHOP					
DESIGN TEMP.	200°F	SPOOL LOCATION	SKID #3					
OPER. PRESS.	215 Psia							
OPER. TEMP.	19°F	CORR. ALLOW.	.0625"					
STRESS RELIEVE	NO	INSULATION	1"C	0	ISSUE FOR CONSTRUCTION	05/16/11	PLO	LH
RADIOGRAPHY	15% NORMAL	PAINT	TRCo SYSTEM #3	NO.	REVISION	DATE	BY	APR

FABRICATION NOTES:

ALL VALVES ARE RAISED FACE UNLESS NOTED.
ALL FITTING MAKE-UP & CUT LENGTHS FOR BW PIPE DO NOT INCLUDE WELD GAPS.
SHOP TO MAKE ADJUSTMENTS FOR WELD GAPS.
ALL PIPE SEAMLESS UNLESS NOTED OTHERWISE.
ALL COUPLING TO BE SADDLED ON.

Thomas Russell Co.
7050 S. Yale, Suite 210
Tulsa, Oklahoma 74136
PH.: 918-481-5682

LINE No.	214-B1-CS-6" 1"C
ASSEMBLY DRAWING	SC6-403
P&ID DRAWING	***-236
DRAWN BY	DV
DATE DRAWN	03/17/11
JOB No.	SC6
SPOOL I.D. No.	SK3-002
REV.	0



J-447
12/19/16
IFC

*** = JOB #

BILL OF MATERIAL

MARK	SIZE	DESCRIPTION	QTY
1		PIPE, XH SMLS, A-106-B 185967	
2		TOL, 3000LB FS, A-105 59061	
3		TOL, 3000LB FS, A-105 59444, 59868	
4		CAP, BW, XH, A-234-WPB ~~5-581~~	
~~5~~		~~NIPPLE, XH SMLS, A-106-B TBE (3" LG)~~	
~~6~~		~~PLUG, SOLID STEEL, ROUND HEAD, THRD, A-105~~	
~~7~~		~~NIPPLE, S/160 SMLS, A-106-B (3" LG)~~	
~~8~~		~~PLUG, SOLID STEEL, ROUND HEAD, THRD, A-105~~	
9		FLG, RFWN, 150LB, XH, A-105 945	
~~10~~	~~3/4~~	~~BALL VALVE, CL2000, THRD, RP (APOLLO MODEL 76-104-01)~~	
~~11~~	~~1/2~~	~~BALL VALVE, CL2000, THRD, RP (APOLLO MODEL 76-103-01)~~	

WELD MAPPING

MARK	SIZE	TYPE	SCH

PIPE CUT LIST

MARK	SIZE	LENGTH	END 1	END 2

DESIGN PRESS.	150 Psig	FAB. LOCATION	SHOP					
DESIGN TEMP.	150 °F	SPOOL LOCATION	SKID #3					
OPER. PRESS.	90 Psig			2	REVISED DIMENSION	11/16/16	MSD	RSC
OPER. TEMP.	AMBIENT °F	CORR. ALLOW.	.0625"	1	NEW DRAWING REVISED TO 2" LINE	10/31/16	MSD	RC
STRESS RELIEVE	NO	INSULATION	NONE	0	ISSUE FOR CONSTRUCTION	05/16/11	PLO	LH
RADIOGRAPHY	NONE	PAINT	SYSTEM #3	NO.	REVISION	DATE	BY	APR

FABRICATION NOTES:
ALL VALVES ARE RAISED FACE UNLESS NOTED.
ALL FITTING MAKE-UP & CUT LENGTHS FOR BW PIPE DO NOT INCLUDE WELD GAPS.
SHOP TO MAKE ADJUSTMENTS FOR WELD GAPS.
ALL PIPE SEAMLESS UNLESS NOTED OTHERWISE.
ALL COUPLING TO BE SADDLED ON.

UOP Russell
Honeywell
UOP
7050 S. Yale, Suite 210
Tulsa, Oklahoma 74136
Phone: 918-481-5882
Fax.: 918-481-7427

LINE No.	2" INSTRUMENT AIR
ASSEMBLY DRAWING	SC6-403
P&ID DRAWING	***-236
DRAWN BY	MSD
DATE DRAWN	10/31/16
JOB No.	SC6
SPOOL I.D. No.	SK3-003
REV.	2

Z:\400 - DRAFTING\001-PROJECTS\445-CRYO\DRAWINGS\400-PIPING\SPOOLS\SKID#3\SK3-003

IRISNDT

RADIOGRAPHIC INSPECTION REPORT

Gamma Type:	IR 192	Film Brand	FUJI, AGFA	Client:	United Contracting Services	Date:	3/15/2017
Curies	94	Film Type:	80,D3	Job#	S-4248 J-447 SK3	IRISNDT#	1143
EFSS:	0.146"	#Film/Cassette:	1	Location:	Tulsa, OK	PKG#	
Code:	B31.3 NFS			Item Inspected:	spool piping		
Material:	Carbon Steel						

Film ID	Interval	Size, Thickness		Welder ID	IQI	S.O.D. Inches	O.F.D. Inches	Density	Tech.	Type and Location of Discontinuities (rejectable discontinuities in square brackets [ ])	(A)ccept (R)eject
[redacted]											
XR141	T-2	6"	.280"	JP	15.F	6.625"	.280"	2-4	RT3	SK3-002, W20	A
	2-3										A
	3-T										A
[redacted]											
XR154	T-2	6"	.280"	SG	15.F	6.625"	.280"	2-4	RT3	CONCAVITY-OK	A
	2-3	SK3-001 - W1								CONCAVITY-OK	A
	3-T									CONCAVITY-OK	A
XR164	T-2	6"	.280"	SG	15.F	6.625"	.280"	2-4	RT3	SK3-002, W13	A
	2-3										A
	3-T										A
[redacted]											

RT Technique:

Exposure	Viewing	Technique
S.W.E.	S.W.V.	1,2,2A,6,7
D.W.E.	S.W.V.	3, 3A
D.W.E.	D.W.V	4, 5, 8

S.O.D. = Source-to-object distance
O.F.D. = Distance from source side of object to film

AB - Arc Burns
BT - Burn Through
CK - Crack
EP - Excessive Penetration
P - Porosity
EL - Elongated Indication
EUIC - External Undercut
IUC - Internal Undercut
HB - Hollow Bead
IP - Incomplete Penetration
S - Slag
IC - Internal Concavity
LF - Lack of Fusion
LC - Low Cover
MA - Misalignment
TI - Tungsten Inclusion

Unit# 395 Miles

In: ____ Out ____ Hrs ____

In: ____ Out ____ Hrs ____

Personnel: Daniel Culver
Casey McDaniel

Film Quantity:	
3 1/2 x 8 1/2 /10	15
3 1/2 x 17	6
4 1/2 x 8 1/2 /10	
4 1/2 x 17	
7 x 17	
14 x 17	
8 x 10	

Interpretation by:
Daniel Culver (PRINT)
(Signature)
Client Representative
I am in full agreement with report contents (Print) (Sign)

SNT-TC-1A II
CGSB
ASNT
Cert # 341

Houston, TX (713) 722 - 7177
Corpus Christi, TX (361) 888 - 4700
Deer Park, TX (281) 476 - 4444
Stanton, CA (714) 861 - 4058
North Houston, TX (713) 446 - 0200

Tulsa, OK (918) 446 - 8773
Mobile, AL (251) 660 - 0024
Beaumont, TX (409) 727 - 2400
Denver, CO (303) 289 - 5253

Griffith, IN (219) 923 - 6501
Texas City, TX New (409) 945 - 2662
Orleans, LA (504) 328 - 0070
Claremore, OK (918) 343 - 1420
West Berlin, NJ (856) 809 - 0270

IRISNDT

RADIOGRAPHIC INSPECTION REPORT

Gamma Type: IR 192 | Film Brand: FUJI
Curies: 95 | Film Type: 80
EFSS: .14 | #Film/cassette:
Code: B3(3
Material:

Client: UCS | Date: 17-Mar-17
IRISNDT #: 1190 | Job #: S-4248
Location: TULSA | PO #:
Item Inspected:

Film ID	Interval	Size, Thickness	Welder ID	IQI	S.O.D. Inches	O.F.D. Inches	Density	Technique	Type and Location of Discontinuities (rejectable discontinuities in square brackets [ ])	(A)ccept (R)eject
XR-116	T-2	6" .280	JG	BF	6.675"	.280	2-4	RT 3	SK3-001, W5	
	2-3									
	3-T									
XR-117	T-2		JG						SK3-002, W17	
	2-3									
	3-T									
XR-143	T-2	2" .218	EM	12F	2.375"	.218			SK3-003, W1	
	2-3									
	3-T									
XR-147	T-2	6" .280	SM	BF	6.675"	.280			SK3-001, W2	
	2-3									
	3-T									
XR-158	T-2		JP						SK3-002, W5	
	2-3									
	3-T									
XR-172	T-2		SM						SK3-002, W15	
	2-3									
	3-T									

RT Techniques:

Exposure	Viewing	Technique
S.W.E	S.W.V	1,2,2A,6,7
D.W.E	S.W.V	3,3A
D.W.E	D.W.V	4,5,8

S.O.D. = Source-to-object distance

O.F.D. = Distance from source side of object to film

AB - Arc Burns
BT - Burn Through
CK - Crack
EP - Excessive Penetration
P - Porosity
EI - Elongated Indication
EUC - External Undercut
IUC - Internal Undercut
HB - Hollow Bead
IP - Incomplete Penetration
S - Slag
IC - Internal Concavity
LF - Lack of Fusion
LC - Low Cover
MA - Misalignment
TI - Tungsten Inclusion

Unit#: 760 Miles:
In: Out: Hrs:
In: Out: Hrs:

Personnel:
CHRIS COMBS
DEAN LOW

Film Quantity:

Interpretation by:
CHRIS COMBS (Print)
(Signature)
SNT-TC-1A:
ASNT: II (Level)
CERT #: 1044
Client Representative: (Print)
I am in full agreement with report contents (Sign)

Houston, TX (713) 722-7177
Corpus Christi, TX (361) 888-4700
Deer Park, TX (281) 476-4444
Stanton, CA (714) 861-4058
North Houston, TX (713) 446-0200
Tulsa, OK (918) 446-8773
Mobile, AL (251) 660-0024
Beaumont, TX (409) 727-2400
Denver, CO (303) 289-5253
www.irisndt.com
Griffith, IN (219) 923-6501
Texas City, TX (409) 945-2662
New Orleans, LA (504) 328-0070
Claremore, OK (918) 343-1420
West Berlin, NJ (856) 809-0270

J-447

SK3 Assy
Spools

ISTI
Weld Procedures

ISTI Plant Services
17207 East 21st Street
Tulsa, OK 74134

Welding Procedure Specification (WPS)

WPS No.: 1001 Date: 1/24/2007 Rev.: 5 Date: 1/5/2017 Page: 1 of 2

By: Date Signed: 1/5/2017

Supporting PQR's: P1-P1-1001 Rev.2 (1/5/17)

Welding Process(es) / Type(s): GTAW / Manual

Joints (QW-402)

Joint Design: Groove and fillet welds

Joint Type	Backing	Root Opening	Groove Angle	Root Face	Groove Radius
Single-V groove	No backing	3/16" max	50 deg min	1/8" max	-
Single bevel	No backing	3/16" max	45 deg min	1/8" max	-
Single-V groove	Gouged & back welded	1/4" max	50 deg min	3/16" max	-
Double bevel	Gouged & back welded	1/4" max	45 deg min	3/16" max	-
Double-V groove	Gouged & back welded	1/4" max	45 deg min	3/16" max	-
Square groove	T-joint	1/32" max	-	-	-
Square groove	No backing	3/32" max	-	-	-

Fillet Welds: All fillet sizes on all base metal thicknesses and all diameters.

Retainers: None

SEE ENGINEERING DRAWINGS FOR MISALIGNMENT TOLERANCES. INTERNAL MISALIGNMENT TO BE 1/4" OF WALL THICKNESS, NOT TO EXCEED 1/8" MAX.

WELD JOINT DESCRIPTIONS SHOWN ARE NOT INCLUSIVE OF ALL THOSE FOUND ON A JOB. WELD JOINT DESIGN REFERENCE IN AN ENGINEERING SPECIFICATION OR A DESIGN DRAWING SHALL TAKE PRECEDENCE OVER WELD JOINTS SHOWN IN THIS WPS.

Base Metals (QW-403)

P-No.: 1 Group No.: 1, 2 Thickness Range (in.): 0.1875 to 1.5000

to P-No.: 1 Group No.: 1, 2

Filler Metals (QW-404)

Spec. No. (SFA): 5.18

AWS No. (Class): ER70S-6

Filler Metal Use: Filler Metal Used

F No.: 6 A No.: 1 (Conforms to QW-422)

Weld Metal Thickness Range: 1.5000 in. maximum

Flux Type: N/A

Flux Trade Name: N/A

Consumable Insert: None

Other:

Flux: None

Product Form: Bare (Solid)

Strip Thickness or Width (in.) : N/A

ISTI Plant Services

Welding Procedure Specification (WPS)

WPS No.: 1001 Date: 1/24/2007 Rev.: 5 Date: 1/5/2017 Page: 2 of 2

Positions (QW-405)

Position of Joint: All Positions

Weld Progression: Vertical up

Preheat (QW-406)

Preheat Temp. Min.: 75 °F

Interpass Temp. Max.: 450 °F

Preheat Maintenance: None

When Base Metal Preheat is < 50°F, preheat to 150°F minimum

Postweld Heat Treatment (QW-407)

Type: No PWHT will be performed

Temperature Range: None °F

Time Range: None

Gas (QW-408)

Gas Composition / Flow Rate

Shielding: 100% Argon / 23-30 CFH

Trailing: None

Backing: None

Electrical Characteristics (QW-409)

Current Type / Polarity: DCEN (straight)

Pulsed Current: None

Tungsten Electrode Type and Size: EWTh-2 / 3/32

Mode of Metal Transfer for GMAW(FCAW): N/A

Max. Heat Input (J/in): None

Energy/Power: CC

Technique (QW-410)

Thermal Processes: -

String or Weave Bead: Stringer and weave bead

Orifice or Gas Cup Size: #5 to #10

Initial and Interpass Cleaning: With wire brush clean 1 inch (25 mm) on both sides of weld joint

Method of Back Gouging: When required, grind until all defects are removed.

Oscillation: N/A

Contact Tube to Work Distance: N/A

Single or Multiple Passes (per side): Multipass

Single or Multiple Electrodes: N/A

Peening: None

No Autogenous Welding is permitted.

GTAW Bead Width limited to 4.5x the rod diameter.

Process Welding Parameters

Weld Layer(s) and/or Pass(es)	Process	Filler Metal		Current		Voltage Range	Travel Speed Range (in/min)
		Class	Diameter (in.)	Type / Polarity	Amperage Range		
Any	GTAW	ER70S-6	1/16	DCEN (straight)	70-150	17-22	Var.
Any	GTAW	ER70S-6	3/32	DCEN (straight)	80-180	18-23	Var.
Any	GTAW	ER70S-6	1/8	DCEN (straight)	130-275	20-25	Var.
Any	GTAW	ER70S-6	3/16	DCEN (straight)	200-375	21-27	Var.

Notes

*Rev. 1: Corrected Preheat to match PQR and added Hardness Results to PQR.

**Rev. 2: Added Preheat temperature for 1-1/4" to 1-1/2" thickness and verify chemical analysis for ER70S-6.

***Rev. 3: Method of confirming ER70S-6 chemical analysis & misalignment limitations (A-No. Verification confirmed by OEM documentation.)

****Rev. 4: Added "No Autogenous Welding is permitted" comment, and "GTAW bead width is limited to 4.5x the rod diameter" comment.

*****Rev. 5: Added NACE MR0175 Vickers Hardness to PQR.

ISTI Plant Services
17207 East 21st Street
Tulsa, OK 74134

Procedure Qualification Record (PQR)

PQR No.: **PI-PI-1001 Rev.2 (1/5/17)** WPS No.: **1001 Rev. 5** Date: **1/24/2007** Page: **1 of 2**

Welding Process(es) / Type(s): **GTAW / Manual**

Joints (QW-402)

Weld Type: Groove weld
Single-V groove
Backing: Open butt, no back weld
Root Opening: 5/32 in. Root Face: 0 in.
Groove Angle: 60 °

Base Metals (QW-403)

Material Spec., Type or Grade:
SA-516, Grade 70 to SA-516, Grade 70
P-No.: 1 Group No.: 2 to P-No.: 1 Group No.: 2
Thickness of Test Coupon (in.): 0.750

Filler Metals (QW-404)

SFA Specification: 5.18
AWS Classification: ER70S-6
Filler Metal Use: Filler Metal Used
Filler Metal F-No: 6
Weld Metal Analysis A-No: 1 (Conforms to QW-422)
Size of Filler Metal (in.): 3/32
Weld Deposit 't' (in.): 0.750
Filler Metal Product Form: Bare (Solid)
Consumable Insert: None
Flux: None

Positions (QW-405)

Position of Joint: 1G - Flat
Weld Progression: N/A

Preheat (QW-406)

Preheat Temp.: 75 °F
Interpass Temp.: 450 °F
Preheat Maintenance: None

Postweld Heat Treatment (QW-407)

Type: No PWHT performed
Temperature: None °F
Time: None hr

Gas (QW-408)

Gas Composition / Flow Rate
Shielding: 100% Argon / 25 CFH
Trailing: None
Backing: None

Electrical Characteristics (QW-409)

Current / Polarity: DCEN (straight)
Amps: 142
Volts: 15
Tungsten Type / Size: EWTh-2 / 3/32
Heat Input: N/R
Pulsed Current: None

Technique (QW-410)

Travel Speed (in/min): 3
Thermal Processes: (1)No
String/Weave Bead: Stringer and weave bead
Oscillation: N/A
Mult./Single Pass (per side): Multipass
Mult./Single Electrode: N/A
Nozzle/Gas Cup Size: 6

(1) *Rev. 1 (2/22/2010): Added Brinell Hardness to PQR.
**Rev. 2 (1/5/2017): Added NACE MR0175 Vickers Hardness to PQR - Lab #M170003 Welder: Mando Tang.
**SEE LAB REPORT FOR ACTUAL HARDNESS READING LOCATIONS.

ISTI Plant Services

Procedure Qualification Record (PQR)

PQR No.: P1-P1-1001 Rev.2 (1/5/17)

Tensile Test (QW-150)

Specimen No.	Width (in.)	Thickness (in.)	Area (in^2)	Ultimate Total Load (lb)	Ultimate Stress (PSI)	Failure Type and Location
1	0.755	0.753	0.5685	41250	72559	Ductile - BM
2	0.757	0.752	0.5693	42050	73863	Ductile - BM

Guided Bend Test (QW-160)

Figure Number and Type	Result	Figure Number and Type	Result
QW-462.2 Side bend	Passed	QW-462.2 Side bend	Passed
QW-462.2 Side bend	Passed	QW-462.2 Side bend	Passed
None		None	

Hardness Test - Brinell/Vickers hardness

Location	Readings								
	1	2	3	4	5	6	7	8	9
SA-516, Grade 70 BM (Brinell)	165	163	159	159	158	167			
SA-516, Grade 70 HAZ (Brinell)	174	175	176	168	169	171			
Weld metal (Brinell)	189	191	186						
SA-516, Grade 70 BM (Vickers)	163.8	161.2	162.4	173.2					
SA-516, Grade 70 HAZ (Vickers)	180.9	189.3	256.3	225.2	227.9	209.9	233.6	232.4	188.7
SA-516, Grade 70 HAZ (Vickers).	197.8								
Weld metal (Vickers)	193.6	181.1	247.9	234.5	181.1				

Visual Examination: Acceptable

Jimmy Dick 102124579
Andres Garcia 102126206
Mando Tang M170003

Welder's Name: J. Dick-4579 A. Garcia-6206 M. Tang-0003 ID: _____ Stamp: _____

Welding of coupon was witnessed by: ISTI Plant Services

Tests Conducted By: Tulsa Gamma Ray, Inc. Test ID.: See Above

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.

Approved By: _____ 1/5/2017
Date

TULSA GAMMA RAY, INC.
INSPECTION DIVISION
1127 S. Lewis Avenue Tulsa, OK 74104-3900
Phone 918-585-3228 Fax 918-584-5598

TEST REPORT

PQR# P1-P1-1001
WPS# 1001
Lab No. 102124579
Material SA516-70
Thickness 0.750"

Date 1-24-07

TENSILE TEST (QW-150)

SPECIMEN NO.	WIDTH	THICKNESS	AREA	ULTIMATE TOATL LOAD (LB)	ULTIMATE UNIT STRESS (PSI)	TYPE OF FAILURE & LOCATION
1	0.755	0.753	0.5685	41250	72559	Ductile-Base
2	0.757	0.752	0.5693	42050	73863	Ductile-Base

GUIDED BEND TESTS (QW-160)

TYPE AND FIGURE NO.	RESULTS
1 SIDE BEND	NO DEFECT GREATER THAN 1/8". "PASSED"
2 SIDE BEND	NO DEFECT GREATER THAN 1/8". "PASSED"
3 SIDE BEND	NO DEFECT GREATER THAN 1/8". "PASSED"
4 SIDE BEND	NO DEFECT GREATER THAN 1/8". "PASSED"

Welder Jimmy Dick

ISTI PLANT SERVICES
Client

Submitted by John Phillips

TULSA GAMMA RAY, INC.

1127 S Lewis Ave Tulsa, OK 74104
918.585.3228

MECHANICAL TEST REPORT

☐ Welder Qualification ☒ Weld Procedure Evaluation

Organization	ISTI PLANT SERVICES	**LAB #**	102126206
Base Metal Type	SA516-70	**PWHT**	N.A.
Coupon Thickness	0.500"	**PQR#**	P1-P1-1001
WPS No.	1001	**Filler**	ER70S-6
Weld Process	GTAW	**Position**	1G
Welder's Name	ANDRES GARCIA		

BENDS

Specimen Number	Bend Type	Results/Comments
1	N/A	N/A
2	N/A	N/A
3	N/A	N/A
4	N/A	N/A

TENSILE TESTS

Specimen Number	Specimen Size	Specimen Area sq. in.	Load at Failure PSI	Ultimate Tensile PSI	Break Location
1	N/A	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	N/A

HARDNESS IN BHN

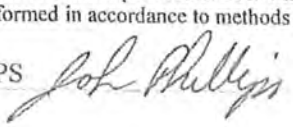
Material 1			Heat Affected Zone			Weld Metal		
1	2	3	1	2	3	1	2	3
165	163	159	174	175	176	189	191	186
Material 2			**Heat Affected Zone**					
1	2	3	1	2	3			
159	158	167	168	169	171			

CHARPY V-NOTCH IMPACT TESTING

Specimen Number	Specimen Type	Specimen Size	Temp. F	Value Ft./Lbs.	Lateral Expansion	Percent Shear
N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A

Other Tests Performed: NONE

Heat Treatment per ASME Sec. VIII Div. I UCS-56, Impacts per UG-84.
All test performed in accordance to methods specified in ASME SA-370 & ASME Sec. IX.

Signature JOHN PHILLIPS  Date 2-22-10

American Piping Inspection, Metallurgical Lab

18501 E. Admiral Pl. Catoosa, Oklahoma 74015
Office: (918) 266-4130

Form: MR-8
Established: 10/2/16
Revision: 0
Date: 10/2/16

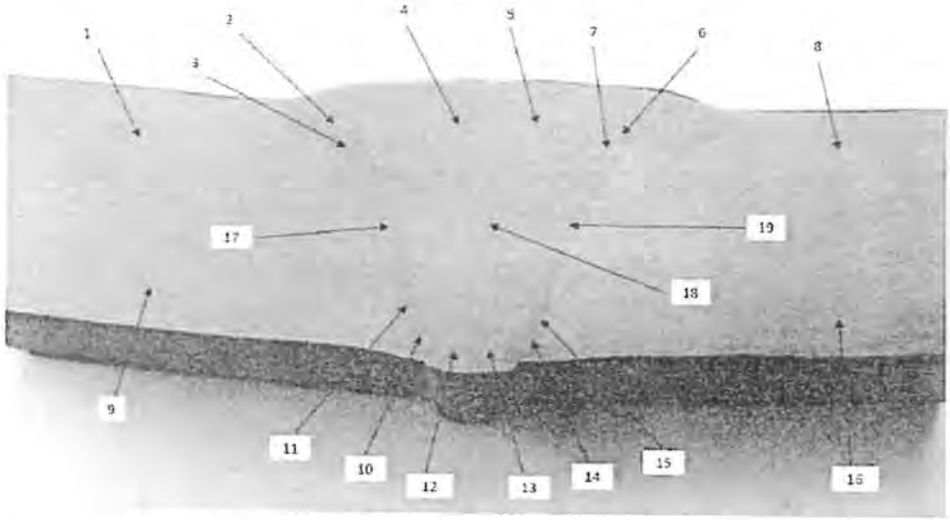
Mechanical/Lab Test Report

Organization:	ISTI Plant Services	Lab Number:	M170003 Rev. 0
Base Material:	1 SA-106 GRB to 2 SA-106 GRB	Heat Number:	N/A
Coupon Dimension:	6.625" O.D. x 0.562" Pos. 1GR	Welder Name/ID:	Mando Tang ID. N/A
WPS/PQR #:	1001	Process(es):	GTAW
Filler Metal:	ER70S-6	PWHT:	N/A

Vickers Hardness (HV10)

Indention Number	Location	Hardness Value	Indention Number	Location	Hardness Value	Indention Number	Location	Hardness Value
1	BM	163.8	11	HAZ	209.9	N/A		
2	HAZ	180.9	12	WM	247.9	N/A		
3	HAZ	189.3	13	WM	234.5	N/A		
4	WM	193.6	14	HAZ	233.6	N/A		
5	WM	181.1	15	HAZ	232.4	N/A		
6	HAZ	256.3	16	BM	173.2	N/A		
7	HAZ	225.2	17	HAZ	188.7	N/A		
8	BM	161.2	18	WM	181.1	N/A		
9	BM	162.4	19	HAZ	197.8	N/A		
10	HAZ	227.9	N/A			N/A		
	Average BM:	165.15		Average HAZ:	214.2		Average WM:	207.64

For Reference Only



Comments

Other Tests: N/A

All testing performed in accordance with the methods specified in NACE MRO175

Approved by: Eric Darge Date: 1/5/2017 Signature: Eric Darge

Title: Certified Associate Welding Inspector

IST1 Plant Services
17207 East 21st Street
Tulsa, OK 74134

Welding Procedure Specification (WPS)

WPS No.: 1003. Date: 11/15/2006 Rev.: 4 Date: 1/5/2017 Page: 1 of 2
By: Date Signed: 1/5/2017
Supporting PQR's: **P1-P1-1003 Rev.4 (1/5/2017)**
Welding Process(es) / Type(s): **(1) GTAW / Manual (2) FCAW / Semiautomatic**

Joints (QW-402)
Joint Design: Groove and fillet welds

Joint Type	Backing	Root Opening	Groove Angle	Root Face	Groove Radius
Single-V groove	No backing	3/16" max	50 deg min	1/8" max	-
Single bevel	No backing	3/16" max	45 deg min	1/8" max	-
Single-V groove	Gouged & back welded	1/4" max	50 deg min	3/16" max	-
Double bevel	Gouged & back welded	1/4" max	45 deg min	3/16" max	-
Double-V groove	Gouged & back welded	1/4" max	45 deg min	3/16" max	-
Square groove	T-joint	1/32" max	-	-	-
Square groove	No backing	3/32" max	-	-	-

Fillet Welds: All fillet sizes on all base metal thicknesses and all diameters.
Retainers: None
Groove weld joint details to be approved by Company Representative.

WELD JOINT DESCRIPTIONS SHOWN ARE NOT INCLUSIVE OF ALL THOSE FOUND ON A JOB. WELD JOINT DESIGN REFERENCE IN AN ENGINEERING SPECIFICATION OR A DESIGN DRAWING SHALL TAKE PRECEDENCE OVER WELD JOINTS SHOWN IN THIS WPS.

Base Metals (QW-403)
P-No.: 1 Group No.: 1 or 2 Thickness Range (in.): 0.1875 to 8.0000
to P-No.: 1 Group No.: 1 or 2

*Rev. 1 (10/15/2009): Added SI Materials designation to supporting PQR line per customer requuest.
**Rev. 2 (9/18/2015): Clarified weld progression, added maximum Hardness Note, and updated to latest Prowrite format.
***Rev. 3 (4/11/2016): claified GTAW Chemistry verification, Tube to Work Contact Distance, grinding if needed between passes ,added preheat ranges, group 2 designation & groove weld joint detail approval by Company Representative statement.
****Rev. 4 (1/5/17): Added NACE MR0175 Vickers Hardness to PQR.

Filler Metals (QW-404)
Spec. No. (SFA): (1) 5.18 (2) 5.20
AWS No. (Class): (1) ER70S-6 (2) E71T-12M
Filler Metal Use:(1) Filler Metal Used
F No.: (1 & 2) 6 A No.: (1 & 2) (verify chemistry)
Weld Metal Thickness Range: (1) 0.2500 in. maximum (2) 8.0000 in. maximum No Pass Greater Than ½" Allowed
Flux Type: N/A
Flux Trade Name: N/A
Consumable Insert: (1) No consumable insert used
Other:
Flux: (1) No flux used
Product Form: (1) Bare (Solid) (2) Flux cored
Supplemental Filler Metal: (2) None
Strip Thickness or Width (in.) : N/A

ISTI Plant Services

Welding Procedure Specification (WPS)

WPS No.: 1003. Date: 11/15/2006 Rev.: 4 Date: 1/5/2017 Page: 2 of 2

Positions (QW-405)

Position of Joint: (1 & 2) All Positions

Weld Progression: (1 & 2) Vertical up

Preheat (QW-406)

Preheat Temp. Min.: 70 °F

Interpass Temp. Max.: 400 °F

Preheat Maintenance: None

70°F< 1.00", 175°F > 1.00"

Postweld Heat Treatment (QW-407)

Type: No PWHT will be performed

Temperature Range: None °F

Time Range: None

Gas (QW-408)

Gas Composition / Flow Rate

Shielding: (1) 100% Argon / 23-30 CFH

(2) 75% Argon, 25% CO2 / 23-30 CFH

Trailing: (1 & 2) None

Backing: (1 & 2) None

Electrical Characteristics (QW-409)

Current Type / Polarity: (1) DCEN (straight) (2) DCEP (reverse)

Pulsed Current: (1) No pulsed current used

Tungsten Electrode Type and Size: (1) EWTh-2 / 3/32 (2) N/A

Mode of Metal Transfer for GMAW(FCAW): (1) N/A (2) Globular arc

Max. Heat Input (J/in): (1 & 2) None

Technique (QW-410)

Thermal Processes: (1 & 2) -

String or Weave Bead: (1 & 2) Stringer and weave bead

Orifice or Gas Cup Size: (1) #5 to #10 (2) 3/8" to 5/8"

Initial and Interpass Cleaning: Grind or wire brush clean 1 inch 925mm) on both sides of weld joint

Method of Back Gouging: When required, grind until all defects are removed.

Oscillation: N/A

Contact Tube to Work Distance: (2) 5/8" - 7/8"

Single or Multiple Passes (per side): (1) Multipass (2) -

Single or Multiple Electrodes: N/A

Peening: (1 & 2) None

(1) ER70S-6 chemistry to be verified bt Typical MTR from filler metal manufacturer.

Process Welding Parameters

Weld Layer(s) and/or Pass(es)	Process	Filler Metal		Current		Voltage Range	Travel Speed Range (in/min)
		Class	Diameter (in.)	Type / Polarity	Amperage Range		
Any	GTAW	ER70S-6	1/16	DCEN (straight)	70-150	n/r	Var.
Any	GTAW	ER70S-6	3/32	DCEN (straight)	80-180	n/r	Var.
Any	GTAW	ER70S-6	1/8	DCEN (straight)	130-275	n/r	Var.
Any	GTAW	ER70S-6	3/16	DCEN (straight)	200-375	n/r	Var.
Any	FCAW	E71T-12M	0.035	DCEP (reverse)	120-200	19-24	Var.
Any	FCAW	E71T-12M	0.045	DCEP (reverse)	150-225	22-26	Var.
Any	FCAW	E71T-12M	1/16	DCEP (reverse)	175-275	25-28	Var.
Any	FCAW	E71T-12M	5/64	DCEP (reverse)	200-400	26-32	Var.
Any	FCAW	E71T-12M	3/32	DCEP (reverse)	300-500	26-34	Var.

ISTI Plant Services
17207 East 21st Street
Tulsa, OK 74134

Procedure Qualification Record (PQR)

PQR No.: P1-P1-1003 Rev.4 (1/5/2017) WPS No.: 1003. Date: 11/15/2006 Page: 1 of 2

Welding Process(es) / Type(s): (1) GTAW / Manual (2) FCAW / Semiautomatic

Joints (QW-402)

Weld Type: Groove weld
Single-V groove
Backing: Open butt, no back weld
Root Opening: 1/8 in. Root Face: - in.
Groove Angle: 60 °

Base Metals (QW-403)

Material Spec., Type or Grade:
SA-516, Grade 70 to SA-516, Grade 70
P-No.: 1 Group No.: 2 to P-No.: 1 Group No.: 2
Thickness of Test Coupon (in.): 1.500

Filler Metals (QW-404)

SFA Specification: (1) 5.18 (2) 5.20
AWS Classification: (1) ER70S-6 (2) E71T-12M
Filler Metal Use: (1) Filler Metal Used
Filler Metal F-No: (1 & 2) 6
Weld Metal Analysis A-No: (1 & 2) (verify chemistry)
Size of Filler Metal (in.): (1) 3/32 (2) 0.045
Weld Deposit 't' (in.): (1) 0.125 (2) 1.375
Pass Greater Than ½": (2) No
Filler Metal Product Form: (1) Bare (Solid) (2) Flux cored
Supplemental Filler Metal: (2) None
Consumable Insert: (1) None

Positions (QW-405)

Position of Joint: (1 & 2) 1G - Flat
Weld Progression: (1 & 2) N/A

Preheat (QW-406)

Preheat Temp.: 32 °F
Interpass Temp.: 500 °F
Preheat Maintenance: None

Postweld Heat Treatment (QW-407)

Type: No PWHT performed
Temperature: None °F
Time: None hr

Gas (QW-408)

Gas Composition / Flow Rate
Shielding: (1) 100% Argon / 25 CFH
(2) 75% Argon, 25% CO2 / 25 CFH
Trailing: (1 & 2) None
Backing: (1 & 2) None

Electrical Characteristics (QW-409)

Current / Polarity: (1) DCEN (straight) (2) DCEP (reverse)
Amps: (1) 140 (2) 160
Volts: (1) 15 (2) 26
Tungsten Type / Size: (1) EWTh-2 / 3/32 (2) N/A
Transfer Mode: (2) Globular arc
Wire Feed Speed (in/min): (2) 300
Heat Input: (1 & 2) N/R

Technique (QW-410)

Travel Speed (in/min): (1) 3 (2) 4
Thermal Processes: (1 & 2) No
String/Weave Bead: (1 & 2) Stringer and weave bead
Oscillation: (1 & 2) N/A
Mult./Single Pass (per side): (1 & 2) Multipass
Mult./Single Electrode: (1 & 2) N/A
Nozzle/Gas Cup Size: (2) .625
Contact Tube to Work Dist.: (2) 3/4

(1) *Rev. 1 (4/3/08): Added Brinell Hardness
**Rev. 2 (10/15/09): Added SI Material
***Rev. 3 (9/18/15): Updated to latest Prowrite Format.

(2) ****Rev. 4 (1/7/2017): Added NACE MRO175 Vickers Hardness to PQR - Lab #M170005 Welder: Arturo Vallejo.
****SEE LAB REPORT FOR ACTUAL HARDNESS READING LOCATIONS

ISTI Plant Services

Procedure Qualification Record (PQR)

PQR No.: P1-P1-1003 Rev.4 (1/5/2017)

Tensile Test (QW-150)

Specimen No.	Width (in.)	Thickness (in.)	Area (in^2)	Ultimate Total Load (lb)	Ultimate Stress (PSI)	Failure Type and Location
1	0.758	1.521	1.15	84350	73300	Ductile - BM
2	0.753	1.527	1.15	83850	72900	Ductile - BM

Guided Bend Test (QW-160)

Figure Number and Type	Result	Figure Number and Type	Result
QW-462.2 Side bend	Passed	QW-462.2 Side bend	Passed
QW-462.2 Side bend	Passed	QW-462.2 Side bend	No defects noted
None		None	

Hardness Test - Brinell/Vickers hardness

Location	Readings								
	1	2	3	4	5	6	7	8	9
SA-516, Grade 70 BM (Brinell)	264	266	258	267	263	269			
SA-516, Grade 70 HAZ (Brinell)	275	273	270	276	275	281			
Weld metal (Brinell)	281	281	289						
SA-106, Grade B BM (Vickers)	159.7	167.5	175.6	169					
SA-106, Grade B HAZ (Vickers)	197.4	199.1	233.6	223.6	178.1	176.1	194.6	186.6	172.9
SA-106, Grade B HAZ (Vickers).	174								
Weld metal (Vickers)	194.3	188.7	184.6	189.9	172.7				

Visual Examination: Acceptable

Welders/Lab Numbers
Jimmy Dick Lab# 102124377
Erik Medrando Lab# 102126341
Arturo Vallejo Lab# W170005

Welder's Name: J. Dick -4377 E. Medrando-6341 A. Vallejo-7005 ID: _____ Stamp: _____

Welding of coupon was witnessed by: ISTI Plant Services

Tests Conducted By: Tulsa Gamma Ray Test ID.: See Above

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.

Approved By: Rod Wolfe 1/5/2017
Date

TULSA GAMMA RAY, INC.
INSPECTION DIVISION
1127 S. Lewis Avenue Tulsa, OK 74104-3900
Phone 918-585-3228 Fax 918-584-5598

TEST REPORT

PQR# P1-P1-1003
WPS# 1003
Lab No. 102124377
Material SA516-70
Thickness 1.500"

Date 11-15-06

TENSILE TEST (QW-150)

SPECIMEN NO.	WIDTH	THICKNESS	AREA	ULTIMATE TOATL LOAD (LB)	ULTIMATE UNIT STRESS (PSI)	TYPE OF FAILURE & LOCATION
1	0.758"	1.521"	1.15	84,350	73,300	Ductile-Base
2	0.753"	1.527"	1.15	83,850	72,900	Ductile-Base

GUIDED BEND TESTS (QW-160)

	TYPE AND FIGURE NO.		RESULTS
#1	SIDE BEND	QW-462.2	NO DEFECT GREATER THAN 1/8". "PASSED"
#2	SIDE BEND	QW-462.2	NO DEFECT GREATER THAN 1/8". "PASSED"
#3	SIDE BEND	QW-462.2	NO DEFECT GREATER THAN 1/8". "PASSED"
#4	SIDE BEND	QW-462.2	NO DEFECT GREATER THAN 1/8". "PASSED"

Welder Jimmy Dick

ISTI PLANT SERVICES
Client

JP
Submitted by John Phillips

All test performed in accordance to methods specified in ASTM A370 & ASME Sec. IX

TULSA GAMMA RAY, INC.

1127 S Lewis Ave Tulsa, OK 74104
918.585.3228

MECHANICAL TEST REPORT

☐ Welder Qualification ☒ Weld Procedure Evaluation

Organization	ISTI PLANT SERVICES	**LAB #**	102126341
Base Metal Type	SA106B	**PWHT**	N.A.
Coupon Thickness	6" Sch 120 (6.625" x 0.562")	**PQR#**	P1-P1-1003
WPS No.	1003	**Filler**	ER70S-6/E71T-12M
Weld Process	GTAW/FCAW	**Position**	6G
Welder's Name	Erik Medrando		

BENDS

Specimen Number	Bend Type	Results/Comments
1	N/A	N/A
2	N/A	N/A
3	N/A	N/A
4	N/A	N/A

TENSILE TESTS

Specimen Number	Specimen Size	Specimen Area sq. in.	Load at Failure PSI	Ultimate Tensile PSI	Break Location
1	N/A	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	N/A

HARDNESS IN BHN

Material 1			Heat Affected Zone			Weld Metal		
1	2	3	1	2	3	1	2	3
264	266	258	275	273	270	281	281	289

Material 2			Heat Affected Zone		
1	2	3	1	2	3
267	263	269	276	275	281

CHARPY V-NOTCH IMPACT TESTING

Specimen Number	Specimen Type	Specimen Size	Temp. F	Value Ft./Lbs.	Lateral Expansion	Percent Shear
NONE	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A

Other Tests Performed: NONE

Heat Treatment per ASME Sec. VIII Div 1 UCS-56. Impacts per UG-84.
All test performed in accordance to methods specified in ASME SA-370 & ASME Sec. IX.

Signature JOHN PHILLIPS JP

Date 4-3-08

American Piping Inspection, Metallurgical Lab
18501 E. Admiral Pl. Catoosa, Oklahoma 74015
Office: (918) 266-4130

Form: MR-8
Established: 10/2/16
Revision: 0
Date: 10/2/16

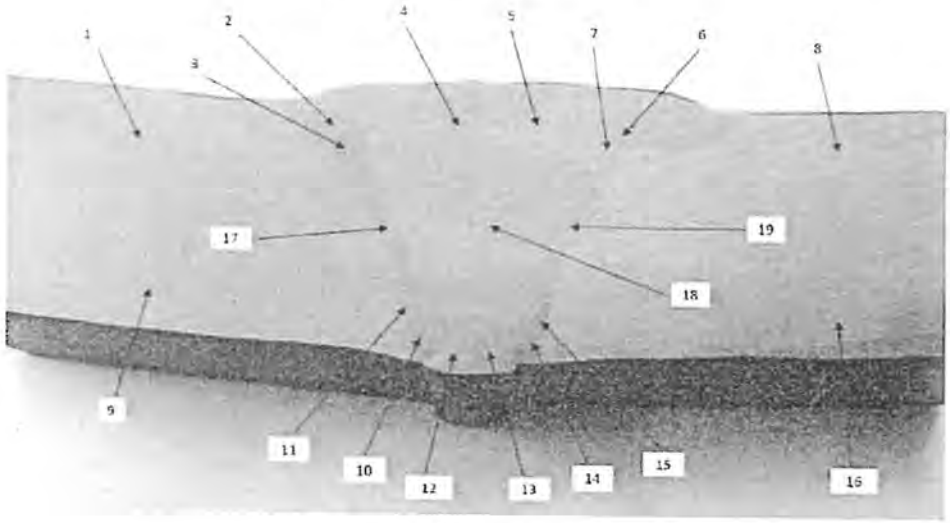
Mechanical/Lab Test Report

Organization:	ISTI Plant Services	Lab Number:	M170005 Rev. 0
Base Material:	1 SA-106 GRB to 2 SA-106 GRB	Heat Number:	N/A
Coupon Dimension:	6.625" O.D. x 0.562" Pos. 1GR	Welder Name/ID:	Arturo Vallejo ID. N/A
WPS/PQR #:	1003	Process(es):	GTAW/FCAW
Filler Metal:	ER70S-6/E71T-12M	PWHT:	N/A

Vickers Hardness (HV10)

Indention Number	Location	Hardness Value	Indention Number	Location	Hardness Value	Indention Number	Location	Hardness Value
1	BM	159.7	11	HAZ	176.1	N/A		
2	HAZ	197.4	12	WM	184.6	N/A		
3	HAZ	199.1	13	WM	189.9	N/A		
4	WM	194.3	14	HAZ	194.6	N/A		
5	WM	188.7	15	HAZ	186.6	N/A		
6	HAZ	233.6	16	BM	169	N/A		
7	HAZ	223.6	17	HAZ	172.9	N/A		
8	BM	167.5	18	WM	172.7	N/A		
9	BM	175.6	19	HAZ	174	N/A		
10	HAZ	178.1	N/A			N/A		
	Average BM:	167.95		Average HAZ:	193.6		Average WM:	186.04

For Reference Only



Comments

Other Tests: N/A

All testing performed in accordance with the methods specified in NACE MR0175

Approved by: Eric Darge Date: 1/5/2017 Signature:

Title: Certified Associate Welding Inspector

ISTI Plant Services
17207 East 21st Street
Tusla, Ok 74134

Welding Procedure Specification (WPS)

WPS No.: 1004. Date: 10/16/2006 Rev.: 4 Date: 1/5/2017 Page: 1 of 2

By: Date Signed: 1/5/2017

Supporting PQR's: P1-P1-1004 Rev. 4 (1/5/2017)

Welding Process(es) / Type(s): (1) GMAW / Semiautomatic (2) FCAW / Semiautomatic

Joints (QW-402)

Joint Design: Groove and fillet welds

Joint Type	Backing	Root Opening	Groove Angle	Root Face	Groove Radius
Single-V groove	No backing	3/16" max	50 deg min	1/8" max	-
Single bevel	No backing	3/16" max	45 deg min	1/8" max	-
Single-V groove	Gouged & back welded	1/4" max	50 deg min	3/16" max	-
Double bevel	Gouged & back welded	1/4" max	45 deg min	3/16" max	-
Double-V groove	Gouged & back welded	1/4" max	45 deg min	3/16" max	-
Square groove	T-joint	1/32" max	-	-	-
Square groove	No backing	3/32" max	-	-	-

Fillet Welds: All fillet sizes on all base metal thicknesses and all diameters.

Retainers: None

All groove weld joint details musdt be approved by Company Representative.

WELD JOINT DESCRIPTIONS SHOWN ARE NOT INCLUSIVE OF ALL THOSE FOUND ON A JOB. WELD JOINT DESIGN REFERENCE IN AN ENGINEERING SPECIFICATION OR A DESIGN DRAWING SHALL TAKE PRECEDENCE OVER WELD JOINTS SHOWN IN THIS WPS.

Base Metals (QW-403)

P-No.: 1 Group No.: 1 or 2 Thickness Range (in.): 0.1875 to 8.0000

to P-No.: 1 Group No.: 1 or 2

*Rev. 1 (7/5/2007): Deleted SA516-70 Material Spec
**Rev. 2 (9/10/2015): Updated to latest Prowrite Format
***Rev. 3 (4/11/2016): Updated contact to work distances, corrected GMAW mode of transfer to reflect actual Volts &Amps used, added Group 2 designation of P Number & added groove weld joint detail approval by Company Representative statement.
****Rev. 4 (1/5/2017): Added NACE MR0175 Vickers Hardness to PQR.

Filler Metals (QW-404)

Spec. No. (SFA): (1) 5.18 (2) 5.20

AWS No. (Class): (1) ER70S-6 (2) E71T-12M

F No.: (1 & 2) 6 A No.: (1 & 2) (verify chemistry)

Weld Metal Thickness Range: (1) 0.2500 in. maximum No Pass Greater Than ½" Allowed
(2) 8.0000 in. maximum No Pass Greater Than ½" Allowed

Flux Type: N/A

Flux Trade Name: N/A

Consumable Insert: N/A

Other:

Product Form: (1) Bare (Solid) (2) Flux cored

Supplemental Filler Metal: (1 & 2) None

Strip Thickness or Width (in.) : N/A

ISTI Plant Services

Welding Procedure Specification (WPS)

WPS No.: 1004. Date: 10/16/2006 Rev.: 4 Date: 1/5/2017

Positions (QW-405)

Position of Joint: (1 & 2) All Positions

Weld Progression: (1 & 2) Vertical up

Preheat (QW-406)

Preheat Temp. Min.: 70 °F

Interpass Temp. Max.: 400 °F

Preheat Maintenance: None

Postweld Heat Treatment (QW-407)

Type: No PWHT will be performed

Temperature Range: None °F

Time Range: None

Gas (QW-408)

Gas Composition / Flow Rate

Shielding: (1 & 2) 75% Argon, 25% CO2 / 32-42 CFH

Trailing: (1 & 2) None

Backing: (1 & 2) None

Electrical Characteristics (QW-409)

Current Type / Polarity: (1 & 2) DCEP (reverse)

Tungsten Electrode Type and Size: (1 & 2) N/A

Mode of Metal Transfer for GMAW(FCAW): (1 & 2) Globular arc

Max. Heat Input (J/in): (1 & 2) None

Technique (QW-410)

Thermal Processes: (1 & 2) -

String or Weave Bead: (1 & 2) Stringer and weave bead

Orifice or Gas Cup Size: (1 & 2) 3/8" to 5/8"

Initial and Interpass Cleaning: Grind or wire brush clean 1 inch (25 mm) on both sides of weld joint

Method of Back Gouging: When required, grind until all defects are removed.

Oscillation: N/A

Contact Tube to Work Distance: (1) 1/2 to 3/4"" (2) 5/8" to 7/8"

Single or Multiple Passes (per side): (1) Multipass (2) -

Single or Multiple Electrodes: N/A

Peening: (1 & 2) None

Process Welding Parameters

Weld Layer(s) and/or Pass(es)	Process	Filler Metal		Current		Voltage Range	Travel Speed Range (in/min)
		Class	Diameter (in.)	Type / Polarity	Amperage Range		
Any	GMAW	ER70S-6	0.035	DCEP (reverse)	100-175	23-26	Var.
Any	GMAW	ER70S-6	0.045	DCEP (reverse)	150-250	23-27	Var.
Any	GMAW	ER70S-6	1/16	DCEP (reverse)	200-300	24-28	Var
Any	FCAW	E71T-12M	0.035	DCEP (reverse)	120-200	19-24	Var.
Any	FCAW	E71T-12M	0.045	DCEP (reverse)	150-225	22-26	Var.
Any	FCAW	E71T-12M	1/16	DCEP (reverse)	175-275	25-28	Var.
Any	FCAW	E71T-12M	5/64	DCEP (reverse)	200-400	26-32	Var.
Any	FCAW	E71T-12M	3/32	DCEP (reverse)	300-500	26-34	Var.

ISTI Plant Services
17207 East 21st Street
Tulsa, OK 74134

Procedure Qualification Record (PQR)

PQR No.: P1-P1-1004 Rev. 4 (1/5/2017) WPS No.: 1004. Date: 1/5/2017 Page: 1 of 2

Welding Process(es) / Type(s): (1) GMAW / Semiautomatic (2) FCAW / Semiautomatic

Joints (QW-402)

Weld Type: Groove weld
Single-V groove
Backing: Open butt, no back weld
Root Opening: 1/8 in. Root Face: - in.
Groove Angle: 60 °

Base Metals (QW-403)

Material Spec., Type or Grade:
SA-516, Grade 70 to SA-516, Grade 70
P-No.: 1 Group No.: 2 to P-No.: 1 Group No.: 2
Thickness of Test Coupon (in.): 1.500

Filler Metals (QW-404)

SFA Specification: (1) 5.18 (2) 5.20
AWS Classification: (1) ER70S-6 (2) E71T-12M
Filler Metal F-No: (1 & 2) 6
Weld Metal Analysis A-No: (1 & 2) (verify chemistry)
Size of Filler Metal (in.): (1 & 2) 0.035
Weld Deposit 't' (in.): (1) 0.125 (2) 1.375
Pass Greater Than ½": (1 & 2) No
Filler Metal Product Form: (1) Bare (Solid) (2) Flux cored
Supplemental Filler Metal: (1 & 2) None

Positions (QW-405)

Position of Joint: (1 & 2) 1G - Flat
Weld Progression: (1 & 2) N/A

Preheat (QW-406)

Preheat Temp.: 70 °F
Interpass Temp.: 400 °F
Preheat Maintenance: None

Postweld Heat Treatment (QW-407)

Type: No PWHT performed
Temperature: None °F
Time: None hr

Gas (QW-408)

Gas Composition / Flow Rate
Shielding: (1 & 2) 75% Argon, 25% CO2 / 35 CFH
Trailing: (1 & 2) None
Backing: (1 & 2) None

Electrical Characteristics (QW-409)

Current / Polarity: (1 & 2) DCEP (reverse)
Amps: (1) 110 (2) 160
Volts: (1) 20 (2) 26
Tungsten Type / Size: (1 & 2) N/A
Transfer Mode: (1 & 2) Globular arc
Heat Input: (1 & 2) N/R

Technique (QW-410)

Travel Speed (in/min): (1) 4 (2) 5
Thermal Processes: (1 & 2) No
String/Weave Bead: (1 & 2) Stringer and weave bead
Oscillation: (1 & 2) N/A
Mult./Single Pass (per side): (1 & 2) Multipass
Mult./Single Electrode: (1 & 2) N/A
Nozzle/Gas Cup Size: (1 & 2) 3/8
Contact Tube to Work Dist.: (1 & 2) 1/2

(1)
*Rev. 1: Corrected FCAW Weld Metal Thickness.
**Rev. 2 (4/8/2008): Added Brinell Hardness.

(2) ***Rev. 3 (9/10/2015): Updated to latest Prowrite Format.
****Rev. 4 (1/5/2017): Added NACE MR0175 Vickers Hardness to PQR - Lab #W170004 Welder: Arturo Vallejo
****SEE LAB REPORT FOR ACTUAL HARDNESS READING LOCATIONS.

ISTI Plant Services

Procedure Qualification Record (PQR)

PQR No.: P1-P1-1004 Rev. 4 (1/5/2017)

Tensile Test (QW-150)

Specimen No.	Width (in.)	Thickness (in.)	Area (in^2)	Ultimate Total Load (lb)	Ultimate Stress (PSI)	Failure Type and Location
1	0.756	1.526	1.15	85425	74300	Ductile - BM
2	0.751	1.520	1.14	83450	73200	Ductile - BM

Guided Bend Test (QW-160)

Figure Number and Type	Result	Figure Number and Type	Result
QW-462.2 Side bend	Passed	QW-462.2 Side bend	Passed
QW-462.2 Side bend	Passed	QW-462.2 Side bend	Passed
None		None	

Hardness Test - Brinell/Vickers Hardness

Location	Readings								
	1	2	3	4	5	6	7	8	9
SA-516, Grade 70 BM (Brinell)	174	168	163	169	168	171			
SA-516, Grade 70 HAZ (Brinell)	174	168	171	175	182	183			
Weld metal (Brinell)	182	183	181						
SA-106, Grade B BM (Vickers)	177.2	181.7	184	179.7					
SA-106, Grade B HAZ (Vickers)	253.9	244.8	211.7	205.4	184.6	186.6	174	184.3	181.4
SA-106, Grade B HAZ (Vickers),	189.6								
Weld metal (Vickers)	187.2	192.7	181.9	167	175.6				

Jimmy Dick-102124379
Mike Littrell-102126352
Arturo Vallejo-W170004

Welder's Name: J. Dick-4379 M. Littrell-6352 A. Vallejo-004 ID: _____ Stamp: _____

Welding of coupon was witnessed by: ISTI Plant Services

Tests Conducted By: Tulsa Gamma Ray Test ID.: See Above

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.

Approved By: _____ 1/5/2017
Date

TULSA GAMMA RAY, INC.
INSPECTION DIVISION
1127 S. Lewis Avenue Tulsa, OK 74104-3900
Phone 918-585-3228 Fax 918-584-5598

TEST REPORT

PQR# P1-P1-1004
WPS# 1004
Lab No. 102124379
Material SA516-70
Thickness 1.500"

Date 10-16-06

Weld Process GMAW/FCAW (ER70S-6/E71T-12M)

TENSILE TEST (QW-150)

SPECIMEN NO.	WIDTH	THICKNESS	AREA	ULTIMATE TOATL LOAD (LB)	ULTIMATE UNIT STRESS (PSI)	TYPE OF FAILURE & LOCATION
1	0.756	1.526	1.15	85425	74300	Ductile-BM
2	0.751	1.520	1.14	83450	73200	Ductile-BM

GUIDED BEND TESTS (QW-160)

TYPE AND FIGURE NO.	RESULTS
1 SIDE BEND	NO DEFECT GREATER THAN 1/8". "PASSED"
2 SIDE BEND	NO DEFECT GREATER THAN 1/8". "PASSED"
3 SIDE BEND	NO DEFECT GREATER THAN 1/8". "PASSED"
4 SIDE BEND	NO DEFECT GREATER THAN 1/8". "PASSED"

Welder Jimmy Dick

ISTI PLANT SERVICES
Client

Submitted by John Phillips

TULSA GAMMA RAY, INC.

1127 S Lewis Ave Tulsa, OK 74104
918.585.3228

MECHANICAL TEST REPORT

☒Welder Qualification ☒Weld Procedure Evaluation

Organization	ISTI plant Services	LAB #	102126352
Base Metal Type	SA106B	PWHT	NONE
Coupon Thickness	6" S/120 (6.625" x .562"wall)		
WPS No.	1004	Weld Process	GMAW/FCAW
Welder's Name	Mike Littrell	ID#	N/A

BENDS

Specimen Number	Bend Type	Results/Comments	
1	Side Bend	No Relevant Indications	PASSED
1	Side Bend	No Relevant Indications	PASSED
3	N/A	N/A	
4	N/A	N/A	

TENSILE TESTS

Specimen Number	Specimen Size	Specimen Area sq. in.	Load at Failure PSI	Ultimate Tensile PSI	Break Location
1	N/A	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	N/A

HARDNESS IN BHN

Material 1			Heat Affected Zone			Weld Metal		
1	2	3	1	2	3	1	2	3
174	168	163	174	168	171	182	183	181
Material 2			**Heat Affected Zone**					
1	2	3	1	2	3			
169	1268	171	175	182	183			

CHARPY V-NOTCH IMPACT TESTING

Specimen Number	Specimen Type	Specimen Size	Temp. F	Value Ft./Lbs.	Lateral Expansion	Percent Shear
N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A

Other Tests Performed: NONE

All test performed in accordance to methods specified in ASME SA-370 & ASTM Sec. IX.

Signature John Phillips JP Date 4-8-08

American Piping Inspection, Metallurgical Lab

18501 E. Admiral Pl. Catoosa, Oklahoma 74015
Office: (918) 266-4130

Form: MR-8
Established: 10/2/16
Revision: 0
Date: 10/2/16

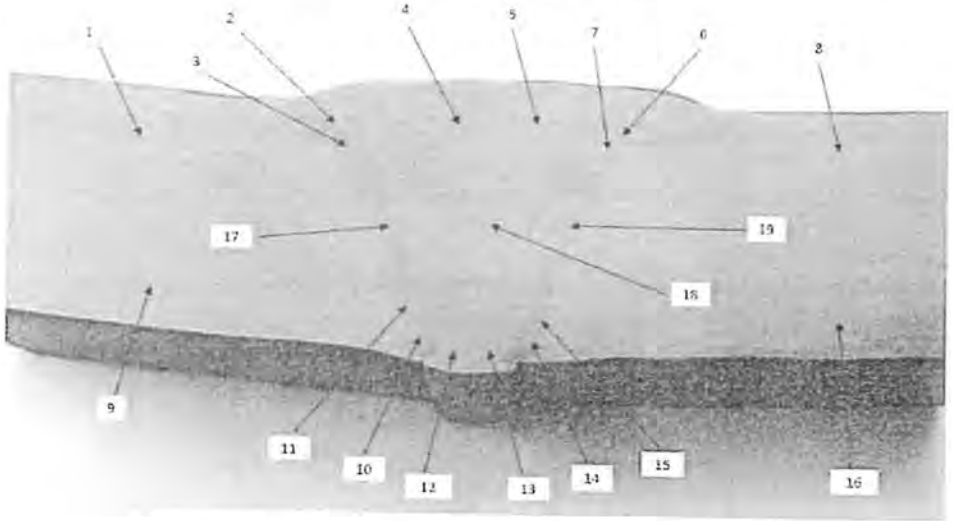
Mechanical/Lab Test Report

Organization:	ISTI Plant Services	Lab Number:	W170004 Rev. 0
Base Material:	1 SA-106 GRB to 2 SA-106 GRB	Heat Number:	N/A
Coupon Dimension:	6.625" O.D. x 0.562" Pos. 1GR	Welder Name/ID:	Arturo Vallejo ID. N/A
WPS/PQR #:	1004	Process(es):	GMAW/FCAW
Filler Metal:	ER70S-6/E71T-12M	PWHT:	N/A

Vickers Hardness (HV10)

Indention Number	Location	Hardness Value	Indention Number	Location	Hardness Value	Indention Number	Location	Hardness Value
1	BM	177.2	11	HAZ	186.6	N/A		
2	HAZ	253.9	12	WM	171.9	N/A		
3	HAZ	244.8	13	WM	167	N/A		
4	WM	187.2	14	HAZ	174	N/A		
5	WM	192.7	15	HAZ	184.3	N/A		
6	HAZ	211.7	16	BM	179.7	N/A		
7	HAZ	205.4	17	HAZ	181.4	N/A		
8	BM	181.7	18	WM	175.6	N/A		
9	BM	184	19	HAZ	189.6	N/A		
10	HAZ	184.6	N/A			N/A		
	Average BM:	180.65		Average HAZ:	201.63		Average WM:	178.88

For Reference Only



Comments

Other Tests: N/A

All testing performed in accordance with the methods specified in NACE MRO175

Approved by: Josh Mattox Date: 1/5/2017 Signature:

Title: Certified Welding Inspector

ISTI Plant Services
17207 East 21st Street
Tulsa, OK 74134

Welding Procedure Specification (WPS)

WPS No.: 1005 Date: 11/20/2006 Rev.: 7 Date: 1/23/2018 Page: 1 of 2
By: Date Signed: 1/23/2018
Supporting PQR's: P8-P8-1005-SS ; P8-P8-1005-SS-Supplemental
Welding Process(es) / Type(s): GTAW / Manual

Joints (QW-402)
Joint Design: Groove and fillet welds

Joint Type	Backing	Root Opening	Groove Angle	Root Face	Groove Radius
Single-V groove	No backing	3/16" max	50 deg min	1/8" max	-
Single bevel	No backing	3/16" max	45 deg min	1/8" max	-
Single-V groove	Gouged & back welded	1/4" max	50 deg min	3/16" max	-
Double bevel	Gouged & back welded	1/4" max	45 deg min	3/16" max	-
Double-V groove	Gouged & back welded	1/4" max	45 deg min	3/16" max	-
Square groove	T-joint	1/32" max	-	-	-
Square groove	No backing	3/32" max	-	-	-

Fillet Welds: All fillet sizes on all base metal thicknesses and all diameters.
Retainers: None

SEE ENGINEERING DRAWINGS FOR MISALIGNMENT TOLERANCES. INTERNAL MISALIGNMENT TO BE 1/4 OF WALL THICKNESS, NOT TO EXCEED 1/8" MAX.

WELD JOINT DESCRIPTIONS SHOWN ARE NOT INCLUSIVE OF ALL THOSE FOUND ON A JOB. WELD JOINT DESIGN REFERENCE IN AN ENGINEERING SPECIFICATION OR A DESIGN DRAWING SHALL TAKE PRECEDENCE OVER WELD JOINTS SHOWN IN THIS WPS.

Base Metals (QW-403)
P-No.: 8 Group No.: 1 Thickness Range (in.): 0.1875 to 8.0000
to P-No.: 8 Group No.: 1

Rev. 1 11/8/08 Added Filler Metal to Base Metal direction.
Rev. 2 9/24/14 Added Backing Gas maintenance notation.
Rev. 3 7/12/16 Clarified no autogenous welding allowed and GTAW bead width limited to 4.5x filler metal diameter.
Rev. 4 7/28/16 Corrected typo from Rev. 3. Weld wire from ER70S-6 to ER308L
Rev. 5 10/20/17 Removed preheat rquirement and lowered interpass temperature to -350°F.
Rev. 6 12/7/17 Added PQR P8-P8-1005-SS-Supplemental to include NACR MR0175 hardness.
Rev. 7 1/23/18 Corrected SFA # to 5.9 & added filler metal to base metal claification

Filler Metals (QW-404)
Spec. No. (SFA): 5.9
AWS No. (Class): ER308L or ER316L
Filler Metal Use: Filler Metal Used
F No.: 6 A No.: 8
Weld Metal Thickness Range: 8.0000 in. maximum
Flux Type: N/A
Flux Trade Name: N/A
Consumable Insert: None
Other:
Flux: None
Product Form: Bare (Solid)
Strip Thickness or Width (in.) : N/A

ISTI Plant Services

Welding Procedure Specification (WPS)

WPS No.: 1005 Date: 11/20/2006 Rev.: 7 Date: 1/23/2018

Positions (QW-405)

Position of Joint: All Positions

Weld Progression: Vertical up

Postweld Heat Treatment (QW-407)

Type: No PWHT will be performed

Temperature Range: None °F

Time Range: None

Preheat (QW-406)

Preheat Temp. Min.: 50 °F

Interpass Temp. Max.: 350 °F

Preheat Maintenance: None

Gas (QW-408)

Gas Composition / Flow Rate

Shielding: 100% Argon / 27-36 CFH

Trailing: None

Backing: 100% Argon / 23-30 CFH

Electrical Characteristics (QW-409)

Current Type / Polarity: DCEN (straight)

Pulsed Current: None

Tungsten Electrode Type and Size: EWTh-2 / 1/8

Mode of Metal Transfer for GMAW(FCAW): N/A

Max. Heat Input (J/in): None

Technique (QW-410)

Thermal Processes: -

String or Weave Bead: Stringer or weave bead

Orifice or Gas Cup Size: #5 to #10

Initial and Interpass Cleaning: With Stainless steel brush clean 2 inches (50 mm) on both sides of weld joint

Method of Back Gouging: When required, grind until all defects are removed.

Oscillation: N/A

Contact Tube to Work Distance: N/A

Single or Multiple Passes (per side): Multipass

Single or Multiple Electrodes: N/A

Peening: None

Backing gas must be maintained through 2nd pass or until 0.250" weld deposit achieved.
No Autogenous welding allowed
GTAW Bead Width limited to 4.5x the filler metal diameter.

Process Welding Parameters

Weld Layer(s) and/or Pass(es)	Process	Filler Metal		Current		Voltage Range	Travel Speed Range (in/min)
		Class	Diameter (in.)	Type / Polarity	Amperage Range		
Any	GTAW	ER308L	3/16	DCEN (straight)	200-375	n/r	Var.
Any	GTAW	ER316L	1/8"	DCEN (straight)	130-275	n/r	Var.
Any	GTAW	ER308L	3/32	DCEN (straight)	80-180	n/r	Var.
Any	GTAW	ER316L	3/16	DCEN (straight)	200-375	n/r	Var.
Any	GTAW	ER308L	1/8	DCEN (straight)	130-275	n/r	Var.
Any	GTAW	ER316L	3/32	DCEN (straight)	80-180	n/r	Var.

Notes

Filler Metal to Base Metal
Filler Metal ER308L allowable for 304 & 304L Base Metal.
Filler Metal ER316L allowable for 316 & 316L Base Metal

ISTI Plant Services
17207 East 21st Street
Tulsa, OK 74134

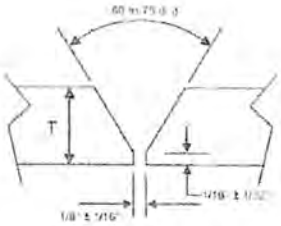
Procedure Qualification Record (PQR)

PQR No.: P8-P8-1005-SS WPS No.: 1005 Date: 11/20/2006 Page: 1 of 2

Welding Process(es) / Type(s): GTAW / Manual

Joints (QW-402)

Weld Type: Groove weld
Single-V groove
Backing: Open butt, no back weld
Root Opening: 5/32 in. Root Face: 0 in.
Groove Angle: 37.5 °



SINGLE VEE GROOVE

Base Metals (QW-403)

Material Spec., Type or Grade:
SA-240, Type 304L to SA-240, Type 304L
P-No.: 8 Group No.: 1 to P-No.: 8 Group No.: 1
Thickness of Test Coupon (in.): 1.500

Filler Metals (QW-404)

SFA Specification: 5.9
AWS Classification: ER308L
Filler Metal Use: Filler Metal Used
Filler Metal F-No: 6
Weld Metal Analysis A-No: 8
Size of Filler Metal (in.): 1/8
Weld Deposit 't' (in.): 1.500
Filler Metal Product Form: Bare (Solid)
Consumable Insert: None
Flux: None

Positions (QW-405)

Position of Joint: 1G - Flat
Weld Progression: N/A

Preheat (QW-406)

Preheat Temp.: 50 °F
Interpass Temp.: 300 °F
Preheat Maintenance: None

Postweld Heat Treatment (QW-407)

Type: No PWHT performed
Temperature: None °F
Time: None hr

Gas (QW-408)

Gas Composition / Flow Rate
Shielding: 100% Argon / 30 CFH
Trailing: None
Backing: 100% Argon / 25 CFH

Electrical Characteristics (QW-409)

Current / Polarity: DCEN (straight)
Amps: 180
Volts: NR
Tungsten Type / Size: EWTh-2 / 1/8
Heat Input: N/R
Pulsed Current: None

Technique (QW-410)

Travel Speed (in/min): NR
Thermal Processes: (1)No
String/Weave Bead: Stringer bead
Oscillation: N/A
Mult./Single Pass (per side): Multipass
Mult./Single Electrode: N/A
Nozzle/Gas Cup Size: 6

Additional Welding Parameters

Layer(s) and/or Pass(es)	Process	Filler Metal AWS Classification	Filler Metal Size (in.)	Current Type / Polarity	Current Amperage Range	Voltage Range	Travel Speed Range (in/min)
ALL	GTAW	ER308L	1/8	DCEN (straight)	180	NR	NR

ISTI Plant Services

Procedure Qualification Record (PQR)

PQR No.: P8-P8-1005-SS

Tensile Test (QW-150)

Specimen No.	Width (in.)	Thickness (in.)	Area (in^2)	Ultimate Total Load (lb)	Ultimate Stress (PSI)	Failure Type and Location
1	0.755	1.520	1.15	93120	81000	Ductile - BM
2	0.753	1.523	1.15	94050	81800	Ductile - BM

Guided Bend Test (QW-160)

Figure Number and Type	Result	Figure Number and Type	Result
QW-462.2 Side bend	Acceptable	QW-462.2 Side bend	Acceptable
QW-462.2 Side bend	Acceptable	QW-462.2 Side bend	Acceptable
None		None	

Macro-Examination Test: None

Visual Examination: Acceptable

Liquid Penetration Test: None

Updated to latest ASME fromat by American Piping Inspection-Metlab 7/12/16

Welder's Name: Jimmy Dick ID: _____ Stamp: _____

Welding of coupon was witnessed by: ISTI Plant Services

Tests Conducted By: Tulsa Gamma Ray Test ID.: 102124373

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.

Approved By: _____ 11/20/2006
Date

TULSA GAMMA RAY, INC.
INSPECTION DIVISION
1127 S. Lewis Avenue Tulsa, OK 74104-3900
Phone 918-585-3228 Fax 918-584-5598

TEST REPORT

PQR# P8-P8-1005-SS
WPS# 1005
Lab No. 102124373
Material SA240-304L
Thickness 1.500"

Date 11-20-06

Weld Process GTAW ER308L

TENSILE TEST (QW-150)

SPECIMEN NO.	WIDTH	THICKNESS	AREA	ULTIMATE TOATL LOAD (LB)	ULTIMATE UNIT STRESS (PSI)	TYPE OF FAILURE & LOCATION
1	0.755	1.520	1.15	93120	81000	Ductile-BM
2	0.753	1.523	1.15	94050	81800	Ductile-BM

GUIDED BEND TESTS (QW-160)

TYPE AND FIGURE NO.	RESULTS
1 SIDE BEND	NO DEFECT GREATER THAN 1/8". "PASSED"
2 SIDE BEND	NO DEFECT GREATER THAN 1/8". "PASSED"
3 SIDE BEND	NO DEFECT GREATER THAN 1/8". "PASSED"
4 SIDE BEND	NO DEFECT GREATER THAN 1/8". "PASSED"

Welder Jimmy Dick

ISTI PLANT SERVICES
Client

Submitted by John Phillips

American Piping Inspection, Metallurgical Lab
18501 E. Admiral Pl. Catoosa, Oklahoma 74015
Office: (918) 266-4130

Form: MR-16
Established: 10/2/16
Revision: 0
Date: 10/2/16

Mechanical/Lab Test Report

Organization:	ISTI Plant Services	Lab Number:	M170193 Rev. 0
Base Material:	1 SA-312 TP304L to 2 SA-312 TP304L	Heat Number:	N/A
Coupon Dimension:	10.750" O.D. x 0.325" Pos. IGR	Welder Name/ID:	Eulid Valezquez ID. N/A
WPS/PQR #:	1005	Process(es):	GTAW
Filler Metal:	ER308L	PWHT:	N/A

Charpy V-Notch Impact Test

Specimen Number	Specimen Size (mm)	V-Notch Location	Temperature (°F)	Impact Value (ft/lbs)	Lateral Expansion (mils)	Percent Shear (%)	Average (ft/lbs)
1	10 x 7.5	WM	-325	41	0.037	30	38.67
2	10 x 7.5	WM	-325	37	0.043	40	
3	10 x 7.5	WM	-325	38	0.043	20	
4	10 x 7.5	HAZ	-325	67	0.047	40	68
5	10 x 7.5	HAZ	-325	70	0.055	40	
6	10 x 7.5	HAZ	-325	67	0.048	45	
N/A							
N/A							
N/A							
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N/A							
N/A							

Comments

*Pipe honed to 0.325" wall thickness by customer.
*Minimum thickness shall be 0.325" when used for Low-Temp. Sevice.

Other Tests: N/A

All testing performed in accordance with the methods specified in ASME SEC IX

Approved by: Eric Darge Date: 2/7/2017 Signature:

Title: Certified Associate Welding Inspector

ISTI Plant Services
17207 East 21st Street
Tulsa, OK 74134

Procedure Qualification Record (PQR)

PQR No.: P8-P8-1005-SS-Supplemental WPS No.: 1005 Date: 12/2/2017 Page: 1 of 2
Welding Process(es) / Type(s): GTAW / Manual

Joints (QW-402)
Weld Type: Groove weld
Single-V groove
Backing: Open butt, no back weld
Root Opening: 0.125 in. Root Face: 0 in.
Groove Angle: 75 °

Base Metals (QW-403)
Material Spec., Type or Grade:
SA-312, TP304L to SA-312, TP304L
P-No.: 8 Group No.: 1 to P-No.: 8 Group No.: 1
Thickness of Test Coupon (in.): 0.432
Diameter of Test Coupon (in.): 6.625

Filler Metals (QW-404)
SFA Specification: 5.9
AWS Classification: ER308L
Filler Metal Use: Filler Metal Used
Filler Metal F-No: 6
Weld Metal Analysis A-No: 8
Size of Filler Metal (in.): 1/8
Weld Deposit 't' (in.): 0.432
Filler Metal Product Form: Bare (Solid)
Consumable Insert: None
Flux: None

Positions (QW-405)
Position of Joint: 1GR - Rotated
Weld Progression: N/A

Preheat (QW-406)
Preheat Temp.: 50 °F
Interpass Temp.: 300 °F
Preheat Maintenance: None

Postweld Heat Treatment (QW-407)
Type: No PWHT performed
Temperature: None °F
Time: None hr

Gas (QW-408)
Gas Composition / Flow Rate
Shielding: 100% Argon / 30 CFH
Trailing: None
Backing: 100% CO2 / 25 CFH

Electrical Characteristics (QW-409)
Current / Polarity: DCEN (straight)
Amps: 180
Volts: n/r
Tungsten Type / Size: EWTh-2 / 1/8
Heat Input: N/R
Pulsed Current: None

Technique (QW-410)
Travel Speed (in/min): n/r
Thermal Processes: (1)No
String/Weave Bead: Stringer bead
Oscillation: N/A
Mult./Single Pass (per side): Multipass
Mult./Single Electrode: N/A
Nozzle/Gas Cup Size: 6

ISTI Plant Services

Procedure Qualification Record (PQR)

PQR No.: P8-P8-1005-SS-Supplemental

Hardness Test - Vickers hardness

Location	Readings								
	1	2	3	4	5	6	7	8	9
SA-312, TP304L BM#1	1-240	9-242							
SA-312, TP304L HAZ#1	2-246	3-244	10-246	11-243	17-241				
Weld metal	4-241	5-243	12-248	13-247	18-245				
SA-312, TP304L HAZ#2	6-247	7-243	14-246	15-243	19-237				
SA-312, TP304L BM#2	8-238	16-235							

Macro-Examination Test: None

Visual Examination: Acceptable

Liquid Penetration Test: None

Refer to attached mechanical report diagram for individual hardness placement.

Welder's Name: Cardenas, Francisco ID: _____ Stamp: V8

Welding of coupon was witnessed by: ISTI Plant Services

Tests Conducted By: American Piping Inspection Test ID.: M172124

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.

Approved By: _____ 12/2/2017
Date

American Piping Inspection, Metallurgical Lab
18501 E. Admiral Pl. Catoosa, Oklahoma 74015
Office: (918) 266-4130

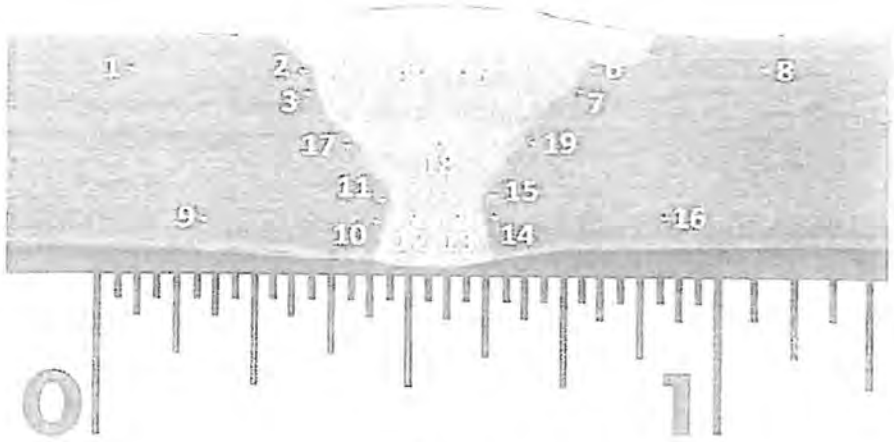
Form: MR-8
Established: 10/2/16
Revision: 0
Date: 10/2/16

Mechanical/Lab Test Report

Organization:	ISTI Plant Services	Lab Number:	M172124 Rev:
Base Material:	1 SA312-304L to 2 SA312-304L	Heat Number:	
Coupon Dimension:	6" Sch 80 (.432" WT) Pos. 1GR	Welder Name/ID:	Francisco Cardenas ID. V8
WPS/PQR #:	1005 / P8-P8-1005-SS	Process(es):	GTAW
Filler Metal:	ER308L	PWHT:	N/A

Vickers Hardness (HV10) Electrolytic 10% Oxalic Etch

Indention Number	Location	Hardness Value	Indention Number	Location	Hardness Value	Indention Number	Location	Hardness Value
1	BM	240	11	HAZ	243	N/A		
2	HAZ	246	12	WM	248	N/A		
3	HAZ	244	13	WM	247	N/A		
4	WM	241	14	HAZ	246	N/A		
5	WM	243	15	HAZ	243	N/A		
6	HAZ	247	16	BM	235	N/A		
7	HAZ	243	17	HAZ	241	N/A		
8	BM	238	18	WM	245	N/A		
9	BM	242	19	HAZ	237	N/A		
10	HAZ	246	N/A			N/A		
	Average BM:	238.75		Average HAZ:	243.6		Average WM:	244.3



Comments

Other Tests:

All testing performed in accordance with the methods specified in: NACE MR0175

Approved by: Jason Pierce Date: 12/2/2017 Signature:

Title: Laboratory Manager

ISTI Plant Services
17207 East 21st Street
Tulsa, OK 74134

Welding Procedure Specification (WPS)

WPS No.: 1012 Date: 5/12/2007 Rev.: 1. Date: 6/30/2016 Page: 1 of 2

By: Date Signed: 6/30/2016

Supporting PQR's: P1-P1-1012

Welding Process(es) / Type(s): (1) GTAW / Manual (2) FCAW / Semiautomatic

Joints (QW-402)

Joint Design: Groove and fillet welds

Joint Type	Backing	Root Opening	Groove Angle	Root Face	Groove Radius
Single-V groove	No backing	3/16" max	50 deg min	1/8" max	-
Single bevel	No backing	3/16" max	45 deg min	1/8" max	-
Single-V groove	Gouged & back welded	1/4" max	50 deg min	3/16" max	-
Double bevel	Gouged & back welded	1/4" max	45 deg min	3/16" max	-
Double-V groove	Gouged & back welded	1/4" max	45 deg min	3/16" max	-
Square groove	T-joint	1/32" max	-	-	-
Square groove	No backing	3/32" max	-	-	-

Fillet Welds: All fillet sizes on all base metal thicknesses and all diameters.

Retainers: None

SEE ENGINEERING DRAWINGS FOR MISALIGNMENT TOLERANCES. INTERNAL MISALIGNMENT TO BE 1/4" OF WALL THICKNESS, NOT TO EXCEED 1/8" MAX.

WELD JOINT DESCRIPTIONS SHOWN ARE NOT INCLUSIVE OF ALL THOSE FOUND ON A JOB. WELD JOINT DESIGN REFERENCE IN AN ENGINEERING SPECIFICATION OR A DESIGN DRAWING SHALL TAKE PRECEDENCE OVER WELD JOINTS SHOWN IN THIS WPS.

Base Metals (QW-403)

P-No.: 1 Group No.: 1 Thickness Range (in.): 0.432 to 0.8640

to P-No.: 1 Group No.: 1

Filler Metals (QW-404)

Spec. No. (SFA): (1) 5.18 (2) 5.20

AWS No. (Class): (1) ER70S-6 (2) E71T-12M

Filler Metal Use: (1) Filler Metal Used

F No.: (1 & 2) 6 A No.: (1) (verify chemistry) (2) 1

Weld Metal Thickness Range: (1) 0.3750 in. maximum (2) 0.4890 in. maximum No Pass Greater Than ½" Allowed

Flux Type: N/A

Flux Trade Name: N/A

Consumable Insert: (1) None

Other:

Flux: (1) None

Product Form: (1) Bare (Solid) (2) Flux cored

Trade Name: (2) Kobelco Frontiarc-711

Supplemental Filler Metal: (2) None

Strip Thickness or Width (in.): N/A

ISTI Plant Services

Welding Procedure Specification (WPS)

WPS No.: 1012 Date: 5/12/2007 Rev.: 1. Date: 6/30/2016

Positions (QW-405)

Position of Joint: (1 & 2) All Positions

Weld Progression: (1 & 2) Vertical up

Preheat (QW-406)

Preheat Temp. Min.: 70 °F

Interpass Temp. Max.: 550 °F

Preheat Maintenance: None

When Base Metal is < 50°F, preheat to 150°F minimum
200°F for Base Metal 1-1/4" to 1-1/2"

Postweld Heat Treatment (QW-407)

Type: No PWHT will be performed

Temperature Range: None °F

Time Range: None

Gas (QW-408)

Gas Composition / Flow Rate

Shielding: (1) 100% Argon / 23-30 CFH
(2) 75% Argon, 25% CO2 / 32-42 CFH

Trailing: (1 & 2) None

Backing: (1 & 2) None

Electrical Characteristics (QW-409)

Current Type / Polarity: (1 & 2) DCEP (reverse)

Pulsed Current: (1) None

Tungsten Electrode Type and Size: (1) EWTh-2 / 3/32 (2) N/A

Mode of Metal Transfer for GMAW(FCAW): (1) N/A (2) Globular arc

Max. Heat Input (J/in): (1) 48280 (2) 30360

Technique (QW-410)

Thermal Processes: (1 & 2) -

String or Weave Bead: (1 & 2) Stringer and weave bead

Orifice or Gas Cup Size: (1) #5 to #10 (2) 3/8" to 5/8"

Initial and Interpass Cleaning: With wire brush clean 1 inch (25 mm) on both sides of weld joint

Method of Back Gouging: When required, grind until all defects are removed.

Oscillation: N/A

Contact Tube to Work Distance: (2) N/A

Single or Multiple Passes (per side): (1) Multipass (2) Multipass

Single or Multiple Electrodes: N/A

Peening: (1 & 2) None

(1) GTAW Chemistry verified by manufacturer's typical Material Test Report (MTR).
GTAW Bead Width limited to 4.5x rod diameter.
No Autogenous Welding allowed

Process Welding Parameters

Weld Layer(s) and/or Pass(es)	Process	Filler Metal		Current		Voltage Range	Travel Speed Range (in/min)
		Class	Diameter (in.)	Type / Polarity	Amperage Range		
Any	GTAW	ER70S-6	1/8	DCEP (reverse)	100-142	14-17	3-6
Any	FCAW	E71T-12M	0.045	DCEP (reverse)	90-110	20-23	5-7

Notes

*Rev. 1 6/30/16: Corrected A-No. Designation, Clarified FCAW Type, and adjusted GTAW/FCAW parameters, added "No single weld pass greater than 1/2"" note, added "No Autogenous Welding allowed" note, added GTAW bead width note, added B31.3 misalignment tolerance note and Preheat note, added GTAW Chemistry verified note, added "Kobelco Frontiarc-71I" to filler metals

ISTI Plant Services
17207 East 21st Street
Tulsa, OK 74134

Procedure Qualification Record (PQR)

PQR No.: P1-P1-1012 WPS No.: 1012 Date: 5/22/2007 Page: 1 of 2

Welding Process(es) / Type(s): (1) GTAW / Manual (2) FCAW / Semiautomatic

Joints (QW-402)

Weld Type: Groove weld
Single-V groove
Backing: Open butt, no back weld
Root Opening: 5/32 in. Root Face: 0 in.
Groove Angle: 60 °

Base Metals (QW-403)

Material Spec., Type or Grade:
SA-333, Grade 6 to SA-333, Grade 6
P-No.: 1 Group No.: 1 to P-No.: 1 Group No.: 1
Thickness of Test Coupon (in.): 0.432
Diameter of Test Coupon (in.): 6.625

Filler Metals (QW-404)

SFA Specification: (1) 5.18 (2) 5.20
AWS Classification: (1) ER70S-6 (2) E71T-12M
Filler Metal Use: (1) Filler Metal Used
Filler Metal F-No: (1 & 2) 6
Weld Metal Analysis A-No: (1) (verify chemistry) (2) 1
Size of Filler Metal (in.): (1) 1/8 (2) 0.045
Weld Deposit 't' (in.): (1) 0.1875 (2) 0.2445
Pass Greater Than ½": (2) No
Filler Metal Product Form: (1) Bare (Solid) (2) Flux cored
Supplemental Filler Metal: (2) None
Consumable Insert: (1) None
Flux: (1) None

Positions (QW-405)

Position of Joint: (1 & 2) 6G - 45 degree pipe
Weld Progression: (1 & 2) Vertical up

Preheat (QW-406)

Preheat Temp.: 70 °F
Interpass Temp.: 550 °F
Preheat Maintenance: None

Postweld Heat Treatment (QW-407)

Type: No PWHT performed
Temperature: None °F
Time: None hr

Gas (QW-408)

Gas Composition / Flow Rate
Shielding: (1) 100% Argon / 25 CFH
(2) 75% Argon, 25% CO2 / 35 CFH
Trailing: (1 & 2) None
Backing: (1 & 2) None

Electrical Characteristics (QW-409)

Current / Polarity: (1 & 2) DCEP (reverse)
Amps: (1) 142 (2) 110
Volts: (1) 17 (2) 23
Tungsten Type / Size: (1) EWTh-2 / 3/32 (2) N/A
Transfer Mode: (2) Globular arc
Wire Feed Speed: (2) N/A
Heat Input: (1) 48280 J/in (2) 30360 J/in
Pulsed Current: (1) None

Technique (QW-410)

Travel Speed (in/min): (1) 3 (2) 5
Thermal Processes: (1 & 2) No
String/Weave Bead: (1 & 2) Stringer and weave bead
Oscillation: (1 & 2) N/A
Mult./Single Pass (per side): (1 & 2) Multipass
Mult./Single Electrode: (1 & 2) N/A
Nozzle/Gas Cup Size: (1) 6 (2) N/A
Contact Tube to Work Dist.: (2) N/A

ISTI Plant Services

Procedure Qualification Record (PQR)

PQR No.: P1-P1-1012

Tensile Test (QW-150)

Specimen No.	Width (in.)	Thickness (in.)	Area (in^2)	Ultimate Total Load (lb)	Ultimate Stress (PSI)	Failure Type and Location
1	0.506	0.419	0.2120	13570	64006	Ductile - BM
2	0.517	0.426	0.2202	14380	65292	Ductile - BM

Guided Bend Test (QW-160)

Figure Number and Type	Result	Figure Number and Type	Result
QW-462.3(a) Face bend	Passed	QW-462.3(a) Root bend	Passed
QW-462.3(a) Face bend	Passed	QW-462.3(a) Root bend	Passed
None		None	

Toughness Test (QW-170)

Specimen Number	Notch Location	Notch Type	Test Temp. (°F)	Impact Value (ft-lb)	Lateral Expansion		Drop Weight Break
					Shear %	Mils	
1	Base metal	"V"	-40	21	10	18	Yes
2	Base metal	"V"	-40	16	10	15	Yes
3	Base metal	"V"	-40	18	10	17	Yes
4	Weld metal	"V"	-40	34	20	36	Yes
5	Weld metal	"V"	-40	20	10	21	Yes
6	Weld metal	"V"	-40	17	10	20	Yes
7	HAZ	"V"	-40	129	40	76	Yes
8	HAZ	"V"	-40	124	40	87	Yes
9	HAZ	"V"	-40	138	40	79	Yes
1.	Weld metal	"V"	-50	18	30	8	No
2.	Weld metal	"V"	-50	24	20	10	No
3.	Weld metal	"V"	-50	25	30	20	No
4.	HAZ	"V"	-50	45	35	30	No
5.	HAZ	"V"	-50	10	10	8	No
6.	HAZ	"V"	-50	80	30	54	No

(2/7/2017): Added -50F CVN Impacts to PQR – Lab #M170192 Welder: Eduardo Rubalcaba

Welder's Name: Raul Meza ID: _____ Stamp: _____

Welding of coupon was witnessed by: ISTI Plant Services

Tests Conducted By: Tulsa Gamma Ray, Inc. Test ID.: 102125172

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.

Approved By: Rod Wold 5/22/2017

Date

TULSA GAMMA RAY, INC.

1127 S Lewis Ave Tulsa, OK 74104
918.585.3228

MECHANICAL TEST REPORT

☐ Welder Qualification ☒ Weld Procedure Evaluation

Organization	ISTI plant Services	**LAB #**	102125172
Base Metal Type	SA333 gr. 6	**PWHT**	NONE
Coupon Thickness	6" S/80 (6.625" x .432"wall)		
WPS No.	1012	**Weld Process**	GTAW/FCAW
Welder's Name	Raul Meza	**ID#**	

BENDS

Specimen Number	Bend Type	Results/Comments	
1	Root Bend	No Relevant Indications	PASSED
1	Face Bend	No Relevant Indications	PASSED
3	Root Bend	No Relevant Indications	PASSED
4	Face Bend	No Relevant Indications	PASSED

TENSILE TESTS

Specimen Number	Specimen Size	Specimen Area sq. in.	Load at Failure PSI	Ultimate Tensile PSI	Failure Type & Break Location
1	0.506" x 0.419"	0.2120	13570	64006	Ductile – Base Metal
2	0.517" x 0.426"	0.2202	14380	65292	Ductile – Base Metal
3	N/A	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	N/A

HARDNESS IN BHN

Material 1			Heat Affected Zone			Weld Metal		
1	2	3	1	2	3	1	2	3
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

CHARPY V-NOTCH IMPACT TESTING

Specimen Number	Notch Type	Notch Location	Specimen Size	Temp. °F	Value Ft./Lbs.	Lateral Expansion Shear %	Lateral Expansion Mils	Drop Weight Break
1	"V"	BM	10mm x 10mm	-40	21	10	18	Yes
2	"V"	BM	10mm x 10mm	-40	16	10	15	Yes
3	"V"	BM	10mm x 10mm	-40	18	10	17	Yes
4	"V"	WM	10mm x 10mm	-40	34	20	36	Yes
5	"V"	WM	10mm x 10mm	-40	20	10	21	Yes
6	"V"	WM	10mm x 10mm	-40	17	10	20	Yes
7	"V"	HAZ	10mm x 10mm	-40	129	40	76	Yes
8	"V"	HAZ	10mm x 10mm	-40	124	40	87	Yes
9	"V"	HAZ	10mm x 10mm	-40	138	40	79	Yes

Other Tests Performed: NONE

All tests performed in accordance to methods specified in ASME SA-370 & ASTM Sec. IX.

Signature John Phillips

Date 5-22-07

American Piping Inspection, Metallurgical Lab
18501 E. Admiral Pl. Catoosa, Oklahoma 74015
Office: (918) 266-4130

Form: MR-16
Established: 10/2/16
Revision: 0
Date: 10/2/16

Mechanical/Lab Test Report

Organization:	ISTI Plant Services	Lab Number:	M170192 Rev. 0
Base Material:	1 SA-333 GR6 to 2 SA-333 GR6	Heat Number:	951029
Coupon Dimension:	6.625" O.D. x 0.432" Pos. IGR	Welder Name/ID:	Eduardo Rubalcaba ID. N/A
WPS/PQR #:	1012	Process(es):	GTAW/FCAW
Filler Metal:	ER70S-6/E71T-12MJ	PWHT:	N/A

Charpy V-Notch Impact Test

Specimen Number	Specimen Size (mm)	V-Notch Location	Temperature (°F)	Impact Value (ft/lbs)	Lateral Expansion (mils)	Percent Shear (%)	Average (ft/lbs)
1	10 x 10	WM	-50	18	0.008	30	22.33
2	10 x 10	WM	-50	24	0.010	20	
3	10 x 10	WM	-50	25	0.020	30	
4	10 x 10	HAZ	-50	45	0.030	35	45
5	10 x 10	HAZ	-50	10	0.008	10	
6	10 x 10	HAZ	-50	80	0.054	30	
N/A							
N/A							
N/A							
N/A							
N/A							
N/A							
N/A							
N/A							
N/A							
N/A							
N/A							
N/A							

Comments

Only one side of the HAZ tested since both base metals were the same Heat Number.

Other Tests: N/A

All testing performed in accordance with the methods specified in ASME SEC IX

Approved by: Eric Darge Date: 2/7/2017 Signature: Eric Darge 2/7/2017

Title: Certified Associate Welding Inspector

ISTI Plant Services

Tulsa, Ok.

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

Company Name: ISTI Plant Services
Approved by / Date: 11-17-2014
WPS No: 1025 Date: 11-17-2014
Supporting PQR No. (s): P1-P1-1025a, P1-P1-1025b
Revision No. 0 Date of Rev. ----

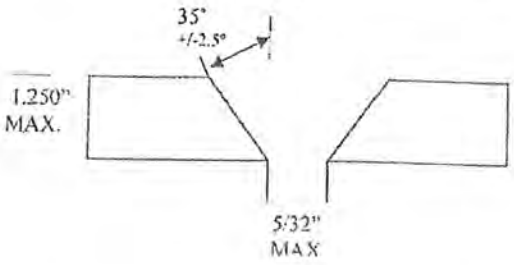
Welding Process(es): GTAW
Type: Manual (Automatic, Manual, Machine, or Semi-Auto)

JOINTS (QW-402)

Joint Design: All Allowable ASME Joint Configurations
Root Spacing:
Backing: WITH OR WITHOUT
Backing Material (Type): PER CUSTOMER REQUIREMENT (Refer to both backing and retainers)

☐ Metal ☐ Nonfusing Metal
☐ Nonmetallic ☐ Other

Details



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 Mfgr. / sketches may be attached to illustrate joint design, weld layers and bead sequence, e.g., for notch toughness procedures, for multiple process procedures, etc.)

V,J or U bevel grooves, fillets or other joints detailed on engineering drawings, production routing or repair procedures.

*BASE METALS (QW-403)

P-No. 1 Group No. 1 or 2 to P-No. 1 Group No. 1 or 2
OR
Specification type and grade
to Specification type and grade
OR
Chem. Analysis and Mech. Prop
To Chem. Analysis and Mech. Prop
Thickness Range:
Base Metal: Groove 0.125" to 1.250" Fillet UNLIMITED
Pipe Dia.: Range Groove UNLIMITED Fillet UNLIMITED
Maximum Pass Thickness ≤ 1/2 in. (13mm) ☒ Yes ☐ No
Other This procedure is qualified for low temperature service to -50°F

*FILLER METALS (QW-404)	1	2
Spec. No. (SFA)	5.18	
AWS No. (Class)	ER70S-6 Verify Chemistry	
F-No.	6	
A-No.	1 Verification confirmed by OEM Documentation	
Size of Filler Metals	3/32", 1/8"	
Filler Metal Product Form	Solid	
Supplemental Filler Metal	None	
Weld Metal		
Deposited Thickness:		
Groove	0.125" to 1.250"	
Fillet	Unlimited	
Electrode-Flux (Class)	N.A.	
Flux Type	No flux added to face of weld	
Flux Trade Name	N.A.	
Consumable Insert	None	
Other		

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

ISTI Plant Services
Tulsa, Ok.

WPS No. 1025 Rev. 0

POSITIONS (QW-405)	
Position of Groove	ALL
Welding Progression:	☒ Up ☐ Down
Position(s) of Fillet	ALL
Other	

POSTWELD HEAT TREATMENT (QW-407)	
Temp Range	No PWHT Performed
Time Range	
Other	B31.3 Requires thickness greater than 3/4" to be PWHT

PREHEAT (QW-406)			
Preheat Temp. Min.	75°F Min. / 200°F for thickness of 1 ¼" to 1 ½"		
Interpass Temp. Max.	450°F	Shielding	
Preheat Maintenance	None	Trailing	
Other	N.A.	Backing	
(Continuous or special heating where applicable should be recorded)		Other	

GAS (QW-408)	Percent Composition	
Gas(es)	% Mixture	Flow Rate
Argon	100	20-35 CFH
N.A.	N.A.	N.A.
N.A.	N.A.	N.A.
N.A.	N.A.	N.A.

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Layers	Process	Classification	Diameter	Current Type & Polarity	Amps (Range)	Wire Feed Speed (Range)	Energy or Power (Range)	Volts (Range)	Travel Speed (Range)	Other, Remarks, Addition
Any	GTAW	ER70S-6	3/32"	DCEN	130-160	N.A.	N.A.	15-19	5-8 ipm	
Any	GTAW	ER70S-6	1/8"	DCEN	140-170	N.A.	N.A.	16-20	6-9 ipm	

Amps and volts, or power or energy range should be recorded for each electrode size, position and thickness, etc.

Pulsing Current: No Pulsing Current Used Heat Input (max.): 24000 J/in Max with 3/32" 23314 J/in Max with 1/8"

Amperage/voltage may be decreased or travel speed increased to maintain maximum heat input (Heat Input is a Nonessential Variable unless used for low temperature service.))

Tungsten Electrode Type and Size: EWTH-2 3/32", 1/8" (Pure Tungsten, 2% Thoriated, etc.)

Mode of Metal Transfer for GMAW (FCAW): N.A. (Spray arc, short circuiting arc, etc.)

Other:

TECHNIQUE (QW-410)	
String or Weave Bead	Stringer or Weave
Orifice, Nozzle or Gas Cup Size	#5 to #10
Initial and Interpass Cleaning (Brushing, Grinding, etc.)	Grinding or wire brush as required
Method of Back Gouging	When required, grind until all defects are removed.
Oscillation	N.A.
Contact Tube to Work Distance	N.A.
Multiple or Single (per side)	Multiple
Multiple or Single Electrodes	Single
Electrode Spacing	N.A.
Peening	None Allowed
Misalignment	Misalignment shall not be greater than 1/4T

ISTI Plant Services
Tulsa,
Oklahoma

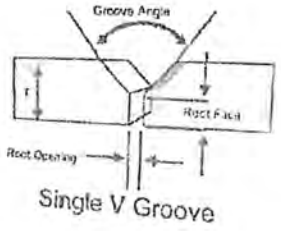
Procedure Qualification Record (PQR)

PQR No.: PI-PI-1025a WPS No.: 1025 Date: 11/17/2014 Page: 1 of 2

Welding Process(es) / Type(s): GTAW / Manual

Joints (QW-402)

Weld Type: Groove weld
Single-V groove
Backing: Open butt, no back weld
Root Opening: 0.125 in. Root Face: 0.0 in.
Groove Angle: 75 °



Single V Groove

Base Metals (QW-403)

Material Spec., Type or Grade:
SA-516-60/65/70 to SA-516-60/65/70
P-No.: 1 Group No.: 1 to P-No.: 1 Group No.: 2
Thickness of Test Coupon (in.): 0.250
Test Coupon certified to SA-516-60/65/70

Filler Metals (QW-404)

SFA Specification: 5.18
AWS Classification: ER70S-6
Filler Metal F-No: 6
Weld Metal Analysis A-No: (verify chemistry)
Size of Filler Metal (in.): 3/32
Weld Deposit 't' (in.): 0.250
Filler Metal Product Form: Bare (Solid)
Consumable Insert: None
Flux: None Added

Positions (QW-405)

Position of Joint: 3G - Vertical
Weld Progression: Vertical up

Preheat (QW-406)

Preheat Temp.: 75 °F
Interpass Temp.: 450 °F
Preheat Maintenance: None

Postweld Heat Treatment (QW-407)

Type: No PWHT performed
Temperature: None °F
Time: None hr

Gas (QW-408)

Gas Composition / Flow Rate
Shielding: 100% Argon / 25 CFH
Trailing: None
Backing: None

Electrical Characteristics (QW-409)

Current / Polarity: DCEN (straight)
Amps: 150
Volts: 17
Tungsten Type / Size: EWTh-2 / 3/32"
Heat Input: 24000 J/in
Pulsed Current: No Pulsed Current

Technique (QW-410)

Travel Speed (in/min): 6
Thermal Processes: No
String/Weave Bead: Stringer bead
Oscillation: N/A
Mult./Single Pass (per side): Multipass
Mult./Single Electrode: N/A
Nozzle/Gas Cup Size: 5

(1) Single Electrode

Additional Welding Parameters

Layer(s) and/or Pass(es)	Process	Filler Metal		Current		Voltage Range	Travel Speed Range (in/min)
		AWS Classification	Size (in.)	Type / Polarity	Amperage Range		
All	GTAW	ER70S-6	3/32	DCEN (straight)	150	16	6

ISTI Plant Services

Procedure Qualification Record (PQR)

PQR No.: P1-P1-1025a

Tensile Test (QW-150)

Specimen No.	Width (in.)	Thickness (in.)	Area (in^2)	Ultimate Total Load (lb)	Ultimate Stress (PSI)	Failure Type and Location
1	0.750	0.202	0.152	12263	80700	Ductile - BM
2	0.750	0.208	0.156	12705	81400	Ductile - BM

Guided Bend Test (QW-160)

Figure Number and Type	Result	Figure Number and Type	Result
QW-462.3(a) Face bend	Acceptable	QW-462.3(a) Root bend	Acceptable
QW-462.3(a) Face bend	Acceptable	QW-462.3(a) Root bend	Acceptable
None		None	

Toughness Test (QW-170)

Specimen Number	Notch Location	Notch Type	Test Temp. (°F)	Impact Value (ft-lb)	Lateral Expansion		Drop Weight Break
					Shear %	Mils	
1	Weld metal	"V"	-67	14	25	23	No
2	Weld metal	"V"	-67	15	30	23	No
3	Weld metal	"V"	-67	17	30	25	No
4	HAZ	"V"	-67	20	30	34	No
5	HAZ	"V"	-67	20	30	36	No
6	HAZ	"V"	-67	19	30	39	No

Hardness Test - Vickers hardness

Location	Readings								
	1	2	3	4	5	6	7	8	9
SA-516-60/65/70 BM-1 Root	17-170	18-171	19-171	20-173					
SA-516-60/65/70 BM-1 Top	1-170	2-183	3-188	4-1197					
SA-516-60/65/70 BM-2 Root	29-166	30-165	31-161	32-163					
SA-516-60/65/70 BM-2 Top	13-170	14-158	15-162	16-161					
SA-516-60/65/70 HAZ-1 Root	21-172	22-165							
SA-516-60/65/70 HAZ-1 Top	5-197	6-192							
SA-516-60/65/70 HAZ-2 Root	27-175	28-170							
SA-516-60/65/70 HAZ-2 Top	11-188	12-173							
Weld metal	7-189	8-191	9-193	10-191	23-152	24-151	25-158	26-160	

Macro-Examination Test: None

Visual Examination: Acceptable

Liquid Penetration Test: None

Vickers hardness in accordnace with NACE SP0472-2010 Figure 2 and 3

Charpy V Notch Specimen Size: 10mm x 5.0mm

Welder's Name: Eulid Valezquez ID: _____ Stamp: _____

PQR was done and welding of coupon was witnessed by: ISTI Plant Services

Tests Conducted By: Tulsa Gamma Ray, Inc. Test ID.: 102135828

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.

Prepared By: John Phillips 11/7/14 Procedure Specialist

Accepted By: _____ 11/7/14 QC Manager

TULSA GAMMA RAY, INC.

1127 S Lewis Ave Tulsa, OK 74104
918.585.3228

LAB / MECHANICAL TEST REPORT

☐ Welder Qualification ☒ Weld Procedure Evaluation

Organization	ISTI Plant Services	LAB #	102135828
Base Metal Type	SA516-60/65/70	PWHT	None
Coupon Thickness	0.250"	PQR#	P1-P1-1025a
WPS No.	1025	Filler	ER70S-6
Weld Process	GTAW	ID#	
Welder's Name	Eulid Valezquez	Position	3G-Up

BENDS

Specimen Number	Type of Bend	Results/Comments
1	FACE BEND #1	PASSED No Relevant Indications Greater Than 1/8"
2	FACE BEND #2	PASSED No Relevant Indications Greater Than 1/8"
3	ROOT BEND #1	PASSED No Relevant Indications Greater Than 1/8"
4	ROOT BEND #2	PASSED No Relevant Indications Greater Than 1/8"

TENSILE TESTS

Specimen Number	Specimen Size	Specimen Area sq. in.	Load at Failure (lbs.)	Ultimate Tensile (psi)	Type of Failure & Location
1	0.750" X 0.202"	0.152	12263	80700	Ductile-BM
2	0.750" X 0.208"	0.156	12705	81400	Ductile-BM

HARDNESS IN BHN

Base Material #1			Heat Affected Zone #1			Weld Metal		
1	2	3	1	2	3	1	2	3
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Heat Affected Zone #2			Base Material #2					
1	2	3	1	2	3			
N/A	N/A	N/A	N/A	N/A	N/A			

CHARPY V-NOTCH IMPACT TESTING

Specimen Number	Specimen Type/Location	Specimen Size	Temp.	Value Ft./Lbs.	Lateral Expansion	Percent Shear	Drop Weight/ Break
1	V/Weld Metal	10mm x 5.0mm	-67°F	14	25	23	No
2	V/Weld Metal	10mm x 5.0mm	-67°F	17	30	23	No
3	V/Weld Metal	10mm x 5.0mm	-67°F	15	30	25	No
4	V/HAZ	10mm x 5.0mm	-67°F	20	30	34	No
5	V/HAZ	10mm x 5.0mm	-67°F	20	30	36	No
6	V/HAZ	10mm x 5.0mm	-67°F	19	30	39	No

Other Tests Performed: NONE

All tests performed in accordance to methods specified in ASME B31.3 & SEC IX.

Signature: John Phillips — Date: 11-17-2014

TULSA GAMMA RAY, INC.

1127 S Lewis Ave Tulsa, OK 74104
918.585.3228

LAB / MECHANICAL TEST REPORT

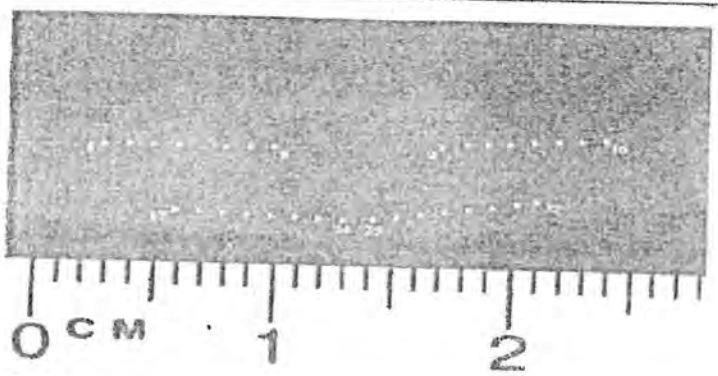
☐ Welder Qualification ☒ Weld Procedure Evaluation

Organization	ISTI Plant Services	LAB #	102135828
Base Metal Type	SA516-60/65/70	PWHT	None
Coupon Thickness	0.250"	PQR#	P1-P1-1025a
WPS No.	1025	Filler	ER70S-6
Weld Process	GTAW	ID#	
Welder's Name	Eulid Valezquez	Position	3G-Up

Microhardness Survey ASTM E384-11
NACE SP0472-2010, Figure 2 and 3

Reading Number	HIV Value	Reading Number	HIV Value
1	170	17	170
2	183	18	171
3	188	19	171
4	197	20	173
5	197	21	172
6	192	22	165
7	189	23	152
8	191	24	151
9	193	25	158
10	191	26	160
11	188	27	175
12	173	28	170
13	170	29	166
14	158	30	165
15	162	31	161
16	161	32	163

Vickers Hardness Survey 2% Nital



Other Tests Performed:	NONE

All tests performed in accordance to methods specified in ASME B31.3 & SEC IX.

Signature	John Phillips	Date	11-17-2014

ISTI Plant Services
Tulsa
Oklahoma

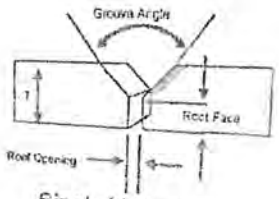
Procedure Qualification Record (PQR)

PQR No.: P1-P1-1025b WPS No.: 1025 Date: 11/17/2014 Page: 1 of 2

Welding Process(es) / Type(s): GTAW / Manual

Joints (QW-402)

Weld Type: Groove weld
Single-V groove
Backing: Open butt, no back weld
Root Opening: 0.125 in. Root Face: 0 in.
Groove Angle: 75 °



Single V Groove

Base Metals (QW-403)

Material Spec., Type or Grade:
SA-516-60/65/70 to SA-516-60/65/70
P-No.: 1 Group No.: 1 to P-No.: 1 Group No.: 2
Thickness of Test Coupon (in.): 0.625
Test Coupon certified to SA516-60/65/70

Filler Metals (QW-404)

SFA Specification: 5.18
AWS Classification: ER70S-6
Filler Metal F-No: 6
Weld Metal Analysis A-No: (verify chemistry)
Size of Filler Metal (in.): 1/8
Weld Deposit 't' (in.): 0.625
Filler Metal Product Form: Bare (Solid)
Consumable Insert: No Consumable Insert or Retainers used
Flux: No flux added

Positions (QW-405)

Position of Joint: 3G - Vertical
Weld Progression: Vertical up

Preheat (QW-406)

Preheat Temp.: 75 °F
Interpass Temp.: 450 °F
Preheat Maintenance: None

Postweld Heat Treatment (QW-407)

Type: No PWHT performed
Temperature: None °F
Time: None hr

Gas (QW-408)

Gas Composition / Flow Rate
Shielding: 100% Argon / 25 CFH
Trailing: None
Backing: None

Electrical Characteristics (QW-409)

Current / Polarity: DCEN (straight)
Amps: 160
Volts: 17
Tungsten Type / Size: EWTh-2 / 1/8
Heat Input: 23314 J/in
Pulsed Current: No Pulsed Current used

Technique (QW-410)

Travel Speed (in/min): 7
Thermal Processes: No
String/Weave Bead: Stringer bead
Oscillation: N/A
Mult./Single Pass (per side): Multipass
Mult./Single Electrode: N/A
Nozzle/Gas Cup Size: #5

(1) Single Electrode

Additional Welding Parameters

Layer(s) and/or Pass(es)	Process	Filler Metal		Current		Voltage Range	Travel Speed Range (in/min)
		AWS Classification	Size (in.)	Type / Polarity	Amperage Range		
Any	GTAW	ER70S-6	1/8	DCEN (straight)	160	17	7

ISTI Plant Services

Procedure Qualification Record (PQR)

PQR No.: PI-PI-1025b

Tensile Test (QW-150)

Specimen No.	Width (in.)	Thickness (in.)	Area (in^2)	Ultimate Total Load (lb)	Ultimate Stress (PSI)	Failure Type and Location
1	0.750	0.504	0.378	29906	79100	Ductile - BM
2	0.750	0.554	0.416	32876	79000	Ductile - BM

Guided Bend Test (QW-160)

Figure Number and Type	Result	Figure Number and Type	Result
QW-462.2 Side bend	Acceptable	QW-462.2 Side bend	Acceptable
QW-462.2 Side bend	Acceptable	QW-462.2 Side bend	Acceptable
None		None	

Toughness Test (QW-170)

Specimen Number	Notch Location	Notch Type	Test Temp. (°F)	Impact Value (ft-lb)	Lateral Expansion		Drop Weight Break
					Shear %	Mils	
1	Weld metal	"V"	-50	123	55	71	No
2	Weld metal	"V"	-50	125	60	71	No
3	Weld metal	"V"	-50	95	30	59	No
4	HAZ	"V"	-50	37	30	22	No
5	HAZ	"V"	-50	35	30	20	No
6	HAZ	"V"	-50	30	25	21	No

Hardness Test - Vickers hardness

Location	Readings								
	1	2	3	4	5	6	7	8	9
SA-516-60/65/70 BM-1 Root	17-168	18-170	19-174	20-177					
SA-516-60/65/70 BM-1 Top	1-150	2-161	3-176	4-205					
SA-516-60/65/70 BM-2 Root	29-175	30-177	31-174	32-172					
SA-516-60/65/70 BM-2 Top	13-208	14-190	15-162	16-159					
SA-516-60/65/70 HAZ-1 Root	21-185	22-188							
SA-516-60/65/70 HAZ-1 Top	5-229	6-233							
SA-516-60/65/70 HAZ-2 Root	27-189	28-187							
SA-516-60/65/70 HAZ-2 Top	11-242	12-236							
Weld Metal	7-233	8-223	9-245	10-240	23-182	24-194	25-191	26-185	

Macro-Examination Test: None

Visual Examination: Acceptable

Liquid Penetration Test: None

Vickers hardness in accordance with NACE SP0472-2010 Figure 2 and 3.

Charpy V Notch Specimen Size: 10mm x 10mm.

Welder's Name: Eulid Valezquez ID: _____ Stamp: _____

PQR was done and welding of coupon was witnessed by: ISTI Plant Services

Tests Conducted By: Tulsa Gamma Ray, Inc. Test ID.: 102135826

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.

Prepared By: John Phillips 11/17/14 Procedure Specialist

Date

Accepted By: Rodfold 11/17/14 QC Manager

Date

TULSA GAMMA RAY, INC.

1127 S Lewis Ave Tulsa, OK 74104
918.585.3228

LAB / MECHANICAL TEST REPORT

☐ Welder Qualification ☒ Weld Procedure Evaluation

Organization	ISTI Plant Services	LAB #	102135826
Base Metal Type	SA516-60/65/70	PWHT	None
Coupon Thickness	0.625"	PQR#	P1-P1-1025b
WPS No.	1025	Filler	ER70S-6
Weld Process	GTAW	ID#	
Welder's Name	Eulid Valezquez	Position	3G-Up

BENDS

Specimen Number	Type of Bend	Results/Comments
1	SIDE BEND #1	PASSED No Relevant Indications Greater Than 1/8"
2	SIDE BEND #2	PASSED No Relevant Indications Greater Than 1/8"
3	SIDE BEND #3	PASSED No Relevant Indications Greater Than 1/8"
4	SIDE BEND #4	PASSED No Relevant Indications Greater Than 1/8"

TENSILE TESTS

Specimen Number	Specimen Size	Specimen Area sq. in.	Load at Failure (lbs.)	Ultimate Tensile (psi)	Type of Failure & Location
1	0.750" X 0.504"	0.378	29906	79100	Ductile-BM
2	0.750" X 0.554"	0.416	32876	79000	Ductile-BM

HARDNESS IN BHN

Base Material #1			Heat Affected Zone #1			Weld Metal		
1	2	3	1	2	3	1	2	3
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Heat Affected Zone #2			**Base Material #2**					
1	2	3	1	2	3			
N/A	N/A	N/A	N/A	N/A	N/A			

CHARPY V-NOTCH IMPACT TESTING

Specimen Number	Specimen Type/Location	Specimen Size	Temp.	Value Ft./Lbs.	Lateral Expansion	Percent Shear	Drop Weight/ Break
1	V/Weld Metal	10mm x 10mm	-50°F	123	71	55	No
2	V/Weld Metal	10mm x 10mm	-50°F	125	71	60	No
3	V/Weld Metal	10mm x 10mm	-50°F	95	59	30	No
4	V/HAZ	10mm x 10mm	-50°F	37	22	30	No
5	V/HAZ	10mm x 10mm	-50°F	35	20	30	No
6	V/HAZ	10mm x 10mm	-50°F	30	21	25	No

Other Tests Performed: NONE

All tests performed in accordance to methods specified in ASME B31.3 & SEC IX.

Signature: John Phillips — Date: 11-17-2014

TULSA GAMMA RAY, INC.

1127 S Lewis Ave Tulsa, OK 74104
918.585.3228

LAB / MECHANICAL TEST REPORT

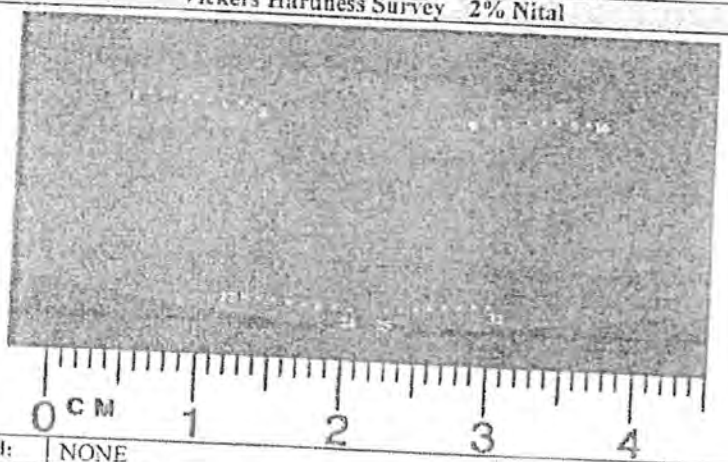
☐ Welder Qualification ☒ Weld Procedure Evaluation

Organization	ISTI Plant Services	LAB #	102135826
Base Metal Type	SA516-60/65/70	PWHT	None
Coupon Thickness	0.625"	PQR#	P1-P1-1025b
WPS No.	1025	Filler	ER70S-6
Weld Process	GTAW	ID#	
Welder's Name	Eulid Valezquez	Position	3G-Up

Microhardness Survey ASTM E384-11
NACE SP0472-2010, Figure 2 and 3

Reading Number	HIV Value	Reading Number	HIV Value
1	150	17	168
2	161	18	170
3	176	19	174
4	205	20	177
5	229	21	185
6	233	22	188
7	233	23	182
8	223	24	194
9	245	25	191
10	240	26	185
11	242	27	189
12	236	28	187
13	208	29	175
14	190	30	177
15	162	31	174
16	159	32	172

Vickers Hardness Survey 2% Nital



Other Tests Performed: NONE

All tests performed in accordance to methods specified in ASME B31.3 & SEC IX.

Signature: John Phillips — Date: 11-17-2014

J-447

SK3 Assy
Spools

ISTI
Welder Qualifications

ISTI Plant Services
17207 East 21st Street
Tulsa, OK 74134

Welder or Welding Operator Performance Qualification (WPQ)

Welder's Name: Rendals, Justin Stamp: HZ
Test WPS No.: 1001 Rev.: 3 WPQ No.: _____ Date: 2/24/2017
Welding process(es) / type(s) used: GTAW / Manual
Type of joint welded: Pipe Groove weld Joint type(s) qualified: Groove and Fillet Welds
Base metal(s) welded: SA-106, Grade B to SA-106, Grade B

Welder Variables (QW-350)	Actual Values Used	Range Qualified
P- or S-Number to P- or S-Number	P-No. 1 to P-No. 1	P-1 thru P-15F,P-34 & P-4X
Base metal thickness (in.)	0.218	WPS Limits
Pipe diameter (in.)	2.375	1.00" minimum
	GTAW / Manual	GTAW / Manual
Backing **	No backing used	With or without backing
AWS classification	ER70S-6	
Filler metal specification (SFA)	5.18	5.xx
Filler metal F-No.	6	F-No. 6
Filler metal product form	Bare (Solid)	Bare / metal cored
Consumable insert	No insert used	Without insert only
Deposit thickness (in.) [>= 3 layers]	0.218 [N/A]	0.4360" maximum
Welding position	6G - 45 degree pipe	All Positions
Weld progression	Vertical up	Vertical up (n4)
Backing gas	No backing gas used	With or Without backing gas
GTAW welding current / polarity	DCEN (straight)	DCEN (straight)

Machine Welding Variables (QW-360)	Actual Values Used	Range Qualified
Direct / remote visual control	N/A	N/A
Automatic voltage control	N/A	N/A
Automatic joint tracking	N/A	N/A
Welding position	N/A	N/A
Consumable insert	N/A	N/A
Backing **	N/A	N/A
Single / multiple pass per side	N/A	N/A

Fillet Welds: Qualified to make fillet welds of any size on all base material thicknesses and pipe diameters of any size.
** Welds with backing include fillets and double-welded groove welds.
Notes: (n4) The root pass, when removed to sound weld metal in preparation for welding the second side, and the cover or wash pass may be up or down.

Guided Bend Test (QW-160)

Figure Number and Type	Result	Figure Number and Type	Result
QW-462.3(a) Face bend	Passed	QW-462.3(a) Root bend	Passed
QW-462.3(a) Face bend	Passed	QW-462.3(a) Root bend	Passed
None		None	

Visual examination results: Visual exam satisfactory per QW-302.4 and QW-194
Volumetric test results: None
Welding test conducted by: ISTI Plant Services
Mechanical/Radiographic tests conducted by: American Piping Inspection Lab test no.: W170118

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.

Approved By: Rod Holden Organization: ISTI Plant Services
2/24/2017
Date

ISTI Plant Services
17207 East 21st Street
Tulsa OK 74134

Welder or Welding Operator Performance Qualification (WPQ)

Welder's Name: Rendals, Justin Stamp: HZ

Test WPS No.: 1004 Rev.: 3 WPQ No.: ______ Date: 2/24/2017

Welding process(es) / type(s) used: GMAW / Semiautomatic and FCAW / Semiautomatic

Type of joint welded: Pipe Groove weld Joint type(s) qualified: Groove and Fillet Welds

Base metal(s) welded: SA-106, Grade B to SA-106, Grade B

Welder Variables (QW-350)	Actual Values Used		Range Qualified	
P- or S-Number to P- or S-Number	P-No. 1 to P-No. 1		P-1 thru P-15F,P-34 & P-4X	
Base metal thickness (in.)	0.562		WPS Limits	
Pipe diameter (in.)	6.625		2.875" minimum	
	GMAW / Semiauto	**FCAW / Semiauto**	**GMAW / Semiauto**	**FCAW / Semiauto**
Backing **	No backing used	Backing used	With or without backing	With backing only
AWS classification	ER70S-6	E71T-12M		
Filler metal specification (SFA)	5.18	5.20	5.xx	5.xx
Filler metal F-No.	6	6	F-No. 6	F-No. 6
Filler metal product form	N/A	N/A	N/A	N/A
Consumable insert	N/A	N/A	N/A	N/A
Deposit thickness (in.) [>= 3 layers]	0.125 [N/A]	0.437 [N/A]	0.2500" maximum	0.8740" maximum
Welding position	1GR - Rotated	1GR - Rotated	Flat only	Flat only
Weld progression	N/A	N/A	N/A	N/A
Backing gas	No backing gas used	No backing gas used	W/WO backing gas	W/WO backing gas
GMAW / FCAW transfer mode	Globular arc	Globular arc	Spray, Pulsed, or Globular	Spray, Pulsed, or Globular

Machine Welding Variables (QW-360)	Actual Values Used		Range Qualified	
Direct / remote visual control	N/A	N/A	N/A	N/A
Automatic voltage control	N/A	N/A	N/A	N/A
Automatic joint tracking	N/A	N/A	N/A	N/A
Welding position	N/A	N/A	N/A	N/A
Consumable insert	N/A	N/A	N/A	N/A
Backing **	N/A	N/A	N/A	N/A
Single / multiple pass per side	N/A	N/A	N/A	N/A

Fillet Welds: Qualified to make fillet welds of any size on all base material thicknesses and pipe diameters of any size.
** Welds with backing include fillets and double-welded groove welds.
Notes:

Guided Bend Test (QW-160)

Figure Number and Type	Result	Figure Number and Type	Result
QW-462.2 Side bend	Passed	QW-462.2 Side bend	Passed
None		None	
None		None	

Visual examination results: Visual exam satisfactory per QW-302.4 and QW-194

Volumetric test results: None

Welding test conducted by: ISTI Plant Services

Mechanical/Radiographic tests conducted by: American Piping Inspection Lab test no.: W170119

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.

Organization: ISTI Plant Services

Approved By: [signature] 2/24/2017
Date

ISTI Plant Services
17207 East 21st Street
Tulsa, OK 74134

Welder or Welding Operator Performance Qualification (WPQ)

Welder's Name: **Hughart, Jesse** Stamp: _ H8
Test WPS No.: **1001** Rev.: 0 WPQ No.: _____ Date: 4/7/2017
Welding process(es) / type(s) used: GTAW / Manual
Type of joint welded: Pipe Groove weld Joint type(s) qualified: Groove and Fillet Welds
Base metal(s) welded: SA-106, Grade B to SA-106, Grade B

Welder Variables (QW-350)	Actual Values Used	Range Qualified
P- or S-Number to P- or S-Number	P-No. 1 to P-No. 1	P-1 thru P-15F,P-34 & P-4X
Base metal thickness (in.)	0.218	WPS Limits
Pipe diameter (in.)	2.375	1.00" minimum
	GTAW / Manual	**GTAW / Manual**
Backing **	No backing used	With or without backing
AWS classification	ER70S-6	
Filler metal specification (SFA)	5.18	5.xx
Filler metal F-No.	6	F-No. 6
Filler metal product form	Bare (Solid)	Bare / metal cored
Consumable insert	No insert used	Without insert only
Deposit thickness (in.) [>= 3 layers]	0.218 [N/A]	0.4360" maximum
Welding position	6G - 45 degree pipe	All Positions
Weld progression	Vertical up	Vertical up (n4)
Backing gas	No backing gas used	With or Without backing gas
GTAW welding current / polarity	DCEN (straight)	DCEN (straight)

Machine Welding Variables (QW-360)	Actual Values Used	Range Qualified
Direct / remote visual control	N/A	N/A
Automatic voltage control	N/A	N/A
Automatic joint tracking	N/A	N/A
Welding position	N/A	N/A
Consumable insert	N/A	N/A
Backing **	N/A	N/A
Single / multiple pass per side	N/A	N/A

Fillet Welds: Qualified to make fillet welds of any size on all base material thicknesses and pipe diameters of any size.
** Welds with backing include fillets and double-welded groove welds.
Notes: (n4) The root pass, when removed to sound weld metal in preparation for welding the second side, and the cover or wash pass may be up or down.

Guided Bend Test (QW-160)

Figure Number and Type	Result	Figure Number and Type	Result
QW-462.3(a) Face bend	Passed	QW-462.3(a) Root bend	Passed
QW-462.3(a) Face bend	Passed	QW-462.3(a) Root bend	Passed
None		None	

Visual examination results: Visual exam satisfactory per QW-302.4 and QW-194
Volumetric test results: None
Welding test conducted by: ISTI Plant Services
Mechanical/Radiographic tests conducted by: American Piping Inspection Lab test no.: W170232

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.

Organization: ISTI Plant Services

Approved By: _____ 4/10/17 Date

ISTI Plant Services
17207 East 21st Street
Tulsa, OK 74134

Welder or Welding Operator Performance Qualification (WPQ)

Welder's Name: Lopez, Jaime Stamp: JL

Test WPS No.: 1001 Rev.: 0 WPQ No.: _____ Date: 8/2/2017

Welding process(es) / type(s) used: GTAW / Manual

Type of joint welded: Pipe Groove weld Joint type(s) qualified: Groove and Fillet Welds

Base metal(s) welded: SA-106, Grade B to SA-106, Grade B

Welder Variables (QW-350)	Actual Values Used	Range Qualified
P- or S-Number to P- or S-Number	P-No. 1 to P-No. 1	P-1 thru P-15F,P-34 & P-4X
Base metal thickness (in.)	0.218	WPS Limits
Pipe diameter (in.)	2.375	1.00" minimum
	GTAW / Manual	GTAW / Manual
Backing **	No backing used	With or without backing
AWS classification	ER70S-6	
Filler metal specification (SFA)	5.18	5.xx
Filler metal F-No.	6	F-No. 6
Filler metal product form	Bare (Solid)	Bare / metal cored
Consumable insert	No insert used	Without insert only
Deposit thickness (in.) [>= 3 layers]	0.218 [N/A]	0.4360" maximum
Welding position	6G - 45 degree pipe	All Positions
Weld progression	Vertical up	Vertical up (n4)
Backing gas	No backing gas used	With or Without backing gas
GTAW welding current / polarity	DCEN (straight)	DCEN (straight)

Machine Welding Variables (QW-360)	Actual Values Used	Range Qualified
Direct / remote visual control	N/A	N/A
Automatic voltage control	N/A	N/A
Automatic joint tracking	N/A	N/A
Welding position	N/A	N/A
Consumable insert	N/A	N/A
Backing **	N/A	N/A
Single / multiple pass per side	N/A	N/A

Fillet Welds: Qualified to make fillet welds of any size on all base material thicknesses and pipe diameters of any size.
** Welds with backing include fillets and double-welded groove welds.
Notes: (n4) The root pass, when removed to sound weld metal in preparation for welding the second side, and the cover or wash pass may be up or down.

Guided Bend Test (QW-160)

Figure Number and Type	Result	Figure Number and Type	Result
QW-462.3(a) Face bend	Passed	QW-462.3(a) Root bend	Passed
QW-462.3(a) Face bend	Passed	QW-462.3(a) Root bend	Passed
None		None	

Visual examination results: Visual exam satisfactory per QW-302.4 and QW-194

Volumetric test results: None

Welding test conducted by: ISTI Plant Services

Mechanical/Radiographic tests conducted by: American Piping Inspection Lab test no.: M171154

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.

Organization: ISTI Plant Services

Approved By: _____ 8/2/17
Date

ISTI Plant Services
17207 East 21st Street
Tulsa, OK 74134

Welder or Welding Operator Performance Qualification (WPQ)

Welder's Name: Lopez, Jaime Stamp: JL
Test WPS No.: 1004 Rev.: 3 WPQ No.: _____ Date: 8/2/2017
Welding process(es) / type(s) used: GMAW / Semiautomatic and FCAW / Semiautomatic
Type of joint welded: Pipe Groove weld Joint type(s) qualified: Groove and Fillet Welds
Base metal(s) welded: SA-106, Grade B to SA-106, Grade B

Welder Variables (QW-350)	Actual Values Used		Range Qualified	
P- or S-Number to P- or S-Number	P-No. 1 to P-No. 1		P-1 thru P-15F,P-34 & P-4X	
Base metal thickness (in.)	0.718		WPS Limits	
Pipe diameter (in.)	6.625		2.875" minimum	
	GMAW / Semiauto	FCAW / Semiauto	GMAW / Semiauto	FCAW / Semiauto
Backing **	No backing used	Backing used	With or without backing	With backing only
AWS classification	ER70S-6	E71T-12M		
Filler metal specification (SFA)	5.18	5.20	5.xx	5.xx
Filler metal F-No.	6	6	F-No. 6	F-No. 6
Filler metal product form	N/A	N/A	N/A	N/A
Consumable insert	N/A	N/A	N/A	N/A
Deposit thickness (in.) [>= 3 layers]	0.125 [N/A]	0.593 [No]	0.1375" maximum	1.1860" maximum
Welding position	1GR - Rotated	1GR - Rotated	Flat only	Flat only
Weld progression	N/A	N/A	N/A	N/A
Backing gas	No backing gas used	No backing gas used	W/WO backing gas	W/WO backing gas
GMAW / FCAW transfer mode	Short-circuiting arc	Globular arc	Short-circuiting arc	Spray, Pulsed, or Globular

Machine Welding Variables (QW-360)	Actual Values Used		Range Qualified	
Direct / remote visual control	N/A	N/A	N/A	N/A
Automatic voltage control	N/A	N/A	N/A	N/A
Automatic joint tracking	N/A	N/A	N/A	N/A
Welding position	N/A	N/A	N/A	N/A
Consumable insert	N/A	N/A	N/A	N/A
Backing **	N/A	N/A	N/A	N/A
Single / multiple pass per side	N/A	N/A	N/A	N/A

Fillet Welds: Qualified to make fillet welds of any size on all base material thicknesses and pipe diameters of any size.
** Welds with backing include fillets and double-welded groove welds.
Notes:

Guided Bend Test (QW-160)

Figure Number and Type	Result	Figure Number and Type	Result
QW-462.2 Side bend	Passed	QW-462.2 Side bend	Passed
None		None	
None		None	

Visual examination results: Visual exam satisfactory per QW-302.4 and QW-194
Volumetric test results: None
Welding test conducted by: ISTI Plant Services
Mechanical/Radiographic tests conducted by: American Piping Inspection Lab test no.: M171153

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.

Approved By: _____ Organization: ISTI Plant Services
8/2/17
Date

TULSA GAMMA RAY INC.
1127 South Lewis Ave. Tulsa OK 74104
PH 918.585.3228 FX 918.584.5598

QW-484A SUGGESTED FORMAT A FOR WELDER PERFORMANCE QUALIFICATIONS (WPQ)

(See QW-301, Section IX, ASME Boiler and Pressure Vessel Code)

Welder's Name: Antonio Flores — Identification No.: Q8

TEST DESCRIPTION

Identification of WPS followed: WPS 1001 — ☒ Test Coupon ☐ Production Weld
Specification of base metal(s): SA106B — Thickness: 0.218"

TESTING CONDITIONS & QUALIFICATIONS

Welding Variables (QW-350)	Actual values	Range Qualified
Welding Process(es)	GTAW	GTAW
Type (i.e.: manual, semi-auto) used	MANUAL	MANUAL
Backing (metal, weld metal, double-welded, etc.)	WITHOUT	WITH/WITHOUT
☐ Plate ☒ Pipe (enter diameter if pipe or tube)	2"	1" & GREATER
Base metal P or S-Number to P- or S Number	P1 to P1	P1 thru P15E,P34, P4X
Filler metal or electrode specification(s) (SFA) (info only)	5.18/5.20	
Filler metal or electrode classification(s) (info only)	ER70S-6	
Filler metal F-Numbers	F6	ALL F6
Consumable Insert (GTAW or PAW)	NONE	NONE
Filler type (solid/metal or flux cored/powdered) (GTAW or PAW)	SOLID	SOLID
Deposit thickness for each process	------	------
Process 1: GTAW 3 layers minimum ☐ yes ☒ no	0.218"	0.436" MAX
Process 2: N/A 3 layers minimum ☐ yes ☐ no	N/A	N/A
Position qualified (2G, 6G, 3F, etc.)	1GR	1GR, 1F
Vertical progression (uphill or downhill)	UPHILL	UPHILL
Type of fuel gas (OFW)	N/A	N/A
Inert gas backing (GTAW, PAW, GMAW)	N/A	N/A
Transfer mode (spray/globular or pulse to short circuit-GMAW)	N/A	N/A
GTAW current type/polarity (AC, DCEP, DCEN)	DCEN	DCEN

RESULTS

Visual Examination of Completed Weld (QW-302.4): ACCEPTABLE

☒ Bend Test ☐ Transverse Root and Face [QW-462.2(a)] ☐ Longitudinal Root and Face [QW-462.3(b)] ☒ Side (QW-462.2)
☐ Pipe bend specimen, corrosion-resistant overlay[QW-462.5(e)] ☐ Plate bend specimen, corrosion resistant overlay[QW-462.5(d)]
☐ Macro test fusion [QW-462.5 (b)] ☐ Macro test for fusion [QW-462.5(e)]

Type	Result	Type	Result	Type	Result
FACE #1	ACCEPTABLE	ROOT #2	ACCEPTABLE	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A

Alternative radiographic examination results (QW-191): N/A
Fillet weld – fracture test (QW-180): N/A — Length and percent of defects: N/A
Macro examination (QW-184): N/A — Fillet size (in.): ____ x ____ — Concavity/convexity (in.): N/A
Other Tests: N/A
Film or Specimens evaluated by: John Phillips — Company: Tulsa Gamma Ray, Inc.
Mechanical tests conducted by: TULSA GAMMA RAY, Inc. — Laboratory Tests: 102135525
Welding supervised by: ISTI Plant Services

We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the latest requirements of Section IX of the ASME Code.

Organization: ISTI Plant Services
Date: 09-29-2014
By: Rod Wold

American Piping Inspection

18501 E Admiral Pl. Catoosa, OK 74015
PH 918.266.4130

QW-484A SUGGESTED FORMAT A FOR WELDER PERFORMANCE QUALIFICATIONS (WPQ)

(See QW-301, Section IX, ASME Boiler and Pressure Vessel Code)

Welder's Name: Antonio Flores — Identification No.: Q8

TEST DESCRIPTION

Identification of WPS followed: 1004
Specification of base metal(s): SA106B
☒ Test Coupon ☐ Production Weld
Thickness: 0.562"

TESTING CONDITIONS & QUALIFICATIONS

Welding Variables (QW-350)	Actual values	Range Qualified
Welding Process(es)	(1)GMAW/(2)FCAW	(1)GMAW/(2)FCAW
Type (i.e.: manual, semi-auto) used	(1)SEMI/(2)SEMI	(1)SEMI/(2)SEMI
Backing (metal, weld metal, double-welded, etc.)	(1)WITHOUT/(2) WITH	(1)WITH OR WITHOUT/(2) WITH
☐ Plate ☒ Pipe (enter diameter if pipe or tube)	6.625"	2 7/8" to UNLIMITED
Base metal P or S-Number to P- or S Number	P1 to P1	P1- P15F, P34 & P4X
Filler metal or electrode specification(s) (SFA) (info only)	(1)5.18/(2)5.20	(1)5.18/(2)5.20
Filler metal or electrode classification(s) (info only)	(1)ER70S-2/(2)E71T-12M	(1)ER70S-6/(2)E71T-12M
Filler metal F-Numbers	F6	ALL F6
Consumable Insert (GTAW or PAW)	NONE	NONE
Filler type (solid/metal or flux cored/powdered) (GTAW or PAW)	(1)SOLID/(2)TUBULAR	(1)SOLID/(2)TUBULAR
Deposit thickness for each process	------	------
Process 1: (1)GMAW 3 layers min. ☐ yes ☒ no	(1) 0.125"	(1) 0.1375" MAX
Process 2: (2)FCAW 3 layers min. ☒ yes ☐ no	(2) 0.437"	(2) 0.874"
Position qualified (2G, 6G, 3F, etc.)	1GR	1G, 1F
Vertical progression (uphill or downhill)	N/A	N/A
Type of fuel gas (OFW)	N/A	N/A
Inert gas backing (GTAW, PAW, GMAW)	NONE	NONE
Transfer mode (spray/globular or pulse to short circuit-GMAW)	(1)SHORT CIRCUIT/(2)GLOBULAR	(1)SHORT CIRCUIT/(2)GLOBULAR
GTAW current type/polarity (AC, DCEP, DCEN)	(1)DCEP/(2)DCEP	(1)DCEP/(2)DCEP

RESULTS

Visual Examination of Completed Weld (QW-302.4): ACCEPTABLE

☒ Bend Test ☐ Transverse Root and Face [QW-462.3(a)] ☐ Longitudinal Root and Face [QW-462.3(b)] ☒ Side (QW-462.2)
☐ Pipe bend specimen, corrosion-resistant overlay[QW-462.5(e)] ☐ Plate bend specimen, corrosion resistant overlay[QW-462.5(d)]
☐ Macro test fusion [QW-462.5 (b)] ☐ Macro test for fusion [QW-462.5(e)]

Type	Result	Type	Result	Type	Result
SIDE BEND #1	ACCEPTABLE	SIDE BEND #2	ACCEPTABLE	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A

Alternative radiographic examination results (QW-191): N/A
Fillet weld – fracture test (QW-180): N/A
Macro examination (QW-184): N/A — Fillet size (in.) ____ x ____ — Length and percent of defects: N/A — Concavity/convexity (in.): N/A
Other Tests: N/A
Film or Specimens evaluated by: Maxwell D. Stocker — Company: American Piping Inspection
Mechanical tests conducted by: American Piping Inspection — Laboratory Tests: M150327-1D
Welding supervised by: ISTI Plant Services

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.

Date: 3-27-15 — Organization: ISTI Plant Services

By: [signature]

TULSA GAMMA RAY INC
1127 South Lewis Ave Tulsa OK 74104
PH 918.585.3228 FX 918.584.5598

QW-484A SUGGESTED FORMAT A FOR WELDER PERFORMANCE QUALIFICATIONS (WPQ)

(See QW-301, Section IX, ASME Boiler and Pressure Vessel Code)

Welder's Name HUGO MEZA Identification No W

TEST DESCRIPTION

Identification of WPS followed 1001
Specification of base metal(s) SA106B
☒ Test Coupon ☐ Production Weld
Thickness .218"

TESTING CONDITIONS & QUALIFICATIONS

Welding Variables (QW-350)	Actual values	Range Qualified
Welding Process(es)	GTAW	GTAW
Type (i.e., manual, semi-auto) used	MANUAL	MANUAL
Backing (metal, weld metal, double-welded, etc.)	NONE	WITH OR WITHOUT
☐ Plate ☒ Pipe (enter diameter if pipe or tube)	2"	1" to UNLIMITED
Base metal P or S-Number to P- or S-Number	P1 to P1	P1- P1
Filler metal or electrode specification(s) (SFA) (info only)	5.18	
Filler metal or electrode classification(s) (info only)	ER70S-6	
Filler metal F-Numbers	6	6
Consumable Insert (GTAW or PAW)	NONE	NONE
Filler type (solid/metal or flux cored powdered) (GTAW or PAW)	SOLID	SOLID
Deposit thickness for each process	.218"	.436"
Process 1 GTAW 3 layers minimum ☒ yes ☐ no		
Process 2 ____ 3 layers minimum ☐ yes ☐ no	N.A.	N.A.
Position qualified (2G, 6G, 3F, etc.)	6G	ALL
Vertical progression (uphill or downhill)	UPHILL	UPHILL
Type of fuel gas (OF-W)	N.A.	N.A.
Inert gas backing (GTAW, PAW, GMAW)	NONE	NONE
Transfer mode (spray, globular or pulse to short circuit-GMAW)	N.A.	N.A.
GTAW current type/polarity (AC, DCEP, DCEN)	DCEN	DCEN

RESULTS

Visual Examination of Completed Weld (QW-302.4) ACCEPTABLE

☒ Bend Test ☒ Transverse Root and face (QW-462.3(a)) ☐ Longitudinal root and face (QW-462.3(b)) ☐ Side (QW-462.3(c))
☐ Pipe bend specimen, corrosion-resistant overlay (QW-462.5(d)) ☐ Plate bend specimen, corrosion resistant overlay (QW-462.5(d))
☐ Macro test fusion (QW-462.5(b)) ☐ Macro test for fusion (QW-462.5(b))

Type	Result	Type	Result	Type	Result
Face	Acceptable	Face	Acceptable		
Root	Acceptable	Root	Acceptable		

Alternative radiographic examination results (QW-191) N.A.
Fillet weld - fracture test (QW-180) N.A.
Macro examination (QW-184) N.A. Fillet size (in.) N.A. Length and percent of defects N.A.
Other Tests N.A. Concavity/convexity (in.) N.A.
Film or Specimens evaluated by RICK PRICE
Mechanical tests conducted by RICK PRICE Company Tulsa Gamma Ray, Inc.
Welding supervised by ISTI Plant Services Laboratory Tests 1021320039
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. Radiography Ticket # N.A.

Date 4-12-11 Organization ISTI Plant Services
By

TULSA GAMMA RAY INC

1127 South Lewis Ave Tulsa OK 74104
PH 918.585.3228 FX 918.584.5598

QW-484A SUGGESTED FORMAT A FOR WELDER PERFORMANCE QUALIFICATIONS (WPQ)

(See QW-301, Section IX, ASME Boiler and Pressure Vessel Code)

Welder's Name: HUGO MEZA Identification No.: W

TEST DESCRIPTION

Identification of WPS followed: 1004
Specification of base metal(s): SA106-B
☒ Test Coupon ☐ Production Weld
Thickness: 0.562"

TESTING VARIBLES & QUALIFICATION LIMITS

Welding Variables (QW-350)	Actual values	Range Qualified
Welding Process(es)	(1)GMAW/(2)FCAW	(1)GMAW/(2)FCAW
Type (i.e., manual, semi-auto) used	(1)SEMI/(2)SEMI	(1)SEMI/(2)SEMI
Backing (metal, weld metal, double-welded, etc.)	(1)Without/(2)With	(1)With or Without/(2) With
☐ Plate ☒ Pipe (enter diameter if pipe or tube)	6"	2 7/8" to UNLIMITED
Base metal P or S-Number to P- or S Number	P1-P1	P1thru P15E, P34 & P4X
Filler metal or electrode specification(s) (SFA) (info only)	5.18/5.20	
Filler metal or electrode classification(s) (info only)	ER70S-6/E71T-12M	
Filler metal F-Numbers	6/6	6/6
Consumable Insert (GTAW or PAW)	NONE	NONE
Filler type (solid/metal or flux cored/powdered) (GTAW or PAW)	(1)SOLID/(2)TUBULAR	(1)SOLID/(2)TUBULAR
Deposit thickness for each process	------	-------
Process 1: GMAW 3 layers min. ☐ yes ☒ no	0.125"	0.1375" MAX
Process 2: FCAW 3 layers min. ☒ yes ☐ no	0.307"	0.614"
Position qualified (2G, 6G, 3F, etc.)	1G	1G, 1F
Vertical progression (uphill or downhill)	N.A.	N.A.
Type of fuel gas (OFW)	N.A.	N.A.
Inert gas backing (GTAW, PAW, GMAW)	NONE	NONE
Transfer mode (spray/globular or pulse to short circuit-GMAW)	SHORT CIRCUIT	SHORT CIRCUIT
GTAW current type/polarity (AC, DCEP, DCEN)	DCEP	DCEP

RESULTS

Visual Examination of Completed Weld (QW-302.4): ACCEPTABLE

☒ Bend Test ☐ Transverse Root and Face [QW-462.3(a)] ☐ Longitudinal Root and Face [QW-462.3(b)] ☒ Side [QW-462.2]
☐ Pipe bend specimen, corrosion-resistant overlay [QW-462.5(c)] ☐ Plate bend specimen, corrosion resistant overlay [QW-462.5(d)]
☐ Macro test fusion [QW-462.5(b)] ☐ Macro test for fusion [QW-462.5(e)]

Type	Result	Type	Result	Type	Result
SIDE BEND #1	PASS				
SIDE BEND #2	PASS				

Alternative radiographic examination results (QW-191): N/A
Fillet weld - fracture test (QW-180): N/A
Macro examination (QW-184): N/A Fillet size (in.): ___ x ___ Length and percent of defects: N/A
Other Tests: N/A Concavity/convexity (in.): N/A
Film or Specimens evaluated by: ROBERT BAKER
Mechanical tests conducted by: ROBERT BAKER Company: TULSA GAMMA RAY, Inc.
Welding supervised by: ISTI PLANT SERVICES Laboratory Tests: 102132585

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 or Contractor: ISTI PLANT SERVICES

Date: 12-7-12

Certified by:

TULSA GAMMA RAY INC.
1127 South Lewis Ave. Tulsa OK 74104
PH 918.585.3228 FX 918.584.5598

QW-484A SUGGESTED FORMAT A FOR WELDER PERFORMANCE QUALIFICATIONS (WPQ)

(See QW-301, Section IX, ASME Boiler and Pressure Vessel Code)

Welder's Name: Hugo Meza Identification No.: W

TEST DESCRIPTION

Identification of WPS followed: 1002 ☒ Test Coupon ☐ Production Weld
Specification of base metal(s): SA106B Thickness: 0.562"

TESTING CONDITIONS & QUALIFICATIONS

Welding Variables (QW-350)	Actual values	Range Qualified
Welding Process(es)	GTAW / SMAW	GTAW / SMAW
Type (i.e.: manual, semi-auto) used	MANUAL	MANUAL
Backing (metal, weld metal, double-welded, etc.)	WITHOUT / WITH	WITH or WITHOUT / WITH
☐ Plate ☒ Pipe (enter diameter if pipe or tube)	6.625"	2.875" & ABOVE
Base metal P or S-Number to P- or S Number	P1 TO P1	P1-P15F, P34 & P4X
Filler metal or electrode specification(s) (SFA) (info only)	5.18/5.1	
Filler metal or electrode classification(s) (info only)	(1)ER70S-6/(2)E7018	
Filler metal F-Numbers	F6/F3	ALL CLASSIFICATIONS
Consumable Insert (GTAW or PAW)	N/A	N/A
Filler type (solid/metal or flux cored/powdered) (GTAW or PAW)	COATED	COATED
Deposit thickness for each process	--------	--------
Process 1: GTAW 3 layers minimum ☐ yes ☒ no	0.125"	0.250" MAX.
Process 2: SMAW 3 layers minimum ☒ yes ☐ no	0.437"	0.874" MAX
Position qualified (2G, 6G, 3F, etc.)	6G	ALL
Vertical progression (uphill or downhill)	UPHILL	UPHILL
Type of fuel gas (OFW)	N/A	N/A
Inert gas backing (GTAW, PAW, GMAW)	N/A	N/A
Transfer mode (spray/globular or pulse to short circuit-GMAW)	N/A	N/A
GTAW current type/polarity (AC, DCEP, DCEN)	DCEN/DCEP	DCEN/DCEP

RESULTS

Visual Examination of Completed Weld (QW-302.4): ACCEPTABLE

☒ Bend Test ☐ Transverse Root and face [QW-462.3(a)] ☐ Longitudinal root and face [QW-462.3(b)] ☒ Side (QW-462.2)
☐ Pipe bend specimen, corrosion-resistant overlay [QW-462.5(c)] ☐ Plate bend specimen, corrosion resistant overlay [QW-462.5(d)]
☐ Macro test fusion [QW-462.5(b)] ☐ Macro test for fusion [QW-462.5(e)]

TYPE	RESULT	TYPE	RESULT	TYPE	RESULT
SIDE BEND #1	ACCEPTABLE	SIDE BEND#3	ACCEPTABLE	N/A	N/A
SIDE BEND #2	ACCEPTABLE	SIDE BEND#4	ACCEPTABLE	N/A	N/A

Alternative radiographic examination results (QW-191): N/A
Fillet weld – fracture test (QW-180): N/A Length and percent of defects: N/A
Macro examination (QW-184): N/A Fillet size (in.): ____ x ____ Concavity/convexity (in.): N/A
Other Tests: N/A
Film or Specimens evaluated by: Maxwell D. Stocker MDS. Company: Tulsa Gamma Ray, Inc.
Mechanical tests conducted by: TULSA GAMMA RAY, INC. Laboratory Tests: 102136018
Welding supervised by: ISTI Plant Services

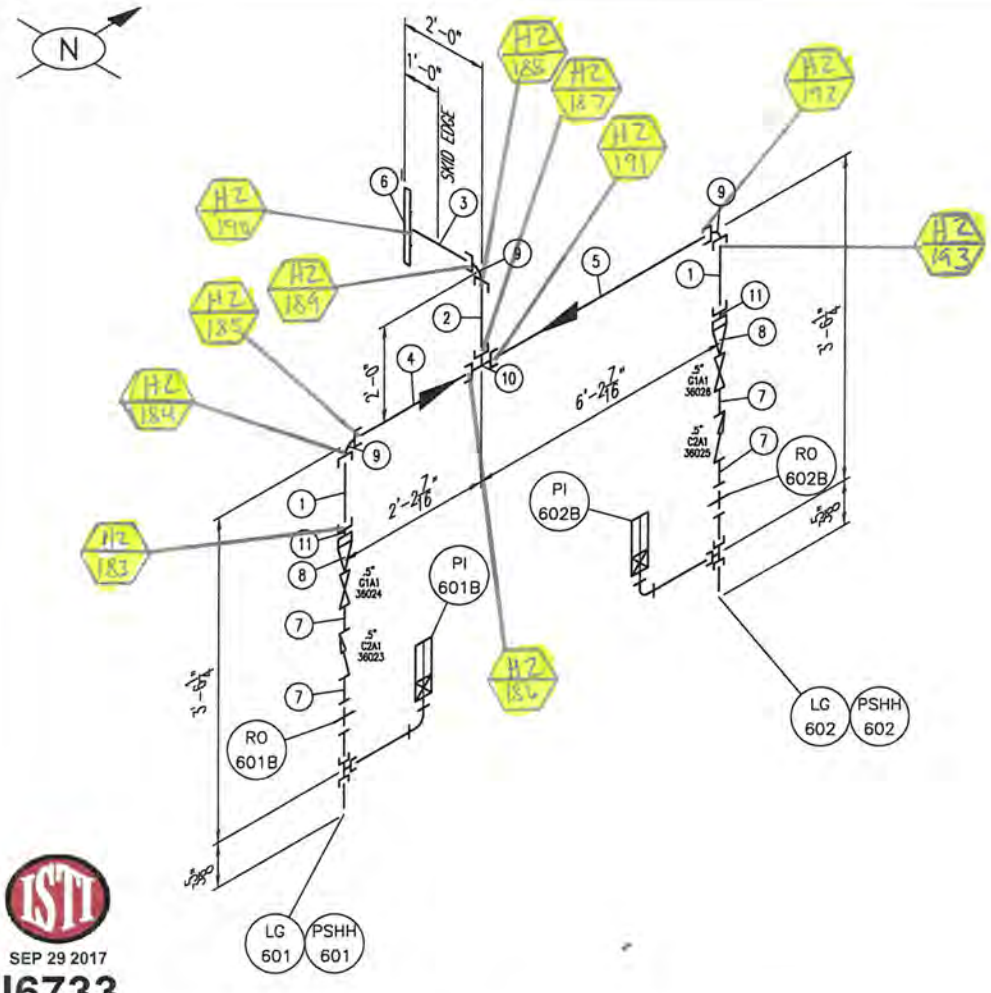
We certify that the statements in this record are correct and that the test welds were prepared, welded, and tested in accordance with the requirements of ASME Section IX Boiler & Pressure Vessel Code.

Date: 12-2-2014 Organization: ISTI Plant Services
By: Rod Lodle

J-447

SK3 Assy
Spools

ISTI
Weld Maps



BILL OF MATERIAL

MARK	QTY	SIZE	DESCRIPTION	LENGTH
1	2	1"	PIPE, XH SMLS, A-106-B PBE	1'-9 7/8"
2	1	1"	PIPE, XH SMLS, A-106-B PBE	1'-10 1/4"
3	1	1"	PIPE, XH SMLS, A-106-B PBE	1'-10 15/16"
4	1	1"	PIPE, XH SMLS, A-106-B PBE	2'-0 11/16"
5	1	1"	PIPE, XH SMLS, A-106-B PBE	6'-0 11/16"
6	1	1"	FLG, RF SW 150LB XH, A-105	
7	4	1/2"	NIPPLE, S/160 SMLS, A-106-B TBE	3"
8	2	1"x1/2"	SWAGE, CONC, XH-S/160, A-106-B PLE-TSE	
9	3	1"	ELL, 90 SW, 3000LB FS, A-105	
10	1	1"	TEE, SW, 3000LB FS, A-105	
11	2	1"	CPLG, SW, 3000LB FS, A-105	

J-447
12/19/16
IFC

ISTI
SEP 29 2017

J6733

*** = JOB #

Sep 13, 2013 - 11:11am Z:\100 - Jobs\SC6_ 60MM Cryo\17.0 Drawings\REV_A\17.4 Piping\SPOOLS\Skid #3\

DESIGN PRESS.	50 Psig	FAB. LOCATION	SHOP				
DESIGN TEMP.	150°F	SPOOL LOCATION	SKID #3				
OPER. PRESS.	50 Psia						
OPER. TEMP.	100°F	CORR. ALLOW.	.125"				
STRESS RELIEVE	NO	INSULATION	NONE	0	ISSUE FOR CONSTRUCTION	02/16/12	DV	LH
RADIOGRAPHY	NONE	PAINT	TRCo SYSTEM #3	NO.	REVISION	DATE	BY	APR

FABRICATION NOTES:

ALL VALVES ARE RAISED FACE UNLESS NOTED.
ALL FITTING MAKE-UP & CUT LENGTHS FOR BW PIPE DO NOT INCLUDE WELD GAPS.
SHOP TO MAKE ADJUSTMENTS FOR WELD GAPS.
ALL PIPE SEAMLESS UNLESS NOTED OTHERWISE.
ALL COUPLING TO BE SWAGED ON.

Thomas Russell Co.
7050 S. Yale, Suite 210
Tulsa, Oklahoma 74136
PH.: 918-481-5682

LINE No.	911-A2-CS-1"
ASSEMBLY DRAWING	SC6-403
FIELD DRAWING	***-236
DRAWN BY	DV
DATE DRAWN	02/13/12
JOB No.	~~SC6~~
SPOOL I.D. No.	SK3-004
REV.	0

J-447

SK3 Assy
Spools

ISTI
Pressure Test Reports

PLANT SERVICES

PNEUMATIC TEST FORM

TEST PACKAGE # 06

ISTI Client **UOP Russell LLC.**

ISTI Job# **J-6733**

TEST PRESSURE **440 psi** TEST MEDIA **Nitrogen**

PRE-PNEUMATIC

Test Supervisor **Jerry Allen** Date: **10/31/2017**

ISTI Quality Rep. **Rod Holden** Date: **10/31/2017**

PNEUMATIC TEST START Date: **10/31/2017** Time: **3:05 PM**

Test Gauge # **Digital** / **576360**

PNEUMATIC TEST COMPLETE Date: **10/31/2017** Time: **4:15 PM**

Chart Recorder# **0-1000 psi** / **08176**

Test Supervisor **Jerry Allen** Date: **10/31/2017**

ISTI Quality Rep. **Rod Holden** Date: **10/31/2017**

POST -PNEUMATIC

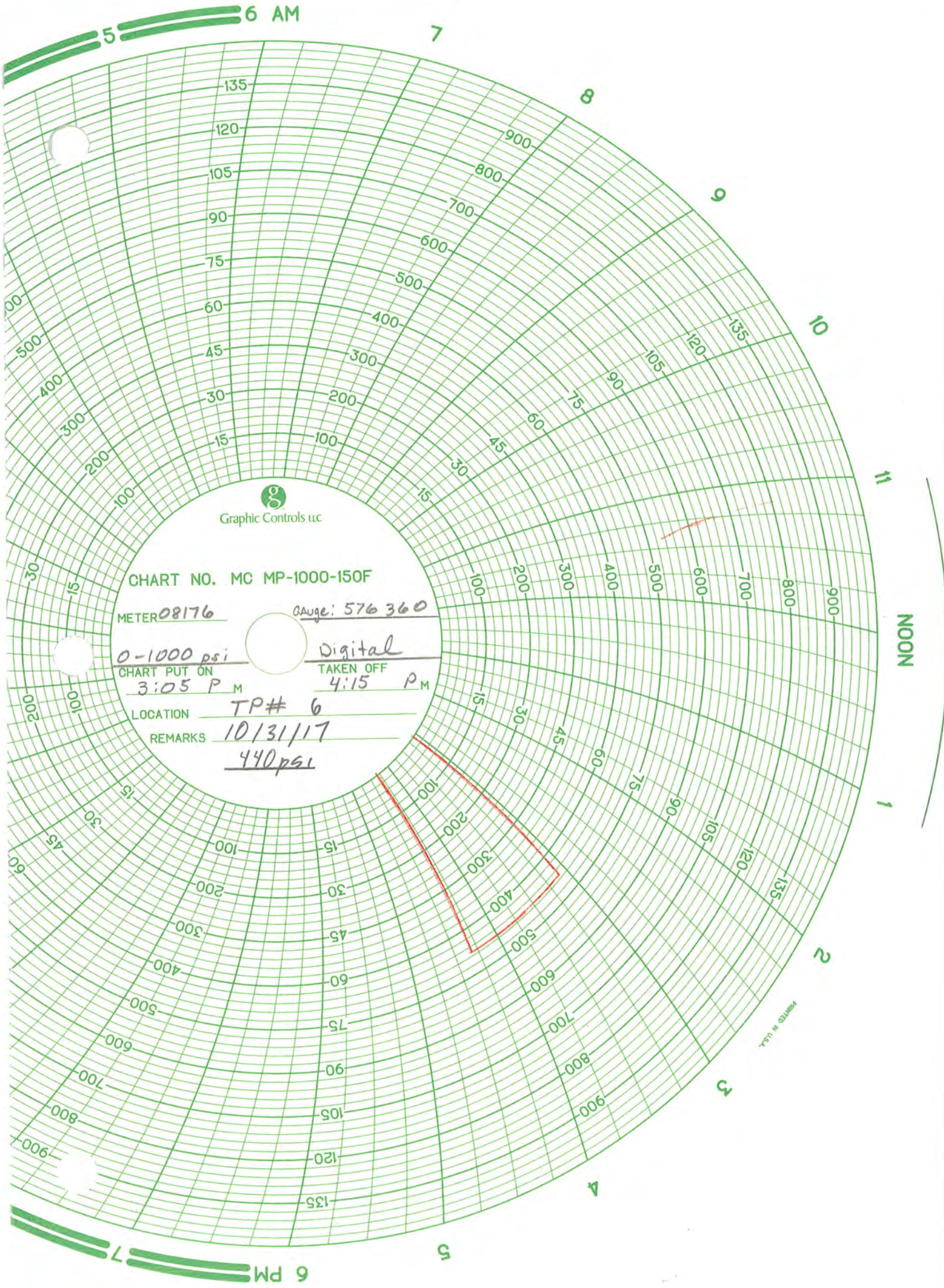
System Piping Dried Date: **10/31/2017**

Test Supervisor **Jerry Allen** Date: **10/31/2017**

ISTI Quality Rep. **Rod Holden** Date: **10/31/2017**

ISTI Plant Services J-6733
Client: UOP Russell

Spool ID	TEST #	Test Date	Test Pressure
SK2-012	TP#6	10/31/2017	440
SK2-014	TP#6	10/31/2017	440
SK2-015	TP#6	10/31/2017	440
SK2-018	TP#6	10/31/2017	440
SK2-020	TP#6	10/31/2017	440
SK2-021-PC2	TP#6	10/31/2017	440
SK2-024	TP#6	10/31/2017	440
SK2-025	TP#6	10/31/2017	440
SK2-029	TP#6	10/31/2017	440
SK2-040	TP#6	10/31/2017	440
SK3-001	TP#6	10/31/2017	440
SK3-002	TP#6	10/31/2017	440


6 AM
NOON
6 PM
Graphic Controls LLC
CHART NO. MC MP-1000-150F
METER 08176
Gauge: 576360
0-1000 psi
Digital
CHART PUT ON 3:05 PM
TAKEN OFF 4:15 PM
LOCATION TP# 6
REMARKS 10/31/17
440psi
PRINTED IN U.S.A.

PLANT SERVICES

PNEUMATIC TEST FORM

TEST PACKAGE # 09

ISTI Client **UOP Russell LLC.**

ISTI Job# **J-6733**

TEST PRESSURE **165psi** TEST MEDIA **Nitrogen**

PRE-PNEUMATIC

Test Supervisor **Jerry Allen** Date: **10/31/2017**

ISTI Quality Rep. **Rod Holden** Date: **10/31/2017**

PNEUMATIC TEST START Date: **10/31/2017** Time: **4:45 PM**

Test Gauge # **Digital** **794666**

PNEUMATIC TEST COMPLETE Date: **10/31/2017** Time: **6:00 PM**

Chart Recorder# **0-1000 psi** **265-42857**

Test Supervisor **Jerry Allen** Date: **10/31/2017**

ISTI Quality Rep. **Rod Holden** Date: **10/31/2017**

POST -PNEUMATIC

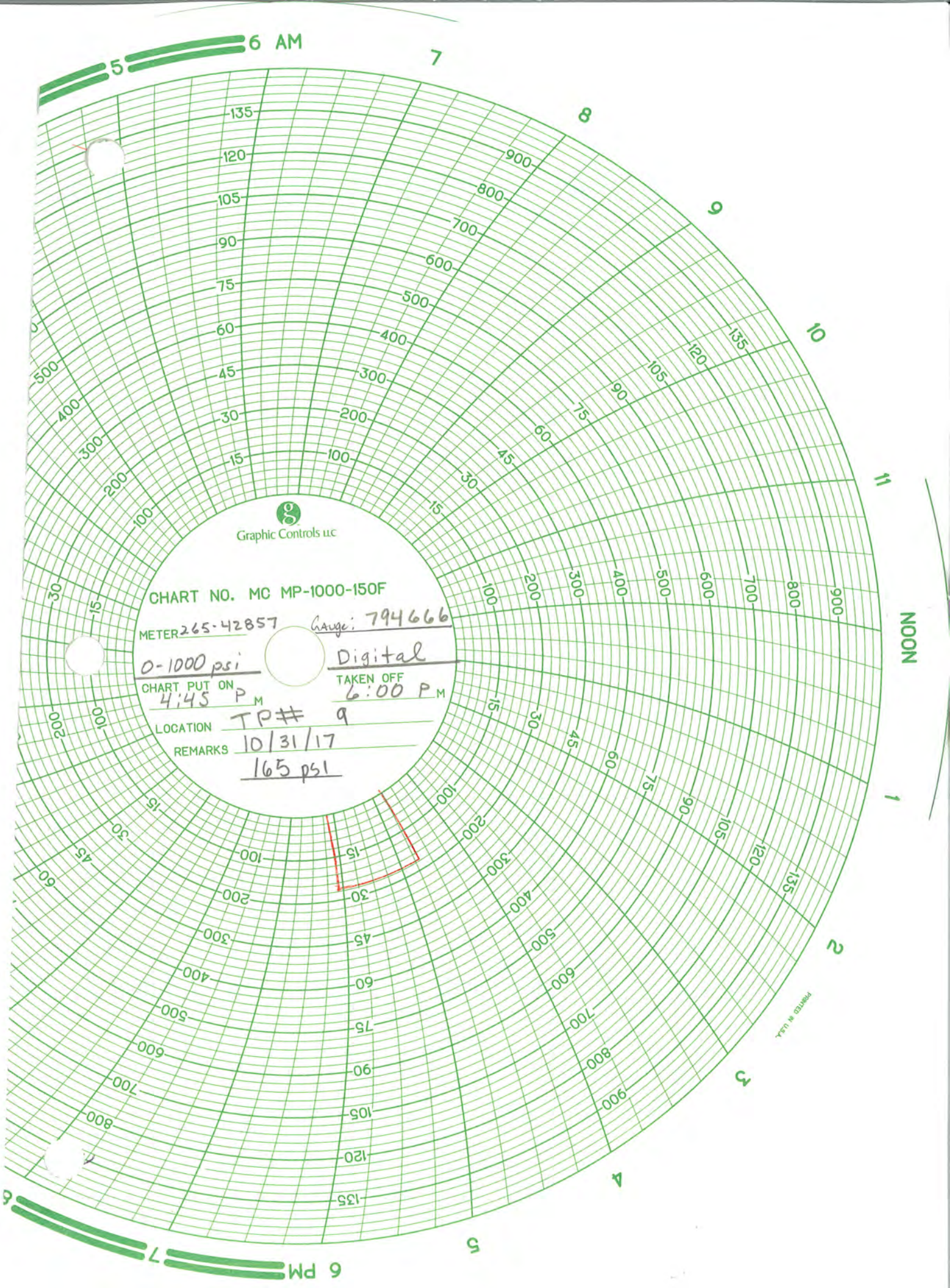
System Piping Dried Date: **10/31/2017**

Test Supervisor **Jerry Allen** Date: **10/31/2017**

ISTI Quality Rep. **Rod Holden** Date: **10/31/2017**

ISTI Plant Services J-6733
Client: UOP Russell

Spool ID	TEST #	Test Date	Test Pressure
SK2-032	TP#9	10/31/2017	165
SK2-033	TP#9	10/31/2017	165
SK2-034	TP#9	10/31/2017	165
SK2-035	TP#9	10/31/2017	165
SK2-036	TP#9	10/31/2017	165
SK2-037	TP#9	10/31/2017	165
SK2-038	TP#9	10/31/2017	165
SK2-039	TP#9	10/31/2017	165
SK2-041	TP#9	10/31/2017	165
SK2-044	TP#9	10/31/2017	165
SK2-046	TP#9	10/31/2017	165
SK2-047	TP#9	10/31/2017	165
SK2-048	TP#9	10/31/2017	165
SK3-003	TP#9	10/31/2017	165
SK3-004	TP#9	10/31/2017	165


6 AM
NOON
6 PM
Graphic Controls LLC
CHART NO. MC MP-1000-150F
METER 265-42857
Gauge: 794666
0-1000 psi
Digital
CHART PUT ON 4:45 PM
TAKEN OFF 6:00 PM
LOCATION TP# 9
REMARKS 10/31/17
165 psi
PRINTED IN U.S.A.

J-447

SK3 Assy
Spools

ISTI
Calibration Certificates

HYDRO-CHART

Calibration → Certification → Repair → Rental

www.hydro-chart.com 7709 E. 42nd Place, Suite 128 Tulsa, OK 74145 918-834-3210

CERTIFICATE OF CALIBRATION

Customer Name:	ISTI
Model:	Barton Pressure/Temperature Recorder
Serial Number:	202-21048
Range:	0 - 2,000 psi / 0 - 150 Deg. F.
Accuracy +/- :	1%
Condition as Left:	Within Tolerance
Date Calibrated:	September 26, 2017
Action Performed:	Calibrated/Certified

Tech: Mark M. Harrison

Authorized Signature: Mark M. Harrison

This certificate applies solely for the equipment listed above.
The primary test and measuring equipment used is calibrated and traceable to the National Institute of Standards and Technology (NIST) United States.

Additel SN: 211H13610038 Asset # 1123679 Due Date: 09/05/2018
Crystal SN: 261773 Asset # 1126050 Due Date: 09/05/2018
Fluke SN: 20000054 Asset # 1141857 Due Date: 10/17/2017

Based on Standard Gravity @72 Deg. F. and 39% Relative Humidity.

CERTIFICATION OF CALIBRATION

THE INSTRUMENTS LISTED BELOW MEET-OR EXCEED PUBLISHED SPECIFICATION AND HAS BEEN CALIBRATED UNDER CONTROLLED CONDITIONS TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (FORMERLY N.B.S.). M & M INSTRUMENTS CONFORMS TO ANSI Z540-1.

CERTIFICATION#: 39190

INSTRUMENT MAKE: CRYSTAL DIGITAL TEST GAUGE
MODEL: XP2i
ID#: NONE
S/N: 356841
DATE: 09-21-17
DUE: 09-21-18
HUMIDITY: 63.2% TEMPERATURE: 74.18 DEG F

SOURCE 1: PRESSUREMENTS W2000/3HP — CERT#: 2103511
SOURCE 2: — CERT#:
SOURCE 3: — CERT#:

INSTRUMENT RECEIVED: IN TOL.

MANUFACTURER ACCURACY: +/-0.1% RDG. 20-100%F.S., +/-0.02%F.S. 0-20%F.S.

COMMENTS:

CERTIFIED BY EP

M & M INSTRUMENTS

5022 SYCAMORE AVE.

PASADENA, TX 77503

PHONE (281) 991-5036
FAX (281) 991-5077

TechCal
Established 1984

Tech Cal Recorder™
Certificate of Calibration

This is to certify that this pressure and/or temperature recorder has been manufactured and calibrated in accordance with Technology & Calibrations, Inc.'s quality assurance program, current revision. All measurements are traceable to the National Institute of Standards and Technology (NIST) and certified in accordance with ANSI/NCSL, Z540-1 and ISO 10012-1. All calibrations performed at 72 degrees Fahrenheit, plus or minus 4 degrees and less than 65% relative humidity. The collective uncertainty of the measurement standard does not exceed 25% of the acceptable tolerance for each characteristic of the measuring and test equipment being certified.

Model Number: 2B1T0 Serial Number: 08176

Pen 1 Range: 1,000 PSI Pen 2 Range: 0-150 Deg. F Pen 3 Range: N/A

The Accuracy of this Recorder is +/- 0.5% of Indicated Range

Date of Calibration: Sep 8, 2017

Customer "In Service Date": _____

Calibration Due Date: _____

Technician: M. Rosales QA Approval: _____

WARRANTY

Tech Cal Recorders are warranted against defective materials or workmanship for 12 months following the date of shipment. Technology & Calibration, Inc.'s liability is limited to repair or replacement at the factory. No obligation can be assumed for recorders subjected to misuse or unauthorized repairs.

HYDRO-CHART
Calibration → Certification → Repair → Rental

www.hydro-chart.com 7709 E. 42nd Place, Suite 128 Tulsa, OK 74145 918-834-3210

CERTIFICATE OF CALIBRATION

Customer Name:	ISTI
Model:	Barton Pressure/Temperature Recorder
Serial Number:	202A-40940
Range:	0 - 1,000 psi / 0 - 150 Deg. F.
Accuracy +/- :	1%
Condition as Left:	Within Tolerance
Date Calibrated:	September 5, 2017
Action Performed:	Calibrated/Certified

Tech: Mark M. Harrison

Authorized Signature: Mark M. Harrison

This certificate applies solely for the equipment listed above.
The primary test and measuring equipment used is calibrated and traceable to the National Institute of Standards and Technology (NIST) United States.
Crystal Engineering SN: 070569 Asset# 1121166 Due Date: 11/10/2017
Fluke SN: 20000054 Asset # 1141857 Due Date: 10/17/2017
Based on Standard Gravity @72 Deg. F. and 39% Relative Humidity.

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CERTIFICATE OF CALIBRATION

Customer Name:	ISTI
Model:	Barton Pressure/Temperature Recorder
Serial Number:	242A-4998
Range:	0 - 2,000 psi / 0 - 150 Deg. F.
Accuracy +/- :	1%
Condition as Left:	Within Tolerance
Date Calibrated:	September 5, 2017
Action Performed:	Calibrated/Certified

Tech: Mark M. Harrison

Authorized Signature: Mark M. Harrison

This certificate applies solely for the equipment listed above.
The primary test and measuring equipment used is calibrated and traceable to the National Institute of Standards and Technology (NIST) United States.
Crystal Engineering SN: 070569 Asset# 1121166 Due Date: 11/10/2017
Fluke SN: 20000054 Asset # 1141857 Due Date: 10/17/2017
Based on Standard Gravity @72 Deg. F. and 39% Relative Humidity.

CERTIFICATION OF CALIBRATION

THE INSTRUMENTS LISTED BELOW MEET-OR EXCEED PUBLISHED SPECIFICATION AND HAS BEEN CALIBRATED UNDER CONTROLLED CONDITIONS TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (FORMERLY N.B.S.). M & M INSTRUMENTS CONFORMS TO ANSI Z540-1.

CERTIFICATION#: 38889

INSTRUMENT MAKE: CRYSTAL DIGITAL TEST GAUGE
MODEL: XP2i
ID#: NONE
S/N: 567628
DATE: 07-27-17
DUE: 07-27-18
HUMIDITY: 55.6% TEMPERATURE: 78.00 DEG F

SOURCE 1: PRESSUREMENTS W2000/3HP — CERT#: 2103511
SOURCE 2: — CERT#:
SOURCE 3: — CERT#:

INSTRUMENT RECEIVED: IN TOL.

MANUFACTURER ACCURACY: +/-0.1% RDG. 20-100%F.S., +/-0.02%F.S. 0-20%F.S.

COMMENTS: REPLACED SENSOR AND BATTERIES.

CERTIFIED BY EP

M & M INSTRUMENTS

5022 SYCAMORE AVE.

PASADENA, TX 77503

PHONE (281) 991-5036
FAX (281) 991-5077

Crystal Engineering Corporation
708 Fiero Lane, Suite 9
San Luis Obispo, CA 93401

TEL 805.595.5477 · FAX 805.595.5466
crystalengineering.net

Report Number: 271065

Certificate of Calibration

Calibrations comply with ISO/IEC 17025:2005 and ANSI NCSL Z540-1-1994

ACCREDITED
CALIBRATION CERT #2601.01

Device Information	
Model	5KPSIXP2I
Serial Number	794845
Water Column (@ 1 Atm)	4° C
Calibration Date	11 July 2017
Verification Date	12 July 2017
As Received Condition	New
As Left Condition	In Tolerance

Laboratory Conditions	
Laboratory ambient conditions throughout this calibration	
Temperature	19 to 23° C
Humidity	20 to 60% RH

Definitions

Temperature ..... Measured temperature of Device Under Test (DUT) during data collection.
Reference Reading .... True value according to our reference standards.
Indicated Reading ..... Displayed reading from test unit.
Condition ..... Pass or Fail.
Difference ..... Indicated reading minus reference reading.
Relative Difference ..... (Difference / reference reading) x 100.
Allowable Tolerance .... ± according to manufacturer's specifications.
Pressure Medium ..... Nitrogen.

Traceability Statement

Reference Standards used in this calibration are traceable to the National Institute of Standards and Technology of the United States (NIST) or other NMI.

System Expanded Uncertainty

System expanded uncertainty evaluation includes the calibration reference used and device under test and is calculated in accordance with ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainties reported represent expanded uncertainties using a coverage factor (k) to approximate a percentage (%) confidence level. *In Tolerance* or *Pass* conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. Test methods defined by COI-054.

Coverage Factor (k)	2
Confidence Level (%)	~ 95

Traceable Reference Standards				
Manufacturer	**Calibration Reference Used**	**Serial Number**	**Report No.**	**Reference Cal. Due**
DHI	PPCH-G 618 10KPSI Pressure Controller	618	16028	19 November 2017

Laboratory Representative
Tony Ly

Quality Representative
Bruce Hitt

Crystal Engineering Corporation
708 Fiero Lane, Suite 9
San Luis Obispo, CA 93401

TEL 805.595.5477 · FAX 805.595.5466
crystalengineering.net

Report Number: 270667

Certificate of Calibration

Calibrations comply with
ISO/IEC 17025:2005 and
ANSI NCSL Z540-1-1994

ACCREDITED
CALIBRATION CERT #2601.01

Device Information	
Model	5KPSIXP2I
Serial Number	794666
Water Column (@ 1 Atm)	4° C
Calibration Date	06 July 2017
Verification Date	06 July 2017
As Received Condition	New
As Left Condition	In Tolerance

Laboratory Conditions	
Laboratory ambient conditions throughout this calibration	
Temperature	19 to 23° C
Humidity	20 to 60% RH

Definitions

Temperature ... Measured temperature of Device Under Test (DUT) during data collection.
Reference Reading .... True value according to our reference standards.
Indicated Reading ..... Displayed reading from test unit.
Condition ..... Pass or Fail.
Difference ..... Indicated reading minus reference reading.
Relative Difference ..... (Difference / reference reading) x 100.
Allowable Tolerance .... ± according to manufacturer's specifications.
Pressure Medium ..... Nitrogen.

Traceability Statement

Reference Standards used in this calibration are traceable to the National Institute of Standards and Technology of the United States (NIST) or other NMI.

System Expanded Uncertainty

System expanded uncertainty evaluation includes the calibration reference used and device under test and is calculated in accordance with ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainties reported represent expanded uncertainties using a coverage factor (k) to approximate a percentage (%) confidence level. *In Tolerance* or *Pass* conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. Test methods defined by COI-054.

Coverage Factor (k)	2
Confidence Level (%)	~ 95

Traceable Reference Standards				
Manufacturer	**Calibration Reference Used**	**Serial Number**	**Report No.**	**Reference Cal. Due**
DHI	PPCH-G 618 10KPSI Pressure Controller	618	16028	19 November 2017

Laboratory Representative
Tony Ly

Quality Representative
Bruce Hitt

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CERTIFICATE OF CALIBRATION

Customer Name:	ISTI
Model:	Barton Pressure/Temperature Recorder
Serial Number:	265-42857
Range:	0 - 1,000 psi and 0 - 150° F.
Accuracy +/- :	1%
Date Calibrated:	June 19, 2017
Condition as received:	Could not test - Clogged Tube
Condition as left:	Within Tolerance
Action Performed:	Calibrated/Certified

Tech: Mark M. Harrison

Authorized Signature: Mark M. Harrison

This certificate applies solely for the equipment listed above. Calibration is performed on-site at 7709 E. 42nd Place #128, Tulsa OK, 74145.
The primary test and measuring equipment used is calibrated and traceable to the National Institute of Standards and Technology (NIST) United States.
Additel SN: 211H136100338 Asset # 1123679 Due Date: 08/23/2017
Fluke SN: 20000054 Asset # 1141857 Due Date: 10/17/2017
Based on Standard Gravity @72 Deg. F. and 39% Relative Humidity.

HYDRO CHART
CALIBRATION SERVICES

7709 EAST 42nd PLACE, SUITE 128 TULSA, OK 74145 918-834-3210

CALIBRATION CERTIFICATION

We certify the instrument identified below has been tested using precision Standards traceable to NIST and the accuracy found is attested to below:

CUSTOMER PIPELINE SUPPLY & SERVICE

MODEL Crystal Engineering XP2i Digital Test Gauge

SERIAL NUMBER 576360

RANGE 0 - 5,000 psi

ACCURACY +/- 0.1 %

CALIBRATED BY Mark M. Harrison Mark M. Harrison

DATE March 27, 2017

The primary test and measuring equipment used is calibrated and traceable to NIST (National Institute of Standards and Technology) United States

Additel SN 211H136100338 Asset # 1123679 Due Date: 08/23/2017

Fluke SN: 20000054 Asset # 1141857 Due Date: 10/17/2017

Based on Standard Gravity @72 Deg. F and 39% Relative Humidity

HYDRO-CHART
CALIBRATION SERVICES

7709 EAST 42nd PLACE, SUITE 128 TULSA, OK 74145 918-834-3210

CALIBRATION CERTIFICATION

We certify the instrument identified below has been tested using precision Standards traceable to NIST and the accuracy found is attested to below:

CUSTOMER ISTI

MODEL Barton Pressure / Temperature Recorder

SERIAL NUMBER 202A - 156510

RANGE 0 - 3,000 psi and 0 - 150° F.

ACCURACY + / - 1 %

CALIBRATED BY Mark M. Harrison Mark M. Harrison

DATE February 6, 2017

The primary test and measuring equipment used is calibrated and traceable to NIST (National Institute of Standards and Technology) United States

Additel SN 211H136100338 Asset # 1123679 Due Date: 08/23/2017

Fluke SN: 20000054 Asset # 1141857 Due Date: 10/17/2017

Based on Standard Gravity @72 Deg. F and 39% Relative Humidity